Business Environment of Infrastructure
Challenges and Way Forward

Conference Proceedings of
International Conference on Management of Infrastructure (ICMI) 2017

Organised by

College of Management & Economics Studies
University of Petroleum & Energy Studies
Dehradun

Conference Proceedings of International Conference on Management of Infrastructure (ICMI) 2017

9th to 10th of February, 2017

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First Impression: 2017

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ISBN: 978-1-63535-614-4

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Message from the desk of Chancellor

Dr. S. J. Chopra

Chancellor

University of Petroleum & Energy Studies

It is a delight to convey my best wishes to the organizers of the "5th International Conference on Management of Infrastructure (ICMI)" from 9th to 10th February 2017 at UPES - Kandoli Campus.

We believe, it is desirable to provide an interdisciplinary forum for policy planners, regulators, professionals, academicians, researchers, entrepreneurs, consultants and administrators to debate, discuss and disseminate information including innovations and improvisations in the broad area of Management of Infrastructure.

I hope this conference will be a stepping stone towards a way forward through sharing of knowledge and experience.

My best wishes for the grand success of the Conference.

Message from the desk of Vice-Chancellor

Dr. Shrihari Honwad

Vice-Chancellor

University of Petroleum & Energy Studies

I am pleased to know that the College of Management & Economics Studies (CoMES), UPES is holding an International Conference on Management of Infrastructure for the 5th consecutive year. To organize an International Conference continuously for the fifth years signifies the acceptance of the conference among the research fraternity. I have been informed that this year the major theme of "Business Environment" is adopted owing to rapid changes being witnessed in world and its potential to impact Energy, infrastructure and Transportation sectors.

I congratulate the team Dr. Dayanand Pandey and Dr. Tarun Dhingra and colleagues from CoMES for consistently putting together a grand show once again and inviting research scholars as well as industry associates from all the parts of the world to contribute in this academic endeavor.

I extend my best wishes to all participants, invited dignitaries, and conference organizers and hope that they make the most of the networking opportunity in a community representing professional pride and make the conference a grand success.

Message from the desk of Director

Dr. Dayanand Pandey
Professor and Director
College of Management & Economics Studies
University of Petroleum & Energy Studies

International Conference on Management of Infrastructure (ICMI) is one of the most celebrated Industry-academia collaboration on 'Infrastructure' organized by the College of Management & Economics Studies (CoMES), UPES at Dehradun. The two days Conference would bring together global leaders in the field of Infrastructure to deliberate on the latest developments and advancements in various facets of the larger set of Infrastructure. The conference offers a forum to discuss and deliberate about the Policies, trends and latest research in the domain of Infrastructure. I am confident that the participants would share the most valuable insights and cases pertaining to the theme. I wish the conference a great success!

The previous ICMI's have drawn attention of professionals, research community, policy makers across the globe and continuing the trend, College of Management & Economics Studies is ready to host "ICMI - 2017". The response for ICMI 2017 has increased when compared to the previous conferences and we are sincerely thankful for all the participants and the authorities of the institutions for their support.

I welcome you all and extend my best wishes to all participants, invited dignitaries, and wish you all a great time, meaningful deliberations and professional networking during this conference at UPES.

Message from the desk of Convener

Dr. Tarun Dhingra
Professor and Head (Dept. of Strategy)
College of Management & Economics Studies
University of Petroleum & Energy Studies

On behalf of the college of Management and Economics Studies (CoMES), UPES, it gives us immense pleasure to welcome you to the 5th International Conference on Management of Infrastructure (ICMI-2017) being held at knowledge acres in Dehradun.

Over the past four years ICMI has proved to be a great opportunity by providing an interdisciplinary forum for discussion, debate and dissemination of information about the new ways of addressing growing complexities and emerging challenges in ever changing infrastructure sector. It has been successful in getting together Practitioners, Researchers, Policy Planners, Regulators, Entrepreneurs, Consultants and Academicians from around the world engaged in the sphere of **E**nergy, **I**nfrastructure and **T**ransportation**.**

The dynamic business environment has changed the economic landscape growth globally. This, in turn, is creating huge demand for private and public sector infrastructure development such as power stations, electricity grids, overall energy requirements, water supply and treatment plants, roads, railways, airports, bridges, telecommunications networks, schools, hospitals, and more. Thus ICMI 2017 has a focus on external and internal business environment influencing the infrastructure (both hard and soft infrastructure). This conference will have deliberations on contemporary issues related to business environment and infrastructure across the globe.

ICMI 2017 has been successful in inviting industry, regulatory and policy veterans from various verticals of infrastructure sector for the keynote sessions. The response of the practitioners and the response of researchers in terms of number and quality of research papers indicate that ICMI taking significant steps towards emerging to be a prestigious, industry need oriented and empirical minded platform for infrastructure research.

This year ICMI 2017 is pleased to collaborate with Power Transmission Corporation of Uttarakhand Ltd. (PTCUL) for providing a platform for deliberating on the challenges faced by the power transmission in the state of Uttarakhand.

We hope that ICMI-2017 provides an excellent opportunity for exchanging ideas on various aspects of management of infrastructure and strive towards providing the various stakeholders with socially significant implementable strategies. We extend our heartfelt gratitude to all the people who have contributed in making ICMI 2017 a success.

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Yaduraj Singh Bhati

Index

Hard Infrastructure

Soft Infrastructure

Internal Business Environment

External Business Environment

Hard Infrastructure

A review of adoption and barriers of rooftop solar photovoltaic system in India.

Amitabh Satapathy*, Dr. Aravind Kumar Jain**, Dr. Sunil Barthwal***

**Assistant Dean Academics, XIME, Kochi*

***Associate Professor, CoMES, University of Petroleum and Energy Studies*

****Associate Professor, CoMES, University of Petroleum and Energy Studies*

Abstract

Success of rooftop solar photovoltaic power will be critical to the growing need of electricity in India. Rooftop PV has several advantages over fossil fuel power. However despite several advantages, adoption of rooftop solar PV has been very slow in India. Although globally there are some countries like Germany, China and Italy which have adopted solar PV very well, India has a long way to go. This paper reviews the advantages solar PV has over other forms of energy and the barriers to its large scale adoption in India.

Introduction

"Solar or coal? The energy India picks may decide Earth's fate"

-Charles C. Mann in December 2015

Indian power sector is at a crossroad. At one end, the country needs to install massive amount of new power projects and at the other end it has ratified the Paris climate change agreement at the UN. So the only option for the country is to switch from the traditional fossil fuel based power generation and get into renewable energy.

With an installed capacity of only 300 GW, it is less than one third of the installed capacity in the U.S. Similarly the per capita electricity consumption at 1075 KWh is almost one third of the world average and less than 10% of the average in developed countries like the U.S., Canada or Australia (Source: World Bank).

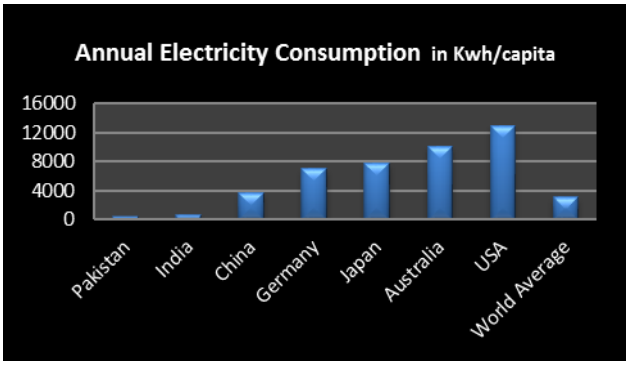

Figure 1; Annual electricity consumption (KWH/capita)

A recent report on Washington Post says that almost a quarter of the population in India live without electricity. Another quarter which is connected to the grid, remain in dark for 10 to15 hours a day due to unscheduled power cuts and load shedding. So the country needs to add almost the double of current installed capacity to reach the world average in terms of power consumption.

Apart from the need to generate more electricity, one more critical issue is our dependency on fossil fuel, especially coal. In terms of Carbon Dioxide emissions, India is the third most polluting country in the world, nearly half of which is contributed by power sector (www.wri.org). So the massive future need for electricity, if comes from fossil fuel, will not only be destructive for India, but also for the entire world. Even if for a moment we ignore the environmental issues, India doesn't have fossil fuel reserve like coal or oil to support the demand. In 2014-15, the country spent more than Rs 1 lakh crore for importing coal (Niti Ayog report). A major reason for the existing power sector crisis is its heavy reliance on centralized power generation, Kapil Narula, Yu Nagai, Shonali Pachauri, (2012). Higher reliance on commercial fuels like coal and oil as a short term measure for meeting increasing demand is disturbing in view of depleting fossil fuels and also pollution. (G D Kamalapur, R Y Udaykumar, 2011). This heavy reliance of Indian power sector on fossil fuel like coal, gas and oil is because of faulty energy policy. It is imperative to note that India depends on import from foreign countries for these fuels (Tariq Muneer, Muhammad Asif, Saima Munawar, 2005). Because of this over dependence on fossil fuel and the country not having sufficient reserve, the annual additions of new power projects took a major hit during the previous few years.

Government of India has realized the current situation and the importance of switching to renewable energy to meet the electricity demand.

"The world must turn to (the) sun to power our future," Prime Minister of India,

Narendra Modi said at the historic COP21 Climate conference in Paris last year. Unveiling its own bold initiative, India pledged that it would derive at least 40% of its energy needs from renewable sources by 2030. Under the Jawaharlal Nehru National Solar Mission (JNNSM), India is aiming to generate 100 GW solar power by 2022, comprising of 40 GW Rooftop and 60 GW of Large and Medium Scale Grid Connected Solar Power.

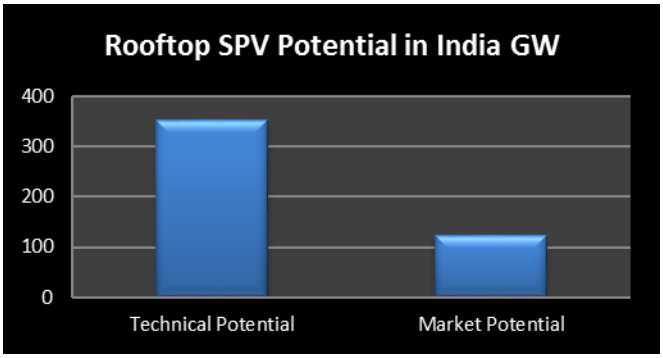

Figure 2; Rooftop SPV potential in India (GW)

Adoption of Solar PV in India

The photo voltaic penetration in percentage of electricity demand in India is less than even 1% as of 2015 compared to almost 8% in countries like Italy or Germany (Source IEA). The installed capacity of solar PV in India is a meager 2% of the world's total installed capacity as of December 31, 2015.

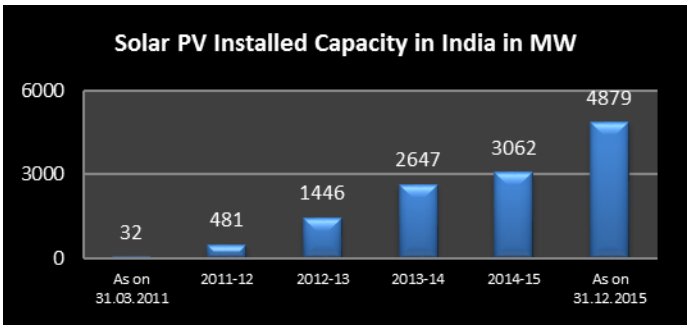

Figure 3; Solar PV installed Capacity in India in MW

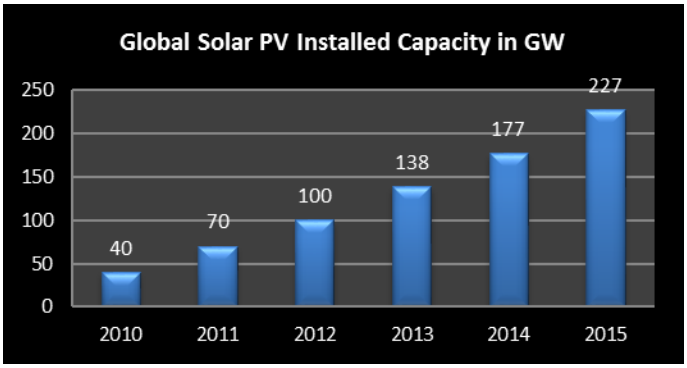

Figure 4; Global Solar PV installed Capacity (GW)

China, Germany, Japan and USA are the leaders in terms of solar PV installed capacity.

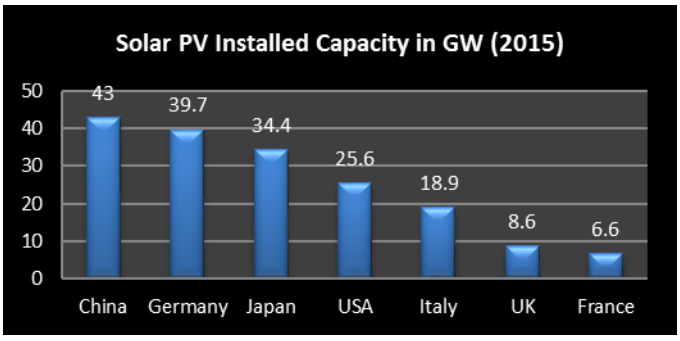

Figure 5; Solar PV installed Capacity in GW(2015)

As we can see, India has been extremely slow in catching up with the growth in solar PV across the world despite having very favourable climatic condition with high solar radiation almost throughout the year.

The situation is even worse if we consider rooftop solar PV exclusively. When the contribution of rooftop solar PV is more than 50% of the total solar PV in countries like Germany, in India the corresponding figure is around 10 to 12%.

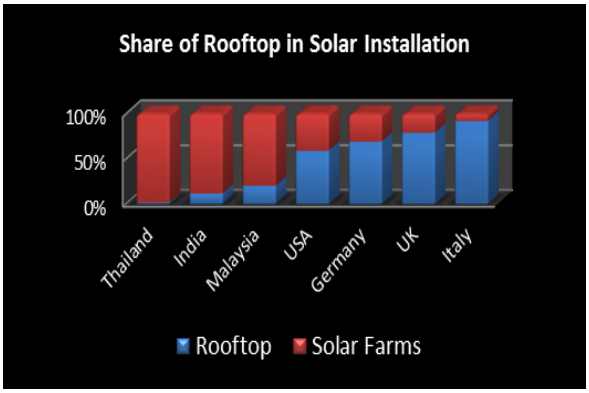

Figure 6; Share of rooftop in solar installation

As of March 2016, the total rooftop solar PV installed in India is only 740 MW. This is miniscule if we look at the potential and the 2022 target of 40 GW set by the government.

Rooftop solar power holds considerable significance considering the shortages of free land in heavily populated countries like India. DownToEarth magazine on September 29, 2016 reported that Electricity for all can be achieved only through rooftop solar power and it is possible by adding only 50GW rooftop solar power. A recent report by A T Kearney (Solar Power and India's Energy Future, 2013), mentions that solar will become a crucial component of India's energy portfolio in the next decade because of several factors; a) Coal is becoming more difficult to obtain, b) Sources of domestic gas are shrinking and c) The urgent need to reduce carbon.

A news article on April 22, 2016 published in the BusinessLine mentioned the apprehension shown by CEOs about the possibility of India missing its solar power target. It cited the major hurdle coming from the rooftop solar power segment. Against a target of 40 GW of rooftop solar power installation by year 2022, the current installation is only around 1 GW.

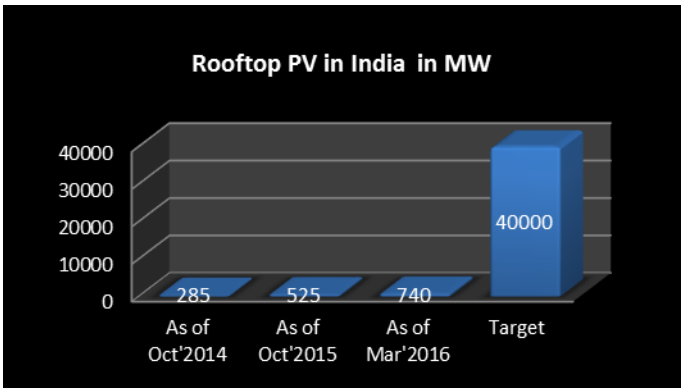

Figure 7; Rooftop PV in India in MW

Considering its significance in providing electricity to households in remote locations and also its contribution in providing clean energy, growth in this segments holds extreme criticality in the over-all success of the India power sector.

Advantages of Solar PV

In general, solar energy technologies can be classified into two broad categories: photovoltaic (PV) and concentrating solar power (CSP). Photovoltaic cells convert sunlight into electric current, whereas CSP uses reflective surfaces to focus sunlight into a beam to heat a working fluid in a receiver. The contribution of CSP is extremely negligible and it is PV that is going to be the major technology for solar power. The total worldwide installed capacity of solar power was only 227 GW by the end of 2015 (IEA). This is less than even 1% of the total solar power potential across the world. Over 22 countries in the world are meeting more than 1% of their power requirements from PV. Italy, Greece and Germany are the leading countries in the world in terms of percentage of their power generation coming from PV with shares of 7.8%, 6.5% and 6.4% respectively, Muhammad Asif (2016).

The advantages of solar photovoltaic power are:

- No green-house gas emission,
- Noise free,
- System has long life of around 25 years, iv) Low maintenance cost,
- Easy to install etc, G D Kamalapur, R Y Udaykumar, (2011).

A study in Australia says that there is no doubt that falling capital costs and growing emissions reduction ambitions will result in solar PV playing a major role in future power systems, Joel Gilmore, Ben Vanderwaal, Ian Rose, Jenny Riesz (2013). In India although wind energy took off much earlier than solar energy, solar energy, however, has a significant advantage over wind energy, as the former is more abundant and more predictable, Tariq Muneer, Muhammad Asif, Saima Munawwar (2005). Study in Tajikistan suggests that solar PV energy has great potential to improve the sustainable development and livelihoods of remote mountain communities, Harald Zandler, Bunafsha Mislimshoeva, and Cyrus Samimi (2016). A study in Bangladesh says that Solar PV is becoming more and more popular because of high modularity, no requirement for additional resource like water and fuel, no moving parts and low maintenance requirement, Md. Alam Hossain Mondal, A.K.M. Sadrul Islam (2011).

A research in India found out the advantages of PV as

- depending on the location, the daily incidence ranges from 4 to 7 kWh/m2, with the hours of sunshine ranging from 2300 to 3200 per year,
- solar energy has low marginal cost of generation,
- can increase energy security by diversifying supply,
- reduces import dependence,
- mitigates fuel price volatility,
- can be an important tool for spurring regional economic development, Naveen Kumar Sharma, Prashant Kumar Tiwari, Yog Raj Sood (2012) .

In Hong Kong the drivers are Climate change and environmental hazards, Danny H.W. Li, K.L. Cheung, Tony N.T. Lam, Wilco W.H. Chan (2012).

Among all sources of renewable energy, solar energy is having the highest potential. A study in San Francisco indicates that the yearly sum of solar radiation for each building ranged from 967 to 2,110 kWh/m², Ziqi Li, Zidong Zhang and Keith Davey (2015). A study in Lebanon suggests that the energy sector in Lebanon consumes about 2.3GW, and if the government taps only 12.5% of the total rooftop surfaces of the residential buildings, it will be able to supply electricity to the whole country even without using any fossil fuel power plant, Claude Ziad Bayeh and Nazih Moubayed (2015). Despite having such a massive potential, the energy is absolutely clean. A recent research in Denmark suggests that the world can shift to entire 100% renewable energy and if done CHG can be reduced to 10.2% of 2000 level by year 2050. Also this will have socio-economic benefits as well, Brian Vad Mathiesen, Henrik Lund, Kenneth Karlsson (2010). A 5 MW solar PV plant studied in Saudi Arabia suggested that it would result in avoiding on an average 914 ton of green-house gases each year entering into atmosphere, Shafiqur Rehman, Maher A. Bader, Said A. Al-Moallem (2007). A 5 MW solar PV plant studied in Oman suggested that total of 7025 and 5944 tons of GHG could be avoided each year if the 5MW PV plant is replacing diesel and natural gas based generation, respectively, A.H. Al-Badi, M.H. Albadi, A.M. Al-Lawati, A.S. Malik (2011).

Rooftop PV has another benefit which is very important in the present context; it reduces the load required for cooling the buildings. A study in the US indicates that rooftop PV reduces the peak load demand

due to reduction in cooling load of the buildings, Suresh B. Sadineni, Fady Atallah, Robert F. Boehm (2012). Another study in Canada also supports this claim, Ian H. Rowlands (2005). Another research in Greece says that building integrated PV applications not only save conventional energy use, but also offsets the ‘‘peak’’ electricity generation from fossil fuel like coal and oil. It reduces emissions from diesel generators. Also, electricity is generated at the point of use and therefore transmission and distribution losses are avoided leading to reduction in utility company’s capital and maintenance costs, G.C. Bakosa, M. Soursosb, N.F. Tsagas (2003). A study in India based on a computer simulation, demonstrated that the energy required for roof-induced cooling load decreased between 73% and 90% after installation of the PV system, Y Kotak, EJ Gago, P Mohanty and T Muneer (2014).

Barriers to the adoption of solar PV

Despite all these advantages of rooftop PV, it has got many barriers. A white paper published by MNRE in 2014 has identified some key barriers to large scale adoption of rooftop solar PV across various consumer categories in India and those are; High upfront cost, Limited financing schemes by banks, Lack of awareness among consumers, Limited standardized rooftop solar PV systems, Inadequate supply chain for rooftop solar PV systems, Inadequate experience of grid connectivity at low voltage, Limitations of solar systems to function during power outage, Higher cost of dual function inverter (which allows consumption of solar electricity during power outage) in India.

A recent study in China finds out major barriers to solar PV as

- Identifying suitable rooftops,
- short life span of many rooftops in China, which are often designed to last only 10 to 15 years compared to the PV life span of 20 to 30 years,
- Lower residential electricity tariff compared to that of commercial and industrial electricity rates, making the self-consumption Feed-In-Tariff less attractive for residential systems,
- Weak legal and institutional mechanisms existing in China to enforce contracts and contract payments,
- Financing,

- Lack of proper standards for connecting PV to the grid at different voltages,
- The time lag of the government in implementing the policies, and
- Availability of labour. Surprisingly one research says that cost is not a significant barrier in China, Fang Zhang, Hao Deng, Robert Margolis, Jun Su (2015). But another research in China says that the cost of PV power generation is the most obvious barrier, Wen Liu, Henrik Lund, Brian Vad Mathiesen, Xiliang Zhang (2011). Govinda R. Timilsina, Lado Kurdgelashvili, Patrick A. Narbel (2012) in the paper "Solar energy: Markets, economics and policies" classified the barriers to solar energy into:
- Technical,
- Economic and
- Institutional barriers.

The paper also discussed various policy instruments that support PV.

Technical barriers are

- Low efficiency of PV modules
- Performance limitations of other system components,
- Inadequate supply of raw material,
- Lack of compatibility of the existing electrical system with conventional energy.

Economic barriers are

- Initial system cost,
- Cost of electricity generated from PV,
- Financing problem because of higher risk.

Institutional barriers are i) Lack of effective and appropriate laws such as Renewable Portfolio Standards or RPS for utilities, ii) The limited ability to train adequate number of technicians to effectively work in a new solar energy infrastructure, iii) Poor understanding of basic system and finance factors among key national and local institutions, iv) Procedural hassles like the need to secure financing and approvals from multiple sources and agencies.

A study in Egypt suggests higher initial investment is a major barrier to PV, Louy Qoaider, Dieter Steinbrecht (2010). In Greece, although the barrier was delay in getting approval, higher growth was witnessed during a period because of 55% of initial cost given as incentive and high FIT, G.C. Bakos (2009). A study in Bangladesh

suggests that the critical factors for adoption of solar PV are Geo-physical (Location, Sunshine, Solar radiation, available surface area), Economic & socio-political factors (capital investment, technology support, political commitment, social acceptance) and Environment factors (GHG emission reduction, environment protection), Md. Humayun Kabir, Wilfried Endlicher, Jonas Jagermeyr (2010).

Experiences from Mexico indicate that technology user interaction is a more critical problem for adoption of PV as compared to cost, efficiency, or other purely technological issues, Ref. Chambouleyron I (1996), Cited by Akanksha Chaurey, Tara Chandra Kandpal (2010). One of the major reasons for the slow adoption of domestic solar PV systems in Asia and Pacific region is the use of very broad or ambiguous terms of administrative criteria, Ref: Urmee T, Harries D, (2009), Cited by Akanksha Chaurey, Tara Chandra Kandpal (2010). Research in Zimbabwe showed presence of a finance scheme has acted as a catalyst for PV growth, Ref. Marawanyika G (1997), Cited by Akanksha Chaurey, Tara Chandra Kandpal (2010).

In Pakistan the major barriers were High initial cost, inadequate renewable energy policy, Unawareness in local communities, inadequate availability of technical knowledge, K.H. Solangi, M.R. Islam, R. Saidur, N.A. Rahim, H. Fayaz (2011). In Honk Kong major challenges were high initial cost, large installation space and heavily obstructed external environment, Danny H.W. Li, K.L. Cheung, Tony N.T. Lam, Wilco W.H. Chan (2012). A study in Saudi Arabia mentions key barriers for renewable energy include huge public subsidies for fossil fuels, government preferences to large scale and centralized projects, investment risks, lack of administrative experience with renewable technologies, and regulatory issues, Muhammad Asif (2016).

In Thailand, despite its National Energy Policy Commission adopting new feed-in tariff in 2013 to support rooftop and community ground-mounted solar installations, the country has not been able to achieve the target yet, Poonnavich Suppanich, Weerin Wangjiraniran (2015). The study found out the 20 critical factors each for acceptance as well as rejection of rooftop PV. The three major factors found for its rejection are Installation cost,

Maintenance, Location of the building whereas the three major factors for its acceptance are Global warming, Technology development and unlimited power potential.

The experience of the implementation of PV in Greece brought out the importance of a simplified licensing procedure and an easier procedure for environmental approvals, Bakos GC (2009). Research highlighted benefits of demonstration of PV systems for raising awareness as also facilitation of finance for the purchase of PV systems by end-users in the developing countries, Ref. Adanu KG (1994), Cited by Akanksha Chaurey, Tara Chandra Kandpal (2010). A survey in Puduchery, India found out some barriers to rooftop solar PV and those are

- Lack of consumer awareness about rooftop solar technology,
- The initial cost of installation
- Higher payback period
- Lack of clarity on subsidy
- Suitability of rooftops
- Requirement of storage battery

Ramakrisna Kappagantu, A Arul Daniel & M Venkatesh (2015). Malti Goel (2016) in her paper "Solar rooftop in India: Policies, challenges and outlook" identified the key challenges for India in growth of rooftop solar PV. Those are

- Consumer awareness and acceptance
- Manufacturing of solar cells and R&D
- Installation technology and skilled worked force
- Need for new business model
- Micro and mini grid development for distributed generation
- Integration of solar energy into national grid and
- Challenges in regulatory framework.

In India also higher capital cost is a major barrier to the growth of rooftop solar PV, Navneet Gupta, R.K. Sharma and Ashish Jasuja (2009). Some of the reasons cited for the poor adoption of PV in India are lack of awareness among prospective users, limited outlets for procurement, unavailability of various models supporting the different requirements among various user segments, high price and limited hours of usage for solar lighting systems, Ref. Velayudhan SK (2003), Rubab S, Kandpal TC (1996) Cited by Akanksha Chaurey, Tara Chandra Kandpal (2010). Grid connectivity is also important as we can see that in Japan and Germany, rooftop solar PV installations connected to the grid, contribute

significantly to the overall market, Akanksha Chaurey, Tara Chandra Kandpal (2010).

Higher temperature is not good for PV. The highest PV output condition occurs at the coldest conditions, Matthew S. Imamura (1994).

Although cost of solar rooftop PV is coming down, it is still debatable whether or not it can compete with fossil fuel under different circumstances and at different locations. A 5 MW solar PV plant studied in Saudi Arabia offers an IRR mean value of 13.53% while the minimum and maximum varied between 10.73% and 16.65%, Shafiqur Rehman, Maher A. Bader, Said A. Al-Moallem (2007). In Korea electricity from solar PV was found more expensive than other sources, Jamin Koo, Kyungtae Park, Dongil Shin, En Sup Yoon (2011). In Oman, one study on a 5MW solar PV plant indicates PV Cost of Electricity is higher than that from gas, but lower than diesel, A.H. Al-Badi, M.H. Albadi, A.M. Al-Lawati, A.S. Malik (2011).

A research done in Nepal found that cost of electricity from solar PV is higher than grid price and that is the major obstacle to its growth, Ramchandra Bhandari, Ingo Stadler (2011). A research in Canada suggests that without drop in installation cost, levelized cost of electricity or LCOE is not at par with grid price. The high initial upfront cost of solar PV still seems to be a hurdle to its adoption, even if the cost of systems is declining, K. Branker, M. J. M. Pathak, J. M. Pearce (2011). In his research the author C.Yang determined that a realistic examination of grid parity would suggest that solar PV has a long way to go in becoming cost-effective in distributed (residential) systems than is normally claimed. The main problems identified were:

- many analysts were not amortizing all of the cost to the end consumers and
- Mistakenly considering manufactured cost instead of retail installed cost when calculating grid parity, C. Yang (2010) cited in Fang Zhang, Hao Deng, Robert Margolis, Jun Su (2015).

A study in Bangladesh says that an IRR of 10.62% can be obtained from any location in Bangladesh for a grid connected PV power plant, Md. Alam Hossain Mondal, A.K.M. Sadrul Islam (2011).

A study in UK indicated that larger size solar PV plants are financially more competitive. Rooftop solar installations of 50 to 250 kW provided positive NPVs, while some of the smaller capacity installations at some sites returned a negative NPV, Katrina Adam, Victoria Hoolohan, James Gooding, Thomas Knowland, Catherine S.E. Bale, Alison S. Tomlin (2016). A research indicated that unavailability of skilled technicians required for promotion and installation of the systems in developing countries as a major barrier, Ref. Yordi B, Stainforth D, Edwards H, Gerhold V, Riesch G, Blaesser G, (1997), Cited by Akanksha Chaurey, Tara Chandra Kandpal (2010). Similarly lack of investments and financing, high transaction costs, subsidies to conventional fuels and lack of awareness about PV systems were found to be significant obstacles for PV in least developing countries, Ref. Muntasser MA, Bara MF, Quadri HA, El-Tarabelsi R, La-azebi IF, (2000), Cited by Akanksha Chaurey, Tara Chandra Kandpal (2010).

In India a research done in 2013 forecasted that grid parity could happen during the period of 2017–19. This is because of the falling prices of PV panels both from China as well as the U.S., and growing cost of grid power in India, Vikas Khare, Savita Nema, Prashant Baredar (2013). A research done on an on-site solar PV plant in the Indian city of Jaipur, in which land and battery costs were not considered, found the Levelized cost of electricity or LCOE as Rs. 14.94, Mevin Chandel, G.D.Agrawal, SanjayMathur, AnujMathur (2014).

Conclusion

Rooftop solar PV will play a major role in meeting the demand for electricity in India as it is not possible to depend in fossil fuel anymore. Apart from supporting environment rooftop solar PV has got other benefits as well like; reduces the cooling load of the buildings, no need of water, less load on transmission lines and immune to the price volatility of fossil fuel. However there have been a few barriers to its adoption. It can be easily seen that higher cost is not the only barrier to the adoption of solar PV.

Even if it is made financially lucrative through supportive policies by the government, the adoption has not been very encouraging. After careful analysis of all the possible barriers and comparison of policies in India with that of other countries, I

noticed that the major reasons attributed to this slower adoption of rooftop solar PV in India are

- Higher upfront cost,
- Financially unattractive business model, c) Lack of standardization in rooftop solar PV,
- Unavailability of skilled manpower providing installation and maintenance services,
- e) Lack of awareness among consumers about rooftop solar PV,
- f) Unsuitability of roof top for installation of solar PV,
- g) Poor quality assurance of the solar PV systems available,
- h) Lack of concern for environment among consumers,
- Lower than required or absence of Feed-in tariff, and
- Difficulty in receiving the financial benefits from the government and permission from local authorities.

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Community Crowd Funding for Socially Relevant Projects– A Viable Model

Abhishek Sinha*, Dr. Ankur Mittal**

**Vignana Jyothi Institute of Management, Hyderabad*

***Associate Professor CoMES, University of Petroleum and Energy Studies*

Abstract

In India, the complex inter-linkages between socio-economic environment and economic prosperity demands increased public involvement in the funding of projects for the community welfare projects. For India to go to the next level certain changes are inevitable. If India wants to become a thought leader it is imperative for government school libraries to have books which matter.

The Indian cities which are desirous of becoming smart cities need to be wifi enabled. Building parks in areas which are being urbanized is now a priority for many. For Swachh Bharat Abhyaan to work the country seems to be in dire need of dustbins and public sanitation system. All these projects aim to remove pain points and need funds.

These are pain points that can be addressed with small monetary contributions from individuals. They can however stall welfare programs which in turn will have cascading effect on sustainable economic growth as these impediments act as demotivating factors for the general public at large. However, as internet connectivity improves, individuals who would want to be engaged in the process and are not physically present can contribute through crowd funding.

Need of the hour is to make community funding work for socially viable civil and developmental projects.

For Community funding to work it is important that both demand and supply side factors are conducive. On the demand side, Community crowd funding engages participants who contribute for the common cause for social and intrinsic satisfaction. On the supply side, internet connectivity and

tenacity of campaigners involved in the process of collecting fund play an important role.

The hygiene factors also play an important role in determining whether community funding would work in the given scenario. Further, red-tape and bureaucratic factors also could play a role in making community funding work.

The concept of crowd funding is not new in India. As a tool, it has been utilized effectively by sports academies as well as film industry.

This necessitates, a deeper understanding of factors impacting viability of crowd funding as a tool for funding socially viable projects. The paper emphasizes why it would work in India. Furthermore it identifies certain perennial problems which have over the years acted as inhibitors in the process of growth. These problems can be solved with the help of community funding. Existing practices in civil crowd community funding globally have been outlined. Paper presents a viability matrix, a metric that would help the campaigners gauge whether fund raising could work for their project. The role of individuals both on the supply side and demand side is then enumerated. Streamlining the role of regulators and administrators which is important for success of the projects is outlined.

Keywords: Community Crowd funding, India, social causes, crowd funding, social projects, community projects

According to the estimates of Masssolution, a US based consulting firm, in the field of *crowd funding, approximately 1 million campaigns have been funded with the help of* crowd funding platforms in the last three year. In the same period, the total funds raised were approximately $3 billion. Hence funding projects work in developed nations.

Spacehive.com – Would it work in India?

In United Kingdom there is a website called Spacehive.com. The website specializes in generating funds for the civic projects. To substantiate, patrons could help generate fund to repair a dilapidated dispensary through the website. A new suburban area could get drinking water through contribution from interested party. Spacehive.com has risen more than £1.5 million funds for 55 projects in the last three years of its existence. Following are the demand and supply dynamics of community investing at spacehive.com.

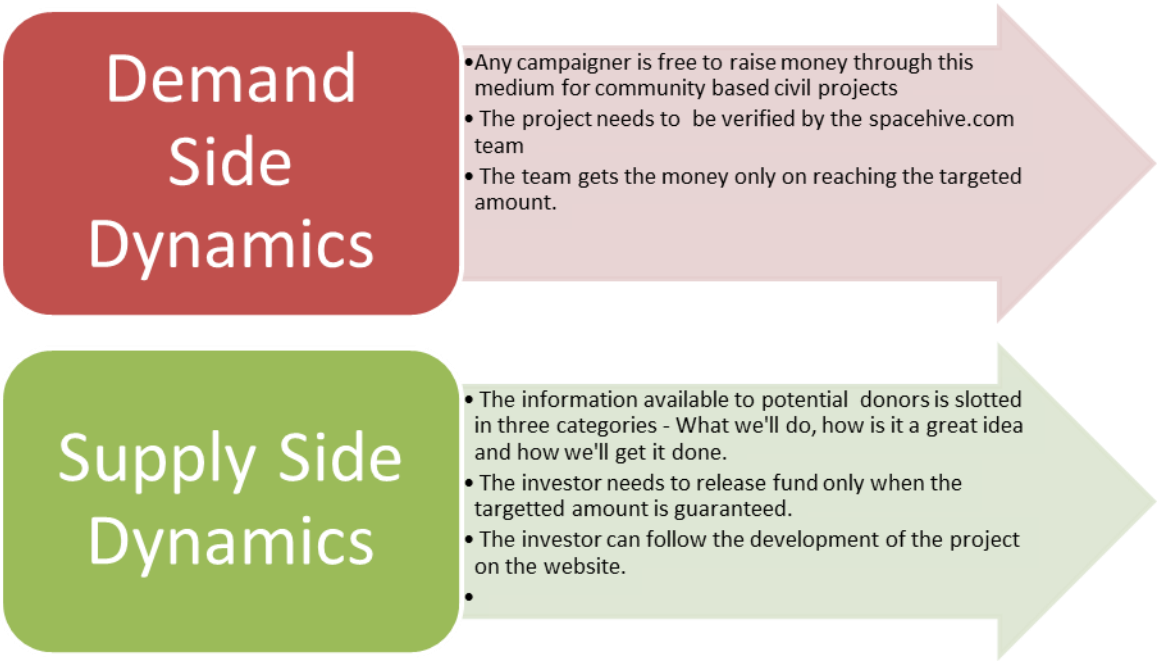

Figure 1 Source: Spacehive.com, Author

Case in the point is a recent project where £337,000 was collected in 80 days to save Ancoats dispensary in the Greater Manchester area. The total budget for the project is £370,000 and there is still 20 days left. If £33,000 is not collected the project would be vanquished. Hence, the raising of funds depends on the ability to attract potential investors from the community. Following is the snapshot of the same.

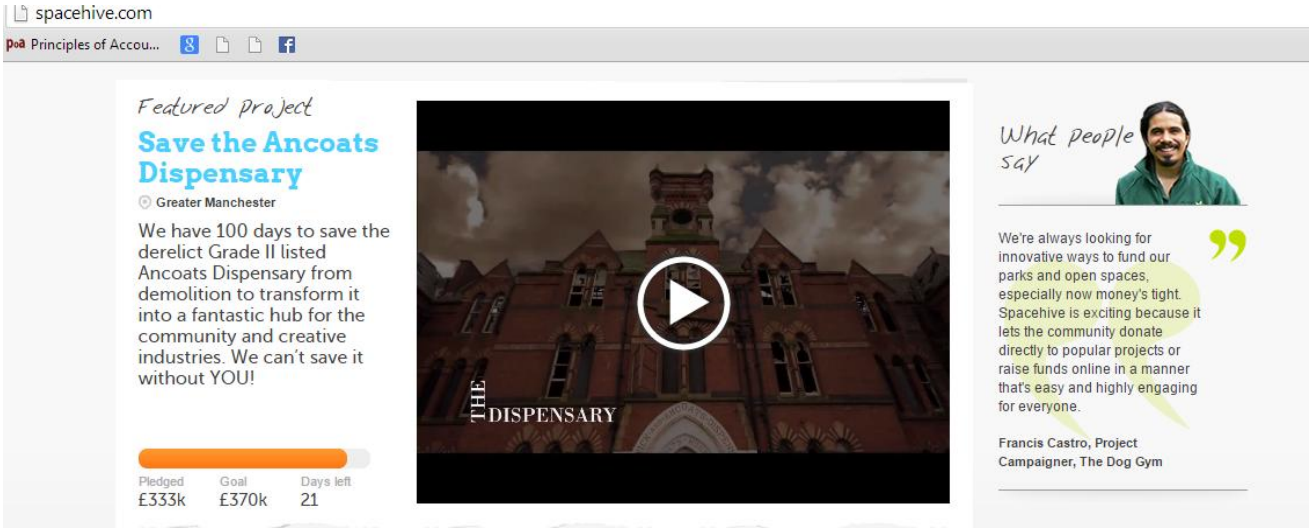

Figure 2

Looking at the failing social projects, many will agree that India needs this kind of community funding website. However can this work in the Indian socio – cultural environment is the all important question that needs to be addressed.

Community Funding: Why would it Work?

"Why should George Soros and Bill Gates have all the fun, deciding where charitable money goes?" – **Ethan Zuckerman, Director, Center for Civic Media, MIT**

Figure 3 Source: Author

Community crowd funding refers to voluntarily providing money for a cause through digital media. As an industry it has gained traction in the last 15 years. The industry caters to a wide foray of fund raisers. They include entrepreneurs, artists, sports academy and social campaigners. The reach of these websites are global hence geographical constraints is not a factor that would impact the projects.

There is no denying that with increase in mobility geographical barriers needs to be considered.

Community crowd funding has the potential to emerge as an important vehicle to raise funds for projects which are socially viable and have a cascading impact on the sustainable growth of Indian economy.

Supply Side Dynamics

The difference between the haves and have-nots has increased considerably over the last few years.

According to the 2014, Credit Suisse Wealth Report the lower half have access to only one percent of the global wealth while the top 10% hold more than 87% of the wealth. This has also led to an increase in the philanthropic activities of "haves" segment of the society.

In India the story is no different. IMF believes the billionaire community in India has double the wealth required to eliminate penury in India. With demographic dividend driving growth, there are a lot of tech savvy individuals who have amassed sizeable wealth in short time by either selling their businesses or by being part of growth story of successful businesses.

Case in the point is Flipkart which has created more than 400 "crorepatis." Furthermore, there are sizeable numbers of Indians who are based overseas and would now want to contribute to the development of the Indian growth story provided they are assured the money goes where they would want it to go.

The solution to the problem here lies in making community crowd funding more popular. It is one of the few tools which give the donor the choice to donate money in the projects which he finds viable and socially impactful.

Of late there have been cases where not only public view but also social funds have been mobilized with the help of social website.

Be it election campaign or social campaign digital media has a relevant role to play. What is the carrot for the benevolent? To start with community funding does not provide monetary benefits to the sponsors. However there are non-monetary benefits such as prestige, higher level of satisfaction, and feeling of gratification which make it attractive. Crowd funding not only helps in raising fund it also helps in engaging the donors in the attainment of the goal for which fund is being raised. Community funding derives strength from the involvement of the masses.

Furthermore, the world grows flat and people migrate to distant land looking for greener pasture; their desire to give back to one's homeland intensifies. In a country like India which has thousands of strong sub-communities the yearning to see fellow community member prosper can be leveraged for successively improving efficacy and efficiency of government projects through community funding tool. Further, as the government impetus on developing smart cities gather momentum the role of netizens in shaping the socially beneficial products would also intensify. The best way to engage citizens is by getting them proactively involved in the process of development.

Hygiene Factors – Growth of internet and cloud computing

In India, approximately 10% of the population uses internet and hence the future growth of internet in the country which is third largest in the terms of internet user is high. "Wall in the hole" experiment which was first conducted in 1999 in Delhi has proved that computer literacy can increase if people have access to computers.

An experiment was conducted in Delhi where a computer was placed in a hole in the wall. The local illiterate kids started using it and soon they learnt computers on their own.

Furthermore mobile telephones have approximately 70% penetration in India internet telephony is catching up fast. Rapid urbanization in India also plays an important role in increasing penetration

Community funding in India

The concept of crowd funding is not new in India. Sectors which have used crowd funding include films, sports, businesses, NGO's etc. The concept of community

funding sans internet for raising money for gathering public and increasing cohesiveness was used effectively by Lokmanya Tilak in the 1890's when he mobilized funds for Ganesh Puja. The Keshavji Naik Chawl where he organized the Ganesh Puja became symbolic of India's struggle for Independence.

To mobilise public opinion and provide a meeting place the concept of Ganesh puja pandals was introduced in Pune by Lokmaya Tilak. In today's context pandals have been replaced by internet as a platform for exchanging information and the contribution of money through internet platforms is fast becoming a preferred source of mobilizing funds for the country.

In 1975, 5 lakh farmers joined hands to fund the movie Manthan. Manthan is the story of farmers of Gujarat and the white revolution. The total amount collected was Rs. 10 lakhs which was half the cost of producing the movie. The sponsorship project was ably led by the father of Indian milk revolution Dr. Kurien. This perhaps is the first instance of a film being sponsored by the agrarian society.

Table 1

Website	Formed in	Focus Area
Rangde.org	2008	It aims at creating a platform, for providing micro credit to the rural entrepreneurs. It works as a viable alternative to micro-finance
http://www.igniteintent.com/	April 2012	Provides a platform for innovative and different ideas
Wishberry.in	2008	Focuses on creative space
Milaap.org	June 2010	It is aimed at providing funds for needy people. Identifies project with the help of field managers.

Mary Kom, a leading boxer was able to raise Rs. 5 lakhs for her boxing academy with the help of a leading insurance company through the campaign known as "Need for Champions". This boxing academy would be established in the city of Manipur.

There are a few other players in the field. However there are none which provide funds specifically for civil projects in India.

The Problem Triangle

The infrastructure maintenance of government hospitals and school in India has almost come to naught. Road repair is also a challenge in most of the cases. The problem triangle shows why the success rate of social civil projects in India is low.

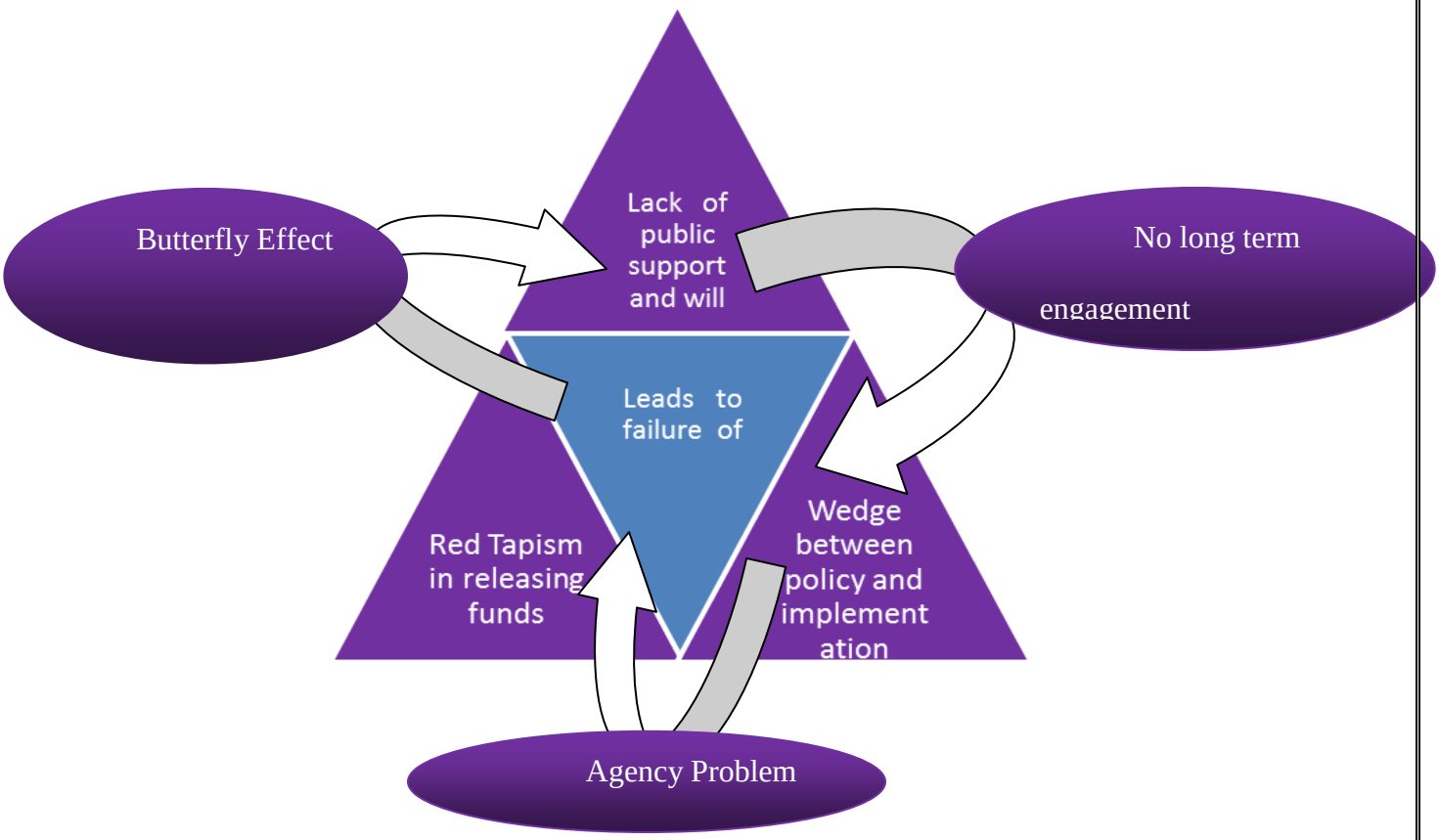

Figure 4

Following are three factors that that have impacted implementation of socially viable projects in India. These problems include:

- Lack of Public Support – The public engagement in socially viable projects is low. The main reason for low support could be the inability of the public to see benefits from the efforts he undertakes and the return he gets. Most of the projects do not yield long term results hence the motivation of individuals are low. As motivation level is low engagement levels are also very low.
- Red-tapism– Most of the projects which start with fanfare, in the long term suffer from dearth of activities. The present government has understood and taken cognizance of this phenomenon. According to "Doing Business 2015", a report released by the World Bank India is languishing at 142 in a group of 189 countries, on the ease of doing business in India. The report goes on

to state that India is ranked 185 among 189 countries in terms of enforcement of contract. It also states that in India it take almost half a year to get permission to set up a warehouse. On the other hand, in Singapore it takes less than a month to get the permissions

- Outcome based evaluation of individuals involved in the process is required. Such a change in evaluation system of government employees is not possible in the short and medium run. Hence removing the red tapism in the system is not going to be easy.
- Gap between policy and implementation.
- In 2012 budget the government allocated 2% of the total outlay on social spending. However, there was a huge under utilization of the allocated funds. This is in spite of the fact that the Indian Government's spending on social projects is abysmally low compared to the amount spent by developed countries, which is on an average 14% of the GDP.

Being a developing country which needs to spend on building infrastructure such as new government schools, digitization of schools, training teachers etc. the government cannot afford to underutilize the budget.

The above three problems stem from the following:

- Butterfly effect: Certain factors which individuals believe can be ignored and will not impact the society at large has cascading impact and hence leads to a lot of socially relevant projects collapsing completely.
- Agency cost: The bureaucrats do not seem to lose much professionally if social projects collapse. This has again prevented outcome based evaluation of the projects. The project's success is not evaluated in the term of gap analysis between desired and achieved impact. Even if it is, the personnel involved do not stand to lose much.
- No Long Term Engagement: There is no long term engagement as the parties who are to be impacted are not always a part of the decision making process. Hence, they lose

interest. In other words agency problems lead to lower engagement.

Viability matrix

Globally a lot of companies and non-government organizations attempt to raise money through community funding. However if one visits the community funding website he would realize that the failure rate is abysmally high. Thus there is a need to understand factors which would make the project successful.

The viability matrix is aimed at creating a metrics which would help decide whether a project is viable to be sponsored through community funding or not. The local engagement of the community is an important factor which determines the viability of such projects. In such projects there are no monetary returns for the investors. He either gets a reward or nothing. The reward is generally non-monetary in nature. Hence, if he does not have any direct benefits from the project he should at least derives intrinsic value.

If the local community is not engaged in the process then funding would not be an easy task. On the other hand more the bottleneck in form of red tapes and bureaucratic bottlenecks in project execution, higher is the probability of success of the funding of the project.

The ability of the campaigners to raise funds through the project is a critical factor which is not being considered while deciding the viability of the project as operational factors would be dealt with separately.

On the x-axis local engagement is measured. While on the y-axis red tapism and bureaucratic is measured. Local engagement refers to the propensity of the local community to fund projects. It does not matter whether the members of the community are physically present.

Donations can be made by people staying overseas also. On the other hand red tapism in the system can act as unifying factors.

In cases where there are no bottlenecks and local involvement is high success of the project would depend on factors other than red tapism.

Figure 5

Probability of Success – High More supply side bottleneck with high demand side engagement leads to high demand	Probability of success – Low High supply side bottleneck with Low local element will not make the system viable unless external donors take interest
Probability of Success - High Low supply side bottleneck with high demand side engagement lead to high viability provided there is proper utilization of funds.	Probability of Success – Low Efficient system with no supply side bottleneck and no local engagement will lead to lower viability

High

Low

Green Red Tapism and Implementation gap

Project Execution Bottleneck

Region – Highly viable

Yellow Region – Viable contingent on certain factors

Red Region – Non Viable

PHILANTHROPIC ECO-SYSTEM

The success of such projects depends on the philanthropic eco system that encourages the individuals to donate for the betterment of the society. The following diagram captures the factors that impact willingness to contribute. The direct and indirect benefits that individuals get determine the willingness to contribute.

For example, if a park needs to be created in particular area residents of apartments which do not have park will be impacted directly while those with apartment would benefit from cascading impact of more trees and open area in their locality. There are some projects which would then require one time payments while there would be others which would require regular payment. The regularity of payment and the amount to be paid would determine the willingness to contribute. If the residents who do not use a park is asked to contribute on a regular basis for maintaining the park he would not willingly do the same. At present community funding works only for projects which involve one time payments. The hygiene factors could include planting trees in a given area if the trees are planted in the area the greenery impacts the health of individuals favorably. Indirect impact could lead to increase in the market value of the property due to the environmental friendly factors.

Rippling factors could include self actualization as well as prestige and recognition within the community. Self actualization could be achieved by seeing one's community prosper. The good example of the same could be Super 30 coaching class in Bihar which provides IIT coaching to the weakest section of the society. Individuals from Bihar who would find the idea useful could donate.

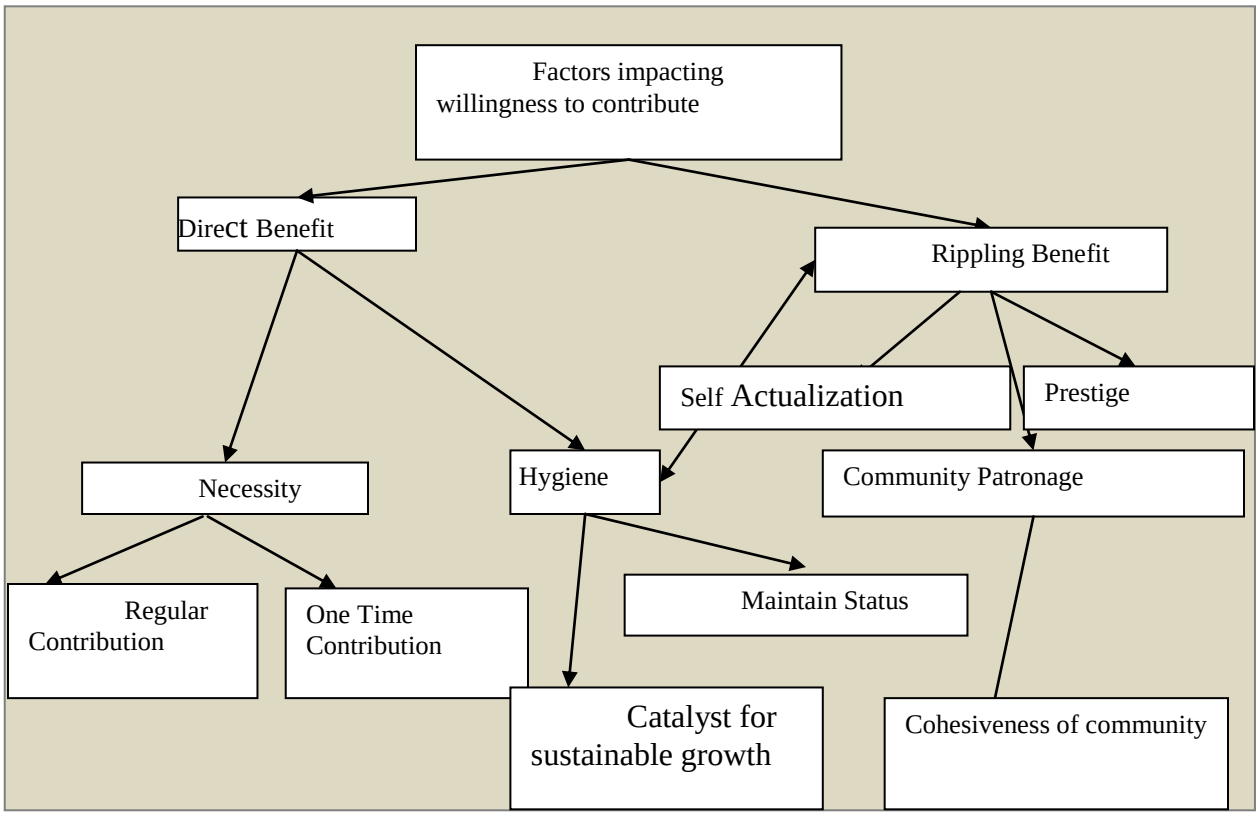

Figure 6

Local Government Machinery's Role in Funding of civil projects

Most of the civil projects that are designed need the approval of local government authorities. However, when there are red tapes and bureaucratize crowd funding can be a viable solution. Here the implementation of the project would not only be the responsibility of the local authorities it would also be shared by the campaigners.

However the senior administration has to play an important role in making sure that there are no roadblocks in the

implementation of the projects and the funds are being used productively. With rapid urbanization it often happens that a group of apartments fall under a particular panchayat. The panchayats at time would not be equipped to take up the challenges that come with rapid growth. These include better infrastructure in terms of roads, street lights etc.

Here the panchayats could involve residential societies to help improve the living standards through social empowerment. Community funding for the downtrodden of the villages could also be undertaken with the help of the local authorities.

In villages the panchayats and local authorities along with distinguished families could identify the need of the villages that are not being financed by the governments. These needs could included updating of books in the library, organizing skill ability course in the village, including computer literacy and opening computer kiosks in these villages.

Role of Central Government

The role of the central government would involve creating a platform for crowd funding. These platforms could be maintained with the help of public private partnership where technology could be handled by the private technology firms while the project validation would be done by government technocrats from semi-government organizations.

Operational Challenges in the process of fund raising

Figure 7

In India raising money for civil projects would not be easy. When it comes to creative field, the efforts of Kochi Muziris Biennale, the longest art festival in India which lasts for 108 days and is held in Kerala is the best example. This year the event is planning to raise fund through crowd funding at crowd funding website catapoolt.com. The reward that sponsors would get is that their contribution would be highlighted on social media. However it has been able to raise only 0.6% of the INR 5 cr, it requires. Hence it does not seem to work in Indian context.

Following are some of the operational challenges faced in the process of fund raising:

Lack of proper strategy –

All these fund raising projects are time bound. The community funding needs to achieve the target in the given time. However if the campaigner is not able to achieve the target they have to return back all the money collected. Hence a proper strategy should in place before kick starting the projects. The campaigners also stand to gain credibility if they are able to collect the minimum amount as more would then want to invest in the particular campaign. Hence the stakes are high.

Solution

The crowd funding websites should provide strategists or trained pram managers to the amateurs. These strategist could include philanthropists, distinguished retired consultants and ex CEO's, CFO's etc.

Lack of digital marketing skills –

The level of digital marketing skills required to sell a project to investors is very high. The ability to reach out to the right audience is of prima facie importance. Most of the campaigners do not have the deep pockets required to hire the digital marketing experts. Those who have financial power believe the project could sell on its own merit. However the same does not happen most of the time. Hence projects fail.

Solution

The crowd funding platform should employ their own .digital marketers who help them build their campaign from scratch. There is lot of examples of best practices globally. For example the Save Ancoats Dispensary page on face book has 1223 likes.

Lack of fundraising platform for civil projects –

In India there is no platform which is dedicated to the cause of civil projects. Hence competing with entrepreneurs might at times be very difficult for amateurs. The civil projects also may appeal to a select community only unlike creative projects and entrepreneurial ideas.

Solution

The government should help build platforms for raising funds for civil projects. These projects should also have methods of notifying the local authorities who at times would like to match the funding generated through crowd funding.

Lack of credibility

Lack of credibility is a problem that a lot of campaigners face. People are wary of fly by night operators and hence do not want to invest in these ideas unless they know the background of the individual involved.

Thus many a time these projects collapse.

Solution

The platforms should provide for a detailed and thorough background check of campaigners in order to add credibility to the whole process.

Conclusion

The future of any developing country hinges on the sustainable growth which in turn depends on the success of social programs. The government has to think of proactive and innovative ways of making these programs work. One such solution is community funding for social projects. This would not only help seamless running of the program but also help increase the public engagement in the projects.

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Delay of Multistoried Residential Building Projects in India Due To Client's Factors

Avin Shekhar Chourasia*, Dr. Karunakar Jha**, Dr. Narendra Nath Dalei***

**Ph.D. Scholar, CoMES -University of Petroleum and Energy Studies*

***Professor and Associate Dean, CoMES- University of Petroleum and Energy Studies*

****Assistant Professor (SS), CoMES- University of Petroleum and Energy Studies*

Abstract

Modern Multi-storied building projects construction are characterized by new standard, advanced technologies, multiparty participation and frequent Client/owner-desired changes. Client's factors lead to project delay and directly impact to project cost as well as Contractor's profitability.

For an example, in National Capital Region's (NCR) performance in timely delivery of residential multi-storied building projects in 2013 was worst in all major cities of India. Only about 1/5 of the residential supply (Multi-storied) committed for delivery in 2013, has been delivered so far. In other major cities also the time performance of project delivery was very poor. The main reasons for delay is related to severe liquidity crises of developers/owners, delay in land handing over, payment to contractors and other

Contractual issues, which lead to delay and disputes. This paper addresses the consequences of Client related factors in construction of Multi-storied residential building projects in India. Client's factors are described in detail and how to control these factors to minimize/avoid such delay.

Keywords: Multi-storied Building construction projects, Delay of Residential Building projects, Delay of Building projects due to contract conditions, Delays-Financial related problem in Construction Industry, Real Estate projects in India, etc

Introduction

The real estate sector is the well-recognized sector globally. The real estate sector can be

subdivided into 4-sectors: Hospitality, Housing, Commercial & Retail.

The growth of this sector is well complemented by the growth urbanization & modernization, which lead to escalate the demand for office space as well as urban and semi-urban accommodations.

In India, real estate is the second largest employer after agriculture and is slated to grow at 30% over the next decade. The real estate sector has been the backbone of the Indian economy and has been a major contributor in the economic growth. Real Estate Sector contributes 8.53% of the total GDP. The housing sector alone contributes 5-6% to the country's Gross Domestic Product (GDP). The Indian real estate market is expected to touch US$ 180 billion by 2020. It is also pertinent to note that this sector has emerged as the fifth largest destination of foreign investment (as per report of Real Estate Sector in India- 2015, by ASA & Associates LLP).

Future Opportunity

India's urban population may increase by 40% in next 15-years. To cater the demand of housing for urban population, India will need to construct approx. 43,000 houses per day till 2022, to achieve the vision of Indian Government i.e. Housing for all by 2022. In addition to this, approx. 100 new cities need to be developed in next decade.

This has the potential for catapulting India to 3rd largest construction market globally.
This sector is expected to contribute 15% to the Indian economy by 2030, become the largest employer by 2022 – employing about 75 million people or more than 13% of the total estimated workforce of India.
The recent policy reforms such as the Real Estate Act'2016, GST, REITs (Real Estate Investment Trust), steps to reduce approval delays/construction delays etc. are only going to strengthen the real estate and construction sector. The sector players now more than ever need to develop a global mindset towards Quality, Timely project delivery, Work culture and Governance.

Strong steps are required to provide faster approvals/execution; delay mitigation and land clearance, long term finance and required resources.

Present scenario

The Indian real estate industry has been a strong propeller towards the country's economic performance. The sector has come a long way and has been turning around in the last decade from being unorganized to a dynamic and structured sector. Several factors such as rising purchasing power, increasing nuclear families, rapid urbanization and rising income levels as well as easily availability of cheap loans for housing, have driven the growth of the sector. Apart from the aforesaid factors, much of this sectoral transformation could also be attributed to investments by institutional private equity and strategic investors in Indian real estate market (KPMG-2015).

However, in the periods ensuing the global financial crisis, the Indian real estate sector witnessed sluggish growth and slackening demand from end users owing largely to an economic slowdown and other macro-economic vulnerabilities such as persistent inflation, elevated fiscal deficit, etc. External financing including private equity investments in the sector dropped as well (from the highs of 2005-2008) leading to liquidity crunches in the hands of developers & negative cash flow of the builder as well as contractor (KPMG-2015).The reasons behind financial crunches of Contractors due to Clients will be discussed below.

Construction industry as well as building sector is being witnessed of delay in completion. It may be defined as "the time overrun, either beyond the completion date specified in the Contract or beyond the date that the parties agreed upon for delivery of a project.

In Gurgaon, only 1/3 of total committed supply for 2013 has been delivered so far. The situation is more alarming in Noida, where only about 1/5 of the residential supply (Multi-storied) committed for delivery in 2013, has been delivered so far. Other major cities like Pune, Mumbai can delivered only approximate 40% of the committed supply of 2013 as per scheduled delivery.

When the project gets delayed, it leads to arbitration, litigation and penalties etc. and incur additional cost.

According to Al-Khali & Al-Ghafy (1999)- Delays can adversely impact on project stakeholders, such as owner/client, contractors, etc. It means loss of revenue for the owner/client due to lack of production facility and loss of profit for the contractor due to higher overhead cost.

There may be different factors for the delay in completion of Multi-storied building

projects in India i.e. Client related factors, Consultant related factors, Contractor related factors, Force Majeure factors, External factors.

Client related factors are very critical, which lead to project delay and impact negatively on Contractor's cash flow & profitability. This paper is dealing with Client related factors in details, which are responsible for delay in completion of Multi-storied building projects in India.

Objectives

The aim of the research is to reduce the extent of delays' impact caused by Client's factors in Multi-storied Residential Building Projects in India. The Objectives of the research as follow:

1. To identify the major root causes of Client-related issues that would lead to delays in Multi-storied residential building projects in India.

2. To study the actual project site conditions which contribute in delay of project's activities.

Literature review

Delays in construction of projects are a major problem in worldwide. Ahmed et al. (2003) suggested that delays are key problem that occurs in construction projects and the extent of these delays may vary from project to project. It is also found that certain projects are few days delay while some projects are delayed by over a month or a year. For delay in building projects in developing/developed countries, several research studies have been carried out in an attempt to identify delay factors.

There is a wide range of views on the causes of time delays for engineering and construction of projects. Many studies have been carried out to assess the cause of delay in construction projects.

Mansfiield et al (1994) studied the causes of delay and cost overrun in construction projects in Nigeria, the result showed that the most important factors are financing and delay in payment to the contractors for completed works, poor contract management, frequent changes in site conditions etc.

Daniel W.M. Chan, Mohan M. Kumarswamy (1996) have found three most significant factors causing delays in local building projects in Hong Kong, are: Low speed of decision making involving all projects teams, mainly variation introduced in mid-stream of the project, Poor site management & supervision, Unforeseen ground conditions. Issue of variation is the most damaging problem in contract management.

Ghulam Abbas Niazai, Kassim Gidado (2009) have the causes of project delay in construction industry of Afghanistan. They have identified the critical factors that causes construction delays are: Security, Payment delays by the Client, Corruption, Poor Qualification of the Contractor's technical staff, Poor site management and supervision by the contractor.

Dr. S.S Pimplikar (2013) has studied the case of Pebble Park Project-Pune, which was delayed by approx. 180 days. He has categories the delay factors in four categories: a. Critical or non-critical delay, Excusable or non-excusable delay, Concurrent or non-concurrent delay and Compensable or non-compensable delay (Dr. S.S Pimplikar (2013). Further he has also mentioned that the project got delayed due following factors: Delay in payment to the contractor, Lack of coordination between different parties involved in project, Quarrel between fitters & client and negative cash flow of contractor. Wa'el Alaghbari, Mohd. Razali A. Kadir have studied the significant factors causing delay in building construction projects in Malaysia. The main finding of the study is that the financial factor is the most influencing factor in causing delay in building projects in Malaysia. Coordination problems are considered the second important factor causing delay followed by the material availability at site.

Frank D.K. Fugar, Adwoa B. Agyakwah-Baah (2010) have analyze the delay factors of building projects in Ghana. They have categorized the delay factors in three groups: Financial, Material and Scheduling & control. According to their studies, the Client, Consultant and Contractors are reported that four major categories are responsible for project delay and cost overrun in Building projects in Ghana: (a) Delay in honoring payment certificates, (b)

Underestimation of the cost of project, time for completion and complexity of the project, (c) Difficulty in accessing bank credit and (d) Poor supervision.

Assaf et al (1995) has studied the delay factors for construction industry of Saudi Arabia. He has done ranking of the following delay factors: (1) Preparation & approval of drawings, (2) Delay in payment by owners, (3) Design changes, (4) Cash problem during construction, (5) Design errors, (6) Labor shortages, (7) Inadequate labor skills.

Similarly, Ogunlana & Promkunong (1996) have studied the delay factors in construction of projects in Bangkok and give ranking to followings delay factors:

(1) Problems of shortage or inadequacies in the industry infrastructure, (2) Problems caused by Clients & Consultants, (3) Problems caused by Contractors-incompetence/inadequacy.

The above reviews vindicates that common reason for delay in Building projects across the world is Client's late payment to the contractor, Change order and Slow decision making by the Client. The review also shows that Client related factors are the critical one, which require more attention to minimize the negative impact over project completion.

Research Methodology

The Paper is based on secondary data available in the online electronic media in the form of expert committee reports on the various delay factors. Newspaper reports, articles and journals related to delay of Building projects is used for data collection.

The literature review is conducted to gather the related information in order to provide full understanding and knowledge on the issues regarding delays due to Client's action and its consequences.

Analysis & Recommendations

Several studies have identified over Client/owner factors which are critical and responsible for delay of Building Projects. Aibinu and Odeyinka have concluded that Client's poor financial status lead to cash flow problem in project, slow decision

making and variation order extend the project completion. Al-Khali and Al-Ghafly considered that delay in project mainly due to delay in making payment to the contractor. Al-Kharashi and Skitmore identified that lack of finance to complete the work and slow decision making by the Client/owner having greatest impact to delay.

This paper described the following Client's factors, which are critical and having more impact in delay of Multi-storied Building project in India:

Client's Contract conditions:

Unrealistic time duration:

Time is the essence of the contract. To finalization of the time duration for completion of particular project, in depth site work experience require. In addition to this, there shall be awareness for surrounding site conditions, which may affect the work progress at site.

Time duration is depending upon the nature of project and timely availability of the resources require to complete the project. While fixing the time duration, there shall be consideration for common site problems which generally occurs at all sites i.e. break down of plant & machineries, minor accidents, emergences and extreme weather conditions etc. But in most of the cases, it is found that Client/owner do not consider such common site problems, which attracts extra time at site.

The Unrealistic Time duration caused by wrong packaging of contract documents, political interference or unprofessional/inexperienced Client's staff.It has been observed by many project managers and organizations across the globe that key reasons for slippages of project completion deadline are 'Unrealistic estimates about the complexity and real quantum of work'. Consultants (and even sponsors), underestimate the complexity and ignore critical risks involved in the project and consider shortest completion duration for the project. One direct consequence of such approach is highly optimistic/unrealistic timelines.

Consultants/Owners are still rigid to consider the extra time which shall be

involved in implementation of last minute change orders.

There are always three main factors that impact the outcome of a project: Speed, Quality and Price.

For completion of a project, prioritize two of these factors. The rest will fall into place for a positive result:

- Prioritizing Speed & Quality- the Price will be high.
- Prioritizing Speed & Price- The Quality will be suffered.
- Prioritizing Quality & Price- It may take More Time than ideal to complete

Change order/variation

To add or delete in the scope of work may become easy via issue of Change Order. It is a process to amend/alter the contractual scope of works. It may add any extra item in the scope of works and reduce/increase the quantity of existing items. Accordingly the contract price varies.

Change orders are common practice in large projects. After formation of scope of works in the contract, total price is also fixed accordingly.

At the time of execution or after completion of any work, Client may ask to change the specific works/items which does not suit best as per his plan. Accordingly client suggests an alternate approach via issuing the change order. The change order shall be on the cost of Client/owner and the additional amount (if any) shall be decided mutually with the contractor and paid to the contractor on agreed time.

There is always a clause in contract for Change/variation Order. Client and contractor shall follow the guidelines/process of issue and payment of change order as mentioned in the contract clause. Moreover, the expenses shall be paid on time to the contractor for occurring in regular works. This will help to the contractor to entertain and carry out the extra item as per Change order, without any delay. If there are unpaid RA bills of the Contractor by the Client for unreasonable time period, it will difficult for the contractor to complete the work in time.

Change in quantity (Quantity variation) or introduction of any extra item (Extra claim) or changes in scope of works, for which additional expenses to be incurred by the contractor and later on the same to be reimbursed by the Client, an approval of Client is required to proceed. But, due to financial impact, Client slow down the process of approval, which lead to dispute and delay in works. Those particular and co-related activities get delayed due to Change order.

Following are the effects of change orders:

- Increase/decrease the cost of the projects by changing scope/specification/design/methodology etc.
- Increase the time duration.
- Arises disputes between parties i.e. Client & Contractor, Contractor & Sub-contractor, Client & Consultant or Consultant & Contractor.

To manage/minimize the negative effects of change order, Client/owner need to adopt the following measures:

- Analyze and review their overall project plan/detail before finalizing the contractual scope of work and specifications, so that possibility of major change order can be minimized.
- If change order is must (can't be avoided), the process for negotiation and finalization of extra claim of the contractor for implementation of such changes, to be on fast track and transparent.
- Final approval and payment to the contractor for extra claim amount to be done in short time.

If financial impact of the change order on the contractor is high, partially advance payment may be released to the contractor, so that additional require material can be procured at site on time.

- There shall not be any huge hold amount of RA bills (Running Account bills) of the contractor. Timely payment of RA bills may support morally and financially to the contractor to take up any additional work in the project.

Discrepancies in Contract documents

Contract documents is a term used to represent all executed agreement between the Client and Contractor; any general,

supplementary or other contract conditions; the drawings and specifications; all addenda issued prior to execution of the contract and any other items specifically stipulated as being included in the contract documents.

The Owner/Client of an engineering and construction project, 1st contracts with an engineering or architectural firm to prepare the specifications, construction drawings and other contract documents and then hires a construction contractor to build that project. The Client/owner carries an implied warranty that the specifications, drawings and other contract documents are accurate and acceptable product will be resulted if such contract documents are followed for the execution of project.

It is quite usual that there may become small and sometime large discrepancies between the provision in the printed form and in the bill of quantities or specification. The preparation of contract documents is not a simple process but one that requires particular skill, care and diligence in view of the Client's interference large nature of documents involved.

Specifications and drawings can be defective because of the followings: error or omission, incompleteness, inadequate detail or description, conflicts, incompatibility or inconsistency, insufficient legibility or coordination to permit satisfactory construction, inability to use the particular material or methodology specified, commercial unavailability of a specified item, or misleading provisions or other similar problems.

Generally it is seen that scope of works is not fully defined and always correlated with specifications & GFC drawings. There is a chance of discrepancy in related documents, which takes time to get clarification and subsequently impose delay in the execution.

To minimize this discrepancy, there shall be one clause available in the contract document i.e. "Priority of documents". This clause shall be clear and listed the document priority in case of discrepancy occurs.

The discrepancies in the scope of work/GFC drawings to be cleared immediately by the Client. Decisions regarding such discrepancies shall be very clear and on written format and convey to the contractor at site level to avoid long delay.

Delay in payment to the Contractor:

A late (or no) payment is fatal to the contractor or subcontractor. Contractual documents reveal that payment of the contractor for completed works is the Client's responsibility. The Contractor is required to submit RA (Running Account) bill to the Client within the time line, along with supporting documents. Subsequently, the RA bill needs to be certified by the Client in time line and convey to the Contractor to submit the Final Invoice as per Certified RA bill, for releasing the payment. This practice of RA bill payment may take 7-10 days' time, if all involved executives (Participants) of Contractor & Client work sincerely as per the Contract.Delay in payment may be occurred due to following reasons:

Client's poor financial condition

A project cannot proceed without adequate financing and the cost of providing adequate financing can be quite large. Most of the Multi-storied residential building projects in India are getting delayed due to inadequate project financing and resulting the delay in Contractor's bill payment.

Client/Owner may get fund for the Project (Residential Building Project) from Bank loan, advance bookings and any private sources. There is also a possibility that Owner/Client may divert fund which is received for the particular project to their other projects. By doing this Client/owner increase the risk in the project and impose to hold/delay contractor's bill payment. In some course of duration, it does not impact much but if it continued to more than 2-3 months, create negative cash flow for the contractor. If Contractor's regular expenses are not being paid on time, he/she will not be in condition to continue the execution and complete the work on time.

It is advisable to check Client's financing strength and payment source for the project before tendering/accepting the project. Contractors need to be more cautious for selecting projects for bidding/tendering and accepting the payment conditions.

Contractor's invalid claim

A payment claim must be in writing and appropriately served to the

recipient/client. It must include adequate information to identify the construction contract, particular construction work, activity, relevant period, which progress payment/extra claim (if any), exact amount due, how that amount was calculated and the due date for payment. It must also clearly state that the claim is made under the clause of contract conditions.

In general practice it is found that contractor makes invalid claim to increase sale & their profit. This unprofessional practice destroys the amicable environment at project and leads to the dispute.

During the period, client/owner may also hold or delay the payment of related works.
To avoid coming across with such situation, contractor shall maintain the genuine practice in best interest of the project and not to make/submit invalid claims.

***Delay in valuation and certification of RA bills*:**

After submission of Contractor's RA bill to the Client along with supporting documents, it is responsibility of the Client to certify the RA bill in short time and accordingly inform to the Contractor to submit the invoice. Moreover, the process of RA bill certification shall not be complicated. There shall not be involvement of many parties for honoring payment certificates.

The payment shall be made as per payment terms of the contract condition. Timely payment helps contractor to procure they require resources on time, which avoid the project delay.

***Insufficient supporting documents along with RA bills*:**

There are always specific supporting documents require which shall be submitted along with RA bill for the certification purpose and such process/requirement shall be listed out in the Contract documents very clearly.. In the absence of such document, the RA bill cannot be certified on time, which leads to payment delay to the

Contractor. However, there is no fault of the Client/owner.

To avoid such delay, Contractor shall follow the contractual process for RA bill submission and submit all require supporting documents to the Client.There

shall be a clause in contract document to motivate Client to pay the Contractor's expenses within the agreed time line. If contractor delay in releasing the contractor's payment, interest shall be paid to the Contractor by Client for delaying such payment.

***Land Acquisition and handing over to Contractor*:**

It has seen that large Infrastructure projects as well as Building projects get delayed due to Non-handing over of site to the Contractor on time. There may be different internal/external issues for delay in site handing over to the Contractor, which shall be taken in care before inviting Tender for the project.

It is responsibility of the Client/owner to provide clear site to the contractor for starting the execution. In case, Client does not provide the clear land (site) to the Contractor as per Contract conditions, the Contractor shall be eligible for the Extension of Time. However, project gets delay due to Non-handing over of land (Site) to the Contractor on time.

***Client's interference and slow decision making*:**

Frequent & un-justified Client's interference also creates delay in completion of project activities.

In general the process of progress monitoring and checking by the Client is clearly mentioned in the Contract documents. 'Reporting of work progresses' by the Contractor, is also mentioned in the contract by which Client/Owner may get all required data/information related to the work progress. There are following ways proposed in all type of Contracts by which Client gets all project related information:

- Daily/ weekly/ monthly progress report
- Progress review meetings
- Contract review meetings
- Design review meetings
- Safety review meetings etc.

These are the regular and contractual practice for the Client's monitoring. In most of the cases it has been seen that clients go beyond the contract practice and ask for different types of reports and creates un-necessary pressure over the contractor for the same. There is also find Clint's

interference in the execution. However, work is being executed as per contract's specification and methodology but Client's over concern and 'Being Client' attitude, creates dispute at site and delay the project.

Where there is a financial impact over the Client/owner, due to any extra item/quantity variation/change order, client slow down the decision making and that specific and correlated activities get delayed.

Clients need to analyze and resolve such issues/claims/change order/variation etc. without taking long time and give final decision shortly.

***Frequent revision in drawings*:**

The project/contract in which design and drawings are to be released by Client/owner, revision may be expected before the execution of that activity. The Good For Construction (GFC) drawings are the final drawings by which, work is executed. If revision/major changes in drawings are released in GFC drawings, it imposes to delay the work activities. It also depends upon magnitude of the proposed changes in the revised GFC drawings.

To minimize this delay, the best option is Design & built contract, in which preparedness of all design & drawings are in the scope of contractor.

Conclusion

Delay in the building construction projects, affects negatively to all the parties who is involved in the project execution and as well as to the customers also. But it is also a fact that Client/owner can recover its loss amount from the contractor by imposing Liquidated Damages (LD) on the Contractor. While drawing up the contract conditions, the Client minimizes their risk by transferring the major risk to the contractor.

Based on several studies it is found that Client's factors are very critical and directly impact to the project time and cost as well as Contractor's cash flow.

Most of the Multi-storied Residential Building projects majorly in Northern India are getting delayed due to negative cash flow of the Contractor. Situation is that the Contractors are not able to complete those projects.

To minimize/avoid such delay in ongoing and upcoming projects, special attention shall be given to all Clients's related factors as described above.

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Distribution Losses: The Problem of Indian Power Sector

Atul Agrawal*, Dr. Anil Kumar**, Dr. T Joji Rao ***

**Senior Executive Chancery, University of Petroleum and Energy Studies*
***Professor, CoMES, University of Petroleum & Energy Studies, India*
**** Associate Professor, CoMES, University of Petroleum and Energy Studies*

Abstract
Proper identification and understanding of various components of aggregate technical and commercial losses is required to understand the ground inefficiencies of the power distribution sector from deeper angle. This paper describes the various components of AT&C losses. The paper relates AT&C losses to the bad financial health of power distribution companies and suggests that the formulation of a strong strategy may help in the improvement of overall efficiency of Indian power sector.

Keywords: AT&C, Technical Losses, Commercial Losses, Power Distribution Sector

Introduction
Performance of Distribution companies in India is measured on the scale of Transmission and Distribution (T&D) losses and Aggregate Technical and Commercial (AT&C) losses. There is a difference between T&D and AT&C losses. T&D losses come from the difference between the Energy Input & the Energy Billed for a particular consumer while the AT&C losses come from the difference of Energy Injected and the Amount of Energy for which Revenue from consumer is actually realized. T&D losses take into consideration of all the losses in Transmission & Distribution system, which includes commercial losses up to the billing point and do not consider the energy for which revenue is being actually realized.

Overview of AT&C Losses:
Aggregate Technical and Commercial (AT&C) losses can be segregated into various loss making components. The head of segregation may be the technical and non-technical (commercial) losses. Short insight on the technical and non-technical (commercial) losses is presented as follows:

Technical Losses:
Technical losses occur in the process of the flow of electricity from one point to another

for end use. Technical losses are inherent in nature and have very low possibility of elimination from the distribution network. The main reason of technical losses is the poor network structure and downgraded network configuration. Improper planning during the design stage and improper maintenance of the network leads to the mismanaged lengths in feeders, overloading and some other related factors. Such nonstandard practices cause the higher proportion of technical losses in the network. Types of technical losses are as follows:

- *Copper Losses:* Copper losses are winding losses and they are core in nature. They occur due to heat generated by the flow of current in conductors of electrical devices; such as transformers etc.
- *Dielectric Losses:* Dielectric losses occur when the heating effect is applied on the dielectric material available in between of conductors.
- *Induction/radiation losses:* These losses are the result of electromagnetic fields generated in the surroundings of conductors.

Technical losses can be computed and controlled provided that the quantity of load is defined and known in advance for a particular power system. Main reasons of technical losses are as follows:

- *Harmonic Distortions:* Pure signals of electricity (AC V&I), contain fundamental frequency of 50 Hz/60 Hz and are supposed to be in the format of an ideal sine wave. However, in actuality, these signals get distorted and result in the combination of manifold sine waves of numerous frequencies. The same has detrimental effects which increase the heating and as per the result higher core losses occur in the system.

- *Single Phase Lines:* If we install a long line in single phase, then it gives the opportunity to transmit more electric load which cause more I^2R losses. Higher resistance & low voltage of a single long line leads to higher losses in the system.

- *Load Unbalancing:* When the load, current and voltage in an electricity network become similar in all 3 phases, then it is known as a

balanced system. In the balanced system, no current flows through the neutral wire as all phases are equally stressed. While in the unbalanced system, due to overstressed phases; the unbalanced current flows through the neutral wire and hence more technical losses occur.

- *Low voltage & Overloading:* Technical losses are proportional to the square of current flow and have an inverse relation with the voltage. Hence, in overload situations when more current flows, higher losses occur. Also, if current is flowing with low voltage, technical losses will be higher than the normal conditions.

- *Low Standard of Insulation:* Lack of maintenance activities are the cause of poor insulation in machineries. Leak level is increased by the poor insulation, hence the problems like overload and low voltage are often seen in the system. Poor insulation and its subsequent effects may also increase the possibility of system collapse.

Commercial Losses (Internal):

Main reasons of the Internal Commercial losses are as follows:

- *Management of service connections:* Proper management of service connections is necessary for the appropriate revenue collection. Releasing the electricity connection without meter, improper billing records, waiving off the past dues in order to connect premise once again are the few examples which contributes enough into commercial losses. Some commercial losses may be hidden or unrecognized if bills for non-existing consumers are generated by the system.

- *Meter reading & billing:* Accurate measurement of the used energy is important for the whole distribution system. There are some cases in which meter reading is not taken due to inaccessibility of the place or locked premise. Certain cases are there in which meter reading is noted as false or if meter does not work properly. Tempering with meter or with recorded data, absenteeism of quality checks, deficiency in billing

software also magnifies the problem significantly.

- *Electricity theft:* Less or no field inspection results in the higher amount of power pilferage. Low accountability towards the prevention of theft, political pressure and sometimes unethical involvement of company staff in such cases lead to higher amount of commercial losses which further deteriorates the health of Distribution utilities.

Commercial losses (External):

The external commercial losses arise from the non-collection of past dues by the discoms. Smart revenue collection techniques may be used to optimize these types of losses. Otherwise constraints like – low number of collection avenues, delay in the disconnection of defaulters, no follow-up with defaulters; shall continue to enhance the problem.

Facts & related significance[1]

The national scenario

The national average of AT&C losses of distribution utilities was recorded at 25.38% in 2012-13. Overall collection efficiency recorded in the same year was 94.35%. Although the average of AT&C losses and level of collection efficiency is changed and improved in comparison to 2011-12 but it cannot be taken as the significant improvement. The region wise lookup of AT&C losses is as follows:

Table 1: Region wise AT&C Losses

Power Region	2011-12	2012-13
Eastern	41.80%	42.06%
Northeastern	35.15%	37.60%
Northern	30.34%	28.84%
Southern	18.89%	17.24%
Western	24.81%	23.36%
National Average	**26.63%**	**25.38%**

Amongst all the power regions in India, Lowest AT&C losses were recorded in the Southern Region while the Eastern Region had the highest proportion of AT&C loss.

Well performing states

Following states detected the improvement in AT&C losses in 2012-13 in comparison to 2011-12:

[1] Source: Report on the Performance of the State Power Utilities; PFC

Table 2: Particulars of AT&C Loss Improvement

Reduction Ratio	Number of States	Name of States
0-2 %	6	Tamilnadu, Kerala Odisha, , Andhra Pradesh, Goa, Punjab
2-4 %	4	Delhi, Chhattisgarh, Uttarakhand, Karnataka
Above 4%	10	Puducherry, Meghalaya, Himachal Pradesh, Jammu and Kashmir, , Mizoram, Rajasthan, Madhya Pradesh, Sikkim, Arunachal Pradesh, Bihar

Low performing states

Following states observed the increment in AT&C losses in 2012-13 in comparison to 2011-12:

Table 3: Particulars of AT&C Loss Increment

Increment Ratio	Number of States	Name of States
0-2 %	5	Gujarat, Maharashtra, Tripura, Uttar Pradesh, West Bengal
2-4 %	1	Assam
4% and above	4	Jharkhand, Haryana

Health of distribution companies

Revenue from Sale of Power

The combined revenue from the sale of electricity by - Distribution Companies, State Electricity Boards or other such utilities, which sell power directly to consumers was recorded at Rs. 288632 Crores in 2012-13 which is 19.66% higher in comparison to the amount of Rs. 241217 Crores in 2011-12. On the other side, the total amount of energy sold registered the growth of 5.23%; as, 657629 MkWh of energy was sold in 2012-13 against the amount of 624951 Mkwh in 2011-12.

The table below shows the region wise growth in sale of power as well as growth in the amount of energy sold in the year of 2012-13:

Table 4: Growth in Energy Sold & Revenue

POWER REGION	Growth	
	Energy Sold (Mkwh)	Revenue
Eastern	9.27%	27.47%
North Eastern	1.65%	7.77%
Northern	6.49%	22.94%
Southern	0.56%	18.38%
Western	7.70%	16.12%
TOTAL	**5.23%**	**19.66%**

The growth in revenue is achieved due to rationalization of tariff. Although this revenue does not include wheeling & related charges, meter charges, subsidies from the State Government etc.

Losses of Utilities[2]

The cumulative turnover[3] of the utilities observed the growth of 16.73% in 2011-12 in comparison to 2010-11 and 18.69% in 2012-13 in comparison to 2011-12. The cumulative expenditure also witnessed the growth of 22.81% and 14.65% for respective years as illustrated.

The recovery of cost (includes depreciation) is shown in the table given below:-

Table 5: Growth in Energy Sold & Revenue of Utilities

Particulars	2010-11	2011-12	2012-13
Total Income excluding subsidy (Rs. Crores)	229213	267560	317557
Total Expenditure (Rs. Crores)	300678	369275	423377
Recovery of cost (%)	76.23%	72.46%	75.01%

The total booked losses of the utilities were increased from Rs. 49577 crores in 2010-11 to Rs.72629 crores in 2011-12. Although these losses were decreased to Rs.69108 crores in the year 2010-11. On the other hand, the cash losses[4] increased from Rs. 60344 crores in 2010-11 to Rs.94100 Crores in 2011-12. These losses decreased to the amount of Rs. 36105 crores during the period of 2012-13.

While taking the subsidy received into consideration, the losses of utilities increased from Rs 51948 Crores (2010-11) to Rs 76867 Crorers (2011-12). These were decreased to Rs. 69972 Crores in 2012-13.

On the other hand, while we do not take subsidy into consideration; the losses of utilities increased from Rs.72282 Crores (2010-11) to Rs.102638 Crores (2011-12) and subsequently to Rs.106071 crores (2012-13).

The way forward

Recently, the Indian power sector has seen many changes in regulations. States of India adopted various initiatives to control the level of losses, but the situation remains the same and the issue of high losses is still plaguing the sector. Hence, to improve the situation, we need to give focus on the root causes of losses and have to design a strategy accordingly.

We need to identify the each component of loss because each and every component may have different root cause. To deal with such

[2] Who sell power directly to consumers
[3] revenue through sale of power + other income - subsidy booked
[4] on revenue and subsidy realized basis

loss components we need to formulate different - different strategies. We also need to have appropriate loss measurement techniques to measure losses accurately. Simultaneously proper segregation of technical and commercial losses is also required.

Various initiatives of State Governments can give the proper results to maximize the benefits if the strategy formulated consists of the following steps:

- *Defining losses:* Present status of losses should be accurately defined by segregating the Technical Losses and Commercial Losses. A future loss reduction target over the years must be set and it may be linked to incentives.

- *Strict Monitoring & Audit:* IT based solutions like SCADA (Supervisory Control & Data Acquisition System) must be implemented by the state utilities in order to enable remote monitoring and accurate acquisition of particulars. Energy audit must be done by the independent body. Energy audit should be done on the all four integrated levels of energy input, i.e. on the level of distribution transformer, feeder, division and on company level.

- *System Strengthening:* Strengthening of Distribution Network by improving HT/LT ratio, augmentation of DT/Substation, Bifurcation of feeders, Implementation of HVDS system; can further lower down the distribution losses. While initiatives like outsourcing of metering, billing and collection related activities, IT solutions for metering, prepaid metering may improve the position of commercial losses.

- *Benchmarking:* Loss reduction strategies of other nations may be followed. Similar strategies can be studied and the best suitable strategy in Indian context may be practiced to reduce the level of losses. Practices like privatization, competition in the distribution segment by enabling retail; implementation of smart grid, etc. are the main things which need focus of policy makers.

Concluding remarks

Revenue for the whole power sector originates from the distribution sector and that is why it's high or low performance affects the whole sector. After unbundling, the power distribution is the only segment[5] which is performing below the expectations of stakeholders. The distribution sector in India is still a monopoly and it is majorly owned by respective state governments. A high proportion of AT&C losses, operational inefficiencies and subsidies are worsening the finances of distribution companies continuously. Recently announced bailout packages are temporary help packages and we need to formulate and focus on a strong strategy which can really help in the revival of Indian Distribution Sector.

Acknowledgements

Corresponding Author would like to thank the reviewers, editors and his family for their guidance and valuable suggestions.

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[5] Amongst Power Generation, Transmission & Distribution

Background Paper

Economic regulation of airport business

Akhil Damodaran*, Dr. Tarun Dhingra**

** Assistant Professor, CoMES, Univeristy of Petroleum & Energy Studies*

***Professor, CoMES, Univeristy of Petroleum & Energy Studies*

Keywords

Till regulation, Price cap, Indian Airports

Introduction

One of the main engines of growth of a country the air Transportation industry is an important pillar for India's Competitiveness in the global scenario. It provides direct and indirect benefit such as jobs, movement of goods and people. Air transportation sector consist mainly of two entities, first is Airlines and the other is Airport. The domestic air traffic in India has grown to 64.47 million from Jan to June 2016.The expected domestic air traffic passenger is expected to grow by 100 million by FY 2017. India is among the five fastest-growing aviation markets globally with 275 million new passengers. The airlines operating in India are projected to record a collective operating profit of Rs 8,100 crore (US$ 1.29 billion) in fiscal year 2016, according to Crisil Ltd.

Indian Airport Industry is also growing at a fast pace , the first PPP airport in India was Cochin International Airport, as demand for new airports Increased 4 new PPP airports were established namely Delhi, Mumbai, Hyderabad, Bangaluru. Our Paper discusses Airport as a Business and the

regulatory systems associated with these business.

Current Scenario of Public Private Airports in India

India has 5 Operational PPP airports namely

- Delhi International Airport,
- Cochin International Airport,
- Hyderabad International Airport,
- Mumbai International Airport and
- Bengaluru International Airport.

Delhi International Airport

Delhi International Airport is a joint venture of GMR group, AAI , and Fraport, DIAL entered into the OMDA agreement on April 4 2006.The initial term contract is of 30 years which can be further extended to 30 years.

Cochin International Airport

Cochin International Airport is the first green field airport in India under Public private partnership a joint venture with Government of Kerala (13%), Central Government (13%) and Non-Resident Indians (NRIs) etc. as major shareholders (74%).The airport pioneered the concept of private investment in the airport sector after being incorporated as a public limited company, receiving investments from nearly 10,000 NRIs from 30 countries.

Hyderabad International Airport

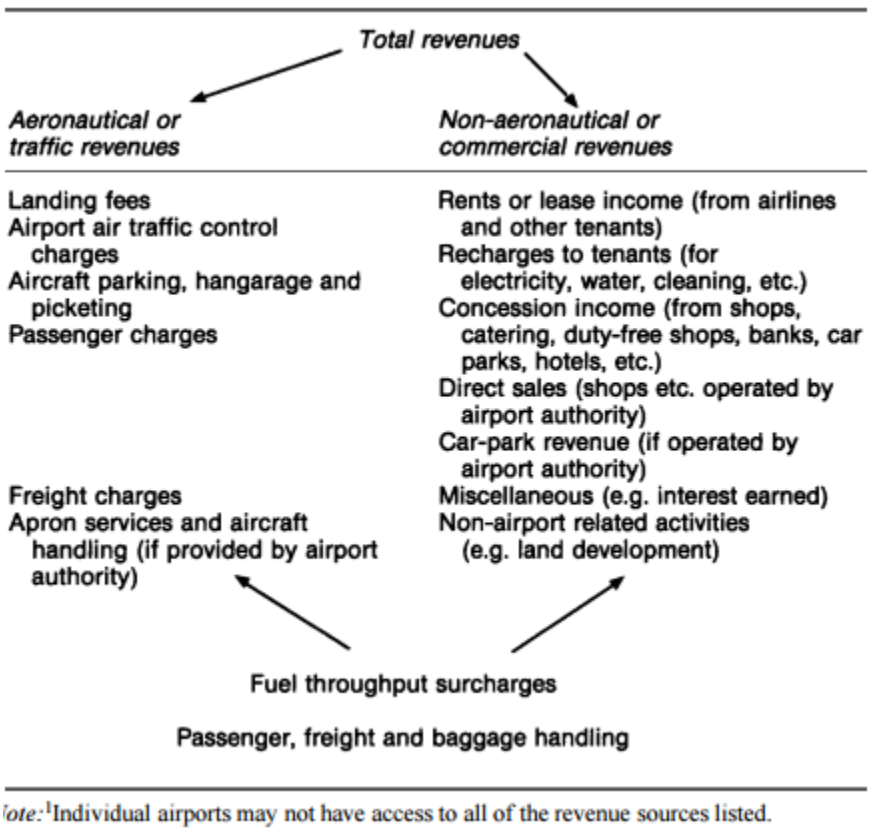
GMR Hyderabad International Airport Limited (GHIAL) is a joint venture by the GMR Group in partnership with, Government of Andhra Pradesh (13%) and Malaysia Airports Holdings. The Company was incorporated to design, finance, build, operate and maintain a world-class Greenfield airport at Shamshabad, Hyderabad. The project is based on the Public Private Partnership (PPP) model and is structured on a Build, Own, Operate and Transfer (BOOT) basis.

Mumbai International Airport

Mumbai International Airport Pvt Ltd. (MIAL), a joint venture between the GVK led consortium (74%) and Airports Authority of India (26%), was awarded the mandate of modernizing and upgrading Mumbai's Chhatrapati Shivaji International Airport (CSIA) in February 2006.

Airport as a Business

Airport Infrastructure needs a very huge sum in terms of cost. This means as an airport operator the initial as well recurring cost may be at higher node. More or less it is the airlines which decide the number passenger and freights arriving or departing from an airport. That means airport as little control over its sources of revenue.



Note: [1]Individual airports may not have access to all of the revenue sources listed.

ref: Doganis, Rigas. 1992. The Airport Business. Routledge. doi:10.1016/0969-6997(94)90041-8

Thus meeting airport capacity demand, as well as staying profitable is a difficult task, The Business of Airport is slightly different from a normal transport business. The airport business consist of Non Aero revenue, Aero Revenue.

Aeronautical revenue are those which arises from operation and landing of aircraft, passenger and freight, they include aircraft-landing fees, passenger-service charges, air-traffic-control. Non-aeronautical revenues are those generated from non-aircraft-related commercial activities in the terminal/s and on airport land. In certain scenarios it is difficult to ascertain which one of the revenue source may come under aeronautical and non-aeronautical as both have common source which is passengers.

Monopolistic nature of the airport

Airport comes under monopoly market because of the nature of its business because of high infrastructure investments and lack of competition between airports, the chances of abuse of dominance increases. This creates the need of regulation by the regulator to regulate the sector to create a conducive environment for players as well as consumer to provide fair treatment for all.

Monopolistic nature of the airports is due to the fact that airports are less prone to competition because airports do not compete with each other due to natural monopoly (the cost of production will be higher than the return).This provides Airports an upper hand comparative to airlines to control price. This nature of the airports may create unfair market if airports are under private ownership. It is because private ownership will have profit maximization as its motive. This condition gave rise to need of regulation of airports.

Price Regulation of Airports

The view of regulation has changed in recent past. Now regulation is moving towards incentive based regulation, which means incentivizing the organization to do the right thing as prescribed by the regulator.

Types of price regulations are:

- Price cap regulation
- Rate of return regulation
- Light touch regulation

Price cap regulation: It is the maximum allowed price which the producer of the good can charge from the consumer. It depends on the factors which are generally beyond the control of regulated firm. the price of a specific product in any given year may be capped at a level which alters over time in response to a price index that is exogenous to the regulated firm and a factor set in advance by the regulator.

Rate of return regulation: It means effects of price levels on the earning of the investors so that investor gets a fair rate of return. Rate of return regulation takes into account a company's costs and allowed rate of return to develop a revenue requirement. This revenue requirement then becomes the target revenue for setting prices.

Light touch regulation: It is similar to self-regulation where the organization decided the price and regulator observes the market .The regulator will interrupt only if there is abnormal price fluctuation and there is chance of customer getting impacted.

Types of till regulation

Till regulation determines the treatment of commercial revenue .Commercial revenue is an attractive opportunity for the airport operator to create profit as well as it motivated the operator for more investment. Till methodology gives regulator a way to ensure

commercial revenue should not be exploited in a manner which harms customer.

Till regulation is basically divided into three types

- Single Till: under single till the whole commercial profit is subtracted from the revenue requirement for airside services and then the aeronautical charges are determined.
- Dual till regulation: Under this treatment, the regulator does not take into account the non-aero revenue while determining aeronautical charges.
- Hybrid Till: its modified single till, certain portion of commercial revenue is taken into account while determining aeronautical charges.
- Generally world over single till is preferred more by airlines as it reduces their airport charges which they need to give to airports and dual till is preferred by the airports as it increases their revenue.

Table 1; Current regulation in Indian PPP Airports

Operator	Tariff determination mechanism as per concession	Till Framework adopted	Non Aero Cross Subsidization	Revenue Share to AAI/Govt
Delhi	CPI-X	Hybrid Till – Based on Concession	30%	45.99% (AAI)
Mumbai	CPI-X	Hybrid Till – Based on Concession	30%	38.7% (AAI)
Hyderabad	YPP based	Implied Dual Till as per Concession Hybrid Till as per Government policy directive	30%	4.0% (Govt)
Bangaluru	YPP based	Implied Dual Till (Single till considered by AERA)	40%	4.0% (Govt)
Kochi	Not defined	Single Till, Temporarily Light touch	0.0%	0.0%
GOA	Not Defined	Hybrid Till as per draft aviation policy	30%	---

Future trends:

CAPA projections shows airport passenger traffic growing from 143 million in 2010/11 to 452 million by 2020/21.This is a promising growth trend for Indian Airport industry, currently commercial revenue expansion is still a promising area which needs exploration. Airport economic regulator is new compare to its global counterparts. As the time goes by regulator will be able to provide policies which are more conducive to competitive environment and will also help to provide a fairplay environment for both airport operator and Airline service provider.

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India's bid for Deepest Energy Corridor

Siddhartha Bhatnagar*, Darshit Paun**

**Business Analyst (Oil & Gas), Tieto Software Technologies Ltd.*

***Commercial, Mahanagar Gas Ltd.*

Abstract

India being a pygmy in the global gas arena its appetite for natural gas is increasing. India's gas consumption is a third of China and fraction of US. While some of the biggest producers have used natural resources to power economic growth, India continue to rely on coal and oil for its energy needs.

However 12th Plan projection shows rise in the demand for gas form power, fertilizer and CGD sector, domestic production is not keeping pace meeting its demand. Revision of gas pricing and new LNG terminals is the reform mantra that government is keen on meeting its gas requirements.

Diversification of gas imports portfolio is the need of the hour and though country has invested enormous political and diplomatic capital in the past, nothing concrete has been substantiated. This paper looks for the opportunities in the Oman-India Pipeline (OIP), Middle East India Deepwater Pipeline (MEIDP), which is expected to eliminate potential vulnerabilities arising from attacks or hijacking of pipelines by subversive elements in Pakistan and Afghanistan. It covers gas reserves of the participating countries, project details and PESTLE analysis of MEIDP vs. TAPI.

List of Abbreviations

Abbreviation	Long Form
ADB	Asian Development Bank
BCM	Billion Cubic Metres
BP	British Petroleum
BSCFD	Billion Standard Cubic Feet per Day
BTU	British Thermal Units
E&P	Exploration & Production
EEZ	Exclusive Economic Zone
EIA	Energy Information Administration
EOR	Enhanced Oil Recovery
EPC	Engineering, Procurement & Construction
GPFA	Gas Pipeline Framework
GSPA	Gas Supply & Purchase Agreement
GST	Goods & Service Tax
IGA	Inter-Governmental Agreement
IRR	Internal Rate of Return
KM	Kilometers
LNG	Liquefied Natural Gas
MEIDP	Middle East India Deepwater Pipeline
MMBTU	Million Metric British Thermal Units
MMSCMD	Million Metric Standard Cubic Meters per Day
OPEC	Organization of Petroleum Exporting Countries
PRI	Political Risk Insurance
RLNG	Degasified Liquefied Natural Gas
SAGE	South Asia Gas Enterprise
SPV	Special Purpose Vehicle
TAPI	Turkmenistan Afghanistan Pakistan India
TCF	Trillion Cubic Feet
TSC	Technical Services Contract
UNDP	United Nations Development Program
USD	United States Dollar

Reserves

India

India being a pygmy in the global gas arena, its appetite for natural gas is increasing. Due to the poor domestic production, it relies on the imports to fulfill the requirement of petrochemicals, fertilizer and power generation units. According to International Energy Association estimates, the country will require 190 billion cubic meters of natural gas annually by 2035. India has been exploring multiple opportunities to widen its fuel mix and diversify its supply chain, of which natural gas forms a vital component.

India meets its natural gas requirement by importing LNG. It was the world's fourth-largest LNG importer in 2013, following Japan, South Korea, and China, and consumed almost 6% of the global market, according to data from IHS Energy.

Due to the geopolitical positioning of the country, it faces difficulty in agreeing with any transnational pipelines between the neighboring countries. The efforts for Iran-Pakistan-India(IPI) pipeline and the Myanmar-Bangladesh-India(MBI) pipeline – are now practically retreated while Trans-Afghanistan Pipeline, has seen a decade of discussion, and has made only a meager progress. With sanctions over Iran now uplifted and appointment of the Asian Development Bank (ADB) as the project's technical and financial advisor, it seems things have stuck the right chord. Though India has made gas pricing reforms with the government approved a new pricing scheme, it is yet to receive any major international investment in the E&P sector.

According to the Oil& Gas Journal, India had 47 TCF of proved natural gas reserves at the beginning of 2014. About 34% of total reserves are located onshore, while 66% are offshore, according to India's Ministry of Oil and Gas.

Iran

Iran is the second-largest proved natural gas reserve holder in the world, behind Russia. It holds 17% of the world's proved natural gas reserves and more than one-third of OPEC's reserves.

Much of the growth of Iranian fields has been hampered by sanctions. Additionally, the lack of foreign investment and insufficient financing, have resulted in the slow growth. Finding new natural gas reserves in Iran is not a high priority because the country contains large amounts of undeveloped known reserves.

Iran does not have the infrastructure in place to export or import LNG. Lack of technology, foreign investment and stemmed with international sanctions made it impossible for Iran to obtain financing and to purchase necessary technology.

Iran trades marginal amounts of natural gas regionally via pipelines. In 2013, more than 90% of Iran's imports came from Turkmenistan, and more than 90% of Iran's exports went to Turkey (EIA Iran, 2015). Iran has the potential to become an important supplier to the region owing to the amount of reserves it has. Iran-Iraq pipeline is expected to be commissioned soon, while Iran-Oman pipeline is facing issues of prices disagreement. Iran-Pakistan pipeline has seen almost complete construction of the pipeline on the Iranian side, while the same has been facing major delay in construction on Pakistan territory.

Transportation Cost Comparison (Pipeline vis-à-vis LNG)

An estimate of gas delivery costs by alternative transportation options done by EIA reveal that for shorter distances, the delivery cost of natural gas transported via pipeline is cheaper than transporting it in the form of LNG. Transportation in the form of LNG becomes more competitive for long distance routes. The normal breakeven distance for an onshore pipeline comes at around 4000 km. The breakeven point has tended to fall over the last decade, as LNG costs have fallen faster than pipeline costs. The breakeven point falls even below for offshore pipelines since the costs are higher in case of off shore pipelines. The table given below compares the transportation costs via on shore and off shore pipelines and transportation in the form of LNG:

Table 1 : Transportation Costs Comparison Pipeline v/s LNG (At Calorific Value = 8500 Kcal/scm)

Distance (km)	Onshore Pipeline (USD/mmbtu)	Offshore Pipeline (USD/mmbtu)	LNG (USD/mmbtu)
800	0.47	0.74	1.78
1600	1.13	2.08	1.86
2400	1.48	2.67	1.95
3200	1.84	3.26	2.04
4000	2.19	3.85	2.12
4800	2.55	4.45	2.21

Source: EIA

Recent sub-sea pipeline projects

Technology prowess has led to the successful commissioning of long sub-sea pipeline projects. Nord Stream project 1222 km long sub-sea pipeline is the longest sub-sea pipeline in the world.

Table 2 Sub-Sea Pipeline Projects in the World

Project	Location	Length	Product
Nord Stream	Russia-Germany	1222	Gas
Blue stream pipeline	Russia-Turkey	1213	Gas
Langeled	Norway-UK	1166	Gas
South Stream	Russia-Bulgaria	925	Gas
FranPipe	Norway-France	840	Gas

Source: EIA

MEIDP – Middle East India Deepwater Pipeline

Features of the Project

Potential Start Points: –

Chabahar, Iran

End Point: –

Near Porbandar (South Gujarat), India

Material / Diameter: - API 5L, Gr. X-70 /24” I.D. (27.2” O.D.)

Wall Thickness: -

32.9-40.5mm WT (DNV OS-F101)

Flow rate: -

1.1BSCFD (31.1mmscmd)

Maximum Depth: -

3,450 meters

Length: -

1,200- 1,300 kilometers

Project Duration: -

5years (as Fast Track Project)

Pipeline Construction: - 2 years

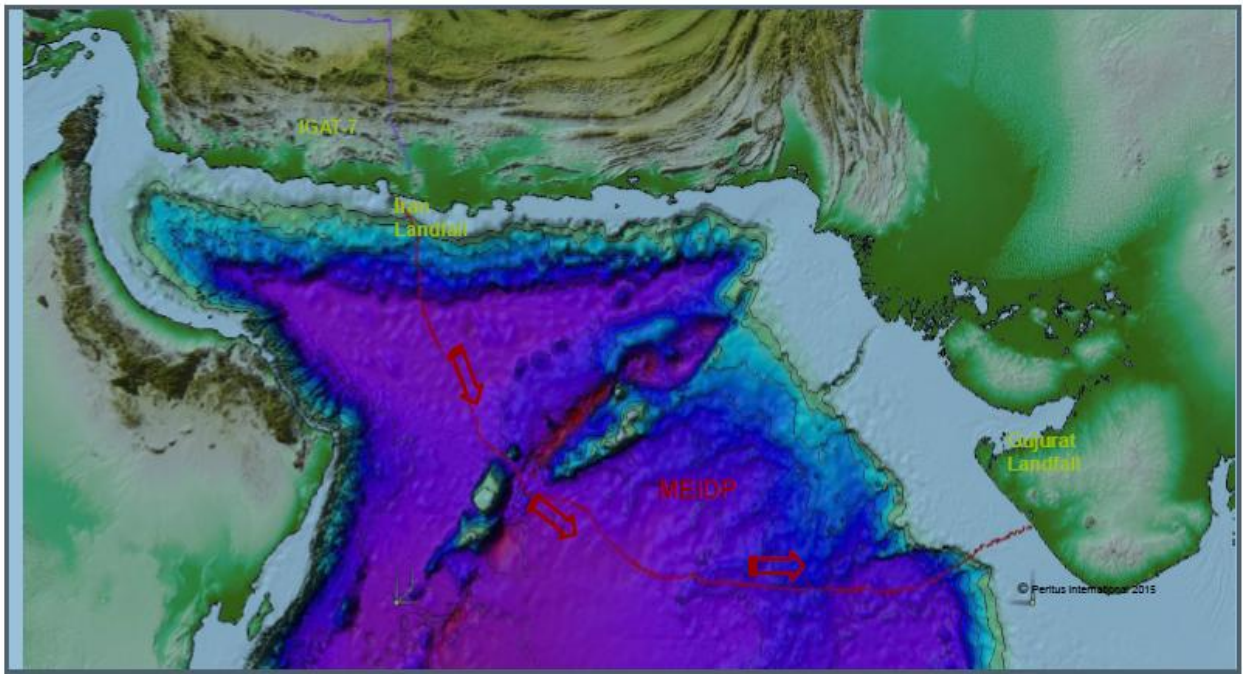


Figure 1: MEIDP Proposed Route

Source: SAGE India

Proposed Project Structure

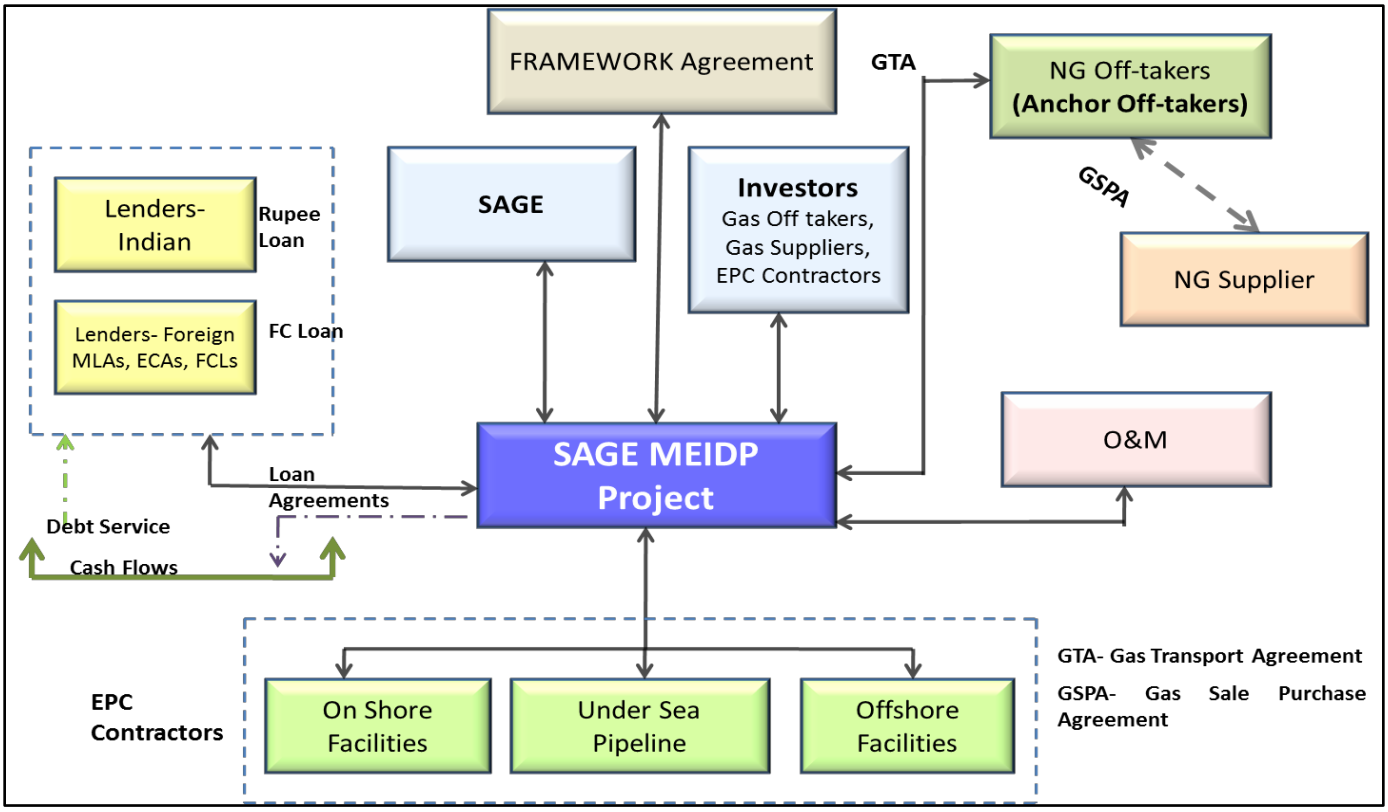


Figure 2: SAGE MEIDP Proposed Project Structure

Source: SAGE India

MEIDP will be the first in a series of pipelines supplying gas to the Gujarat coast of India, from the vast available resources in the Middle East, by the safest, most economic and reliable means. The proposed project structure will be carried through a series of investments from the Gas off takers, Gas suppliers and counterparties including EPC Contractors developing on shore facilities, off shore facilities and undersea pipeline. The consortium would be led by SAGE and backed by the Gas supplier countries and Gas off taker country. The project would be funded by an optimal mix of debt and equity, the details of which are elaborated below. Gas off takers will execute mutually acceptable GSPA with suppliers. The GSPA can be of take or pay nature so that the gas suppliers and

transporter are ensured of the steady cash flow from the project. The pipeline would act as a "Common Carrier" wherein SAGE would be the Gas transporter and will be paid Gas transportation for pipeline use.

Project Cost

Particulars	Offshore Segment	Iran Onshore Segment	India Onshore Segment	CCS*	GPRT#	Total
Material Procurement	960.6	2.2	1.3	202.6	100.0	1,266.6
Construction	1,708.2	7.1	5.6	196.7	118.2	2,035.9
Pre- Commissioning& Commissioning	89.8			8.1	5.3	103.1
Engineering & Project Management	120.2	7.8	7.8	50.6	40.0	226.4
Insurance and Certification	69.0	0.1	0.1	10.2	5.6	85.0
Contingency	863.6	5.1	4.4	196.9	113.3	1,183.4
Total Hard Cost	**3,811.3**	**22.4**	**19.1**	**665.0**	**382.3**	**4,900.3**
Contingency Dewatering	57.2					57.2
Total Project Cost	**3868.5**	**22.4**	**19.1**	**665.0**	**382.3**	**4957.4**

Figure 3: Cost Structure (Indicative) in USD Mn)

Source: SAGE India

EPC Partnerships

The project cost is estimated to be around $ 4.9 billion from Iran Coast to the west coast of Gujarat. SAGE expects the transportation tariff in the range of $2.5 per MMBTU. Funding through a mix of several financial instruments would be required in order to secure funds for such a humongous CAPEX project. SAGE has signed MoUs and working agreements with several suppliers to ensure that the materials required for the deepwater pipeline project can be procured within the country. Moreover, working MoUs have also been signed with the gas suppliers, gas off takers, and gas consumers.

Cost Competitiveness

MEIDP v/s Other Similar projects

The table below compares the cost of other similar projects with the cost estimated for MEIDP. The unit cost of MEIDP project is in line with the unit cost of other similar deep sea pipeline projects.

Table 3 : Cost Comparison of MEIDP vis-à-vis Other Similar Projects

Project	Length (KM)	Capacity (BCM)	No. -	Diameter (inch)	Depth (Meter)	Cost (m' US$)	Unit Cost (US$/Inch/m)
Medgaz	210	8	1	24	2165	806	160
South Stream	925	63	4	32	2200	12800	108
Nord Stream	1222	55	2	48	210	11264	96
ITGI	217	10	1	32	1800	640	92
Blue Stream	396	16	2	24	2200	1700	89
Europie 1	670	18	1	40	70	3400	140
Europipe 2	642	24	1	42	354	1690	6.3
Franpipe	840	19	1	42	70	1866	53
Langeled	1166	24.5	1	44	385	2720	53
MEIDP	1300	11	1	27	3500	4000	113

Source: SAGE India

RLNG v/s MEIDP

In 2014, India ‘s natural gas demand was around 405 MMSCMD, the net indigenous production was 73.42 MMSCMD while 48.57 MMSCMD of natural gas was imported in the form of LNG. The balance demand was unmet (Petroleum Planning & Analysis Cell, 2014). MEIDP could prove to be an assured source for the ever increasing appetite of natural gas in India. The comparison of additional cost components that can be attributed to price of imported natural gas is shown below:

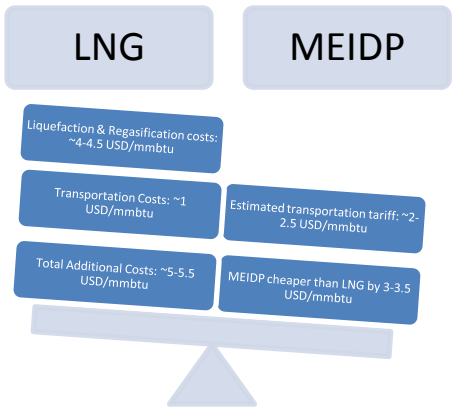


Figure 4: Cost Comparison RLNG vis-à-vis MEIDP

Based on the estimates, the long term price outlook of natural gas from MEIDP is roughly around ~20% to 30 % cheaper as compared to RLNG.

Key Financial Challenges

Considering the risk profile of the project, the financers have to negotiate with all stakeholders of the project to enhance the viability of the project. Complex and interdependent agreements have to be designed in order to cover all possible risks of the project. A project this complex also invites equity participation from the host governments to ensure the lenders of the viability of the project. The figure given below mentions key financing challenges posed by the project:

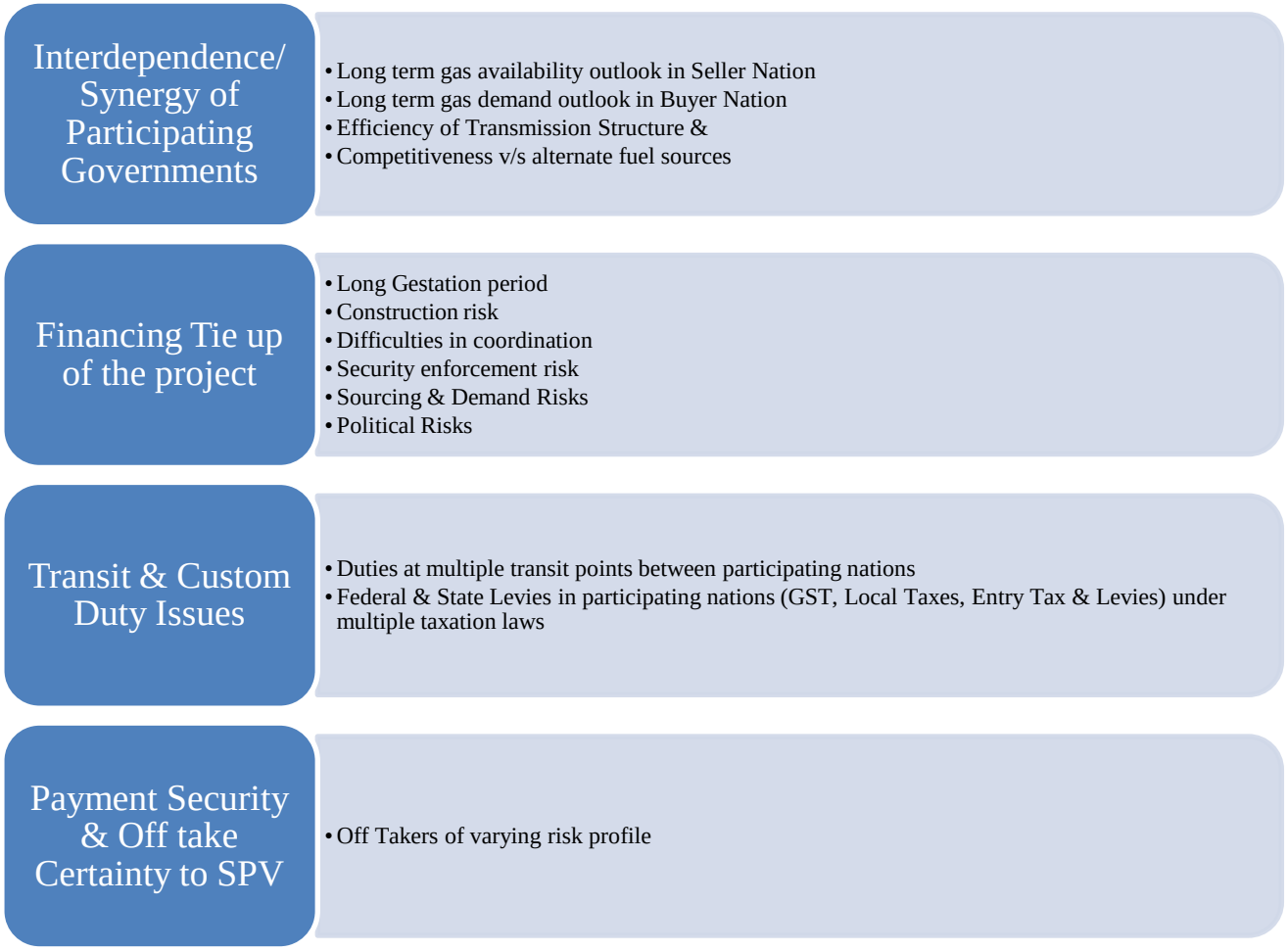


Figure 5 :Key Financial Challenges

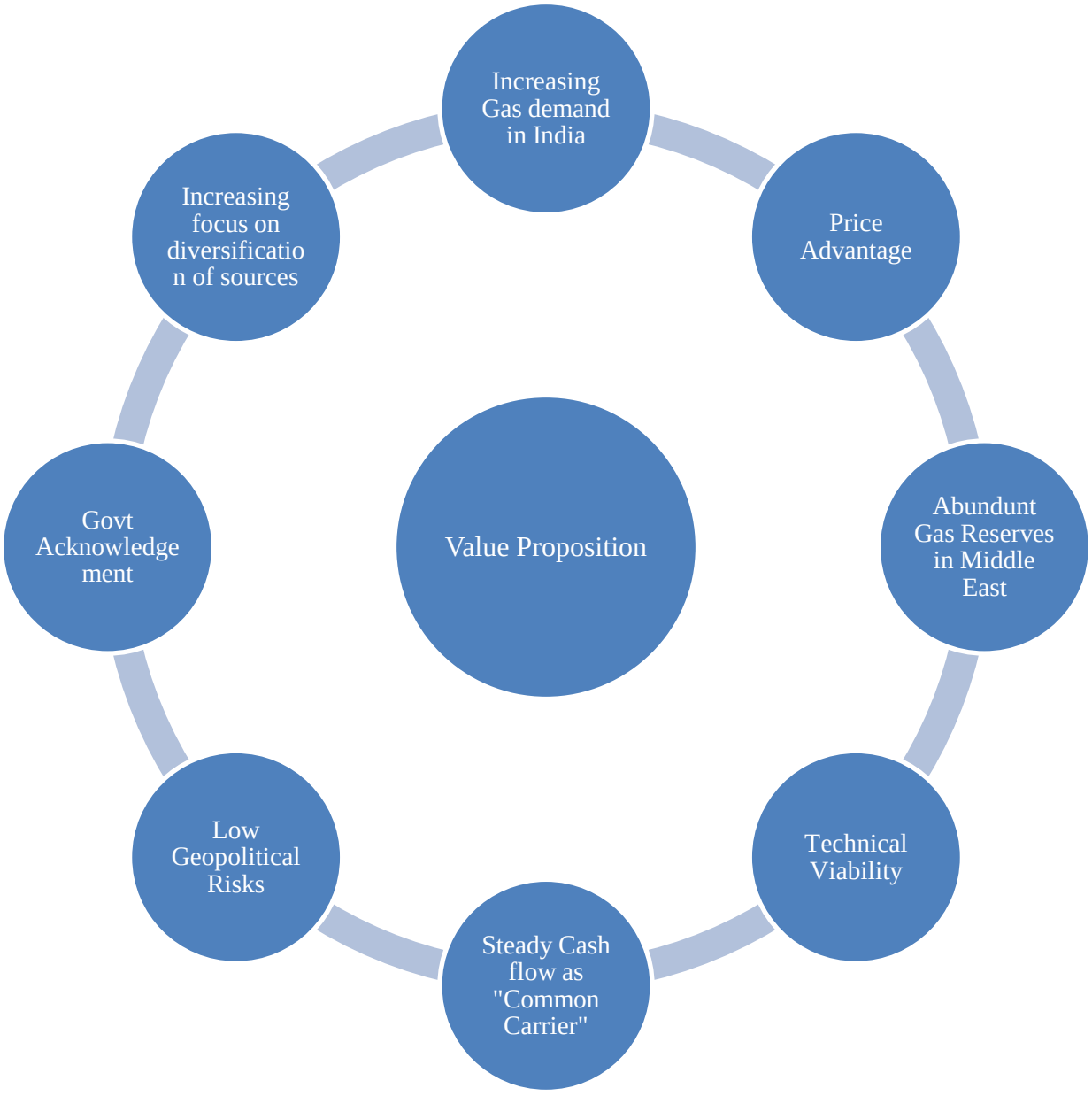
Risk Analysis & Mitigation

Table 4 :Risk Analysis & Mitigation for MEIDP

Risk	MITIGATION STRATEGY
Construction risk/project development risk	
Completion risk	Management capability of spv &epc contractor Liquidated damages in the technical/construction contracts Inter govt. Agreements for support & security of project activities & assets. Time & cost overrun support by spv sponsors
Financing risk	Strong & bankable contractual framework among participating nations, gas buyers & sellers and spv Credit risk of off-takers Appetite for financing Pri cover
Environmental/ statutory approvals	Participation of govt./psu companies of participating nations Inter-governmental agreements
Engineering risk	Selection of reputed pmc & technology partners
Post construction risk	
Operating risk	Appointment of reputed pipeline operator Transportation agreement between spv & gas buyers Liquidated damages in the operational contracts Support from participating nations as equity holders in spv
Management risk	Overall management by consortium leader Participating nations to manage operations
Capacity off-take, market & payment risk	Strong contractual framework with take or pay obligations Comprehensive technical assessment of gas supply sources by a reputed consultant Participation of buyer & seller country in spv Assessment of credit risk of off-takers
Other risks	
Political risk	Strong contractual framework between participating nations and respective gas sellers & buyers Multilateral participation Participation of international agencies like epc contractors, spv consortium members etc. Economic interdependence between gas seller & buyer countries Political risk insurance(pri) coverage International dispute resolution
Force majeure risk	Suitable insurance coverage

Value Proposition by MEIDP

India's transnational gas pipeline dream has been long held back. Several options that have been explored in the past have been either been dwindled into political discussions or lost hope in crossing the neighbor's borders. With the availability of the deep water pipeline technology and MEIDP could be India's safest bet for transnational pipeline connectivity. The figure explains the value proposition offered by MEIDP.



PESTEL Analysis TAPI vs MEIDP

Political Factors

The TAPI pipeline project faces threats in term of security and political instability in the region. It will pass through Afghanistan and Pakistan that are unstable and prone to attacks by extremists.High costs incurred in securing the pipeline may render the project financially unviable. It can also deter investors from investing in high-risk zones. Though in recent times India and Pakistan have shown flexibility towards each other, their hostile relations have always been an impediment for the growth of regional trade and connectivity (ICWA, 2012).

MEIDP involves the countries that need more attention in terms of gas trade which could help in planting a good political condition both in Oman and Iran. The relaxation of international economic sanctions against Iran could help in level playing field for the smooth execution. The sea based pipeline option seems to have been influenced by a desire to avoid taking the politically and socially unstable route.

Economic Factors

The TAPI project seems extremely attractive in theory; however, it has faced enormous economic challenges over the decades. Project now being shepherded by ADB (Asian Development Bank) injects strong belief of commissioning. The TAPI provides plausible economic opportunities to Pakistan, India and Afghanistan. It may transform India-Pakistan relations by enhancing interdependence in the energy sector and the economic field. Due to more economic opportunities, new markets will be opened for landlocked Turkmenistan as it can extend its exports to the east where there is a remarkable demand for energy (CPGS, 2014).

Over the last decade, with the help of EOR technologies, Oman has been able to give fresh life to its existing fields. Focusing keenly on LNG terminals, country has an excellent opportunity to venture in the pipeline business with energy starved country India. It is currently involved in only one pipeline i.e. Dolphin pipeline project. On the other hand, Iran sitting on the 2nd largest natural gas reserves will start in new business assignments as international sanctions has lifted up now. With its recent

natural gas offering to India at $2.95/mmbtu (Business Standard, 2015), MEIDP could deliver natural gas at near domestic price.

Social Factors

Energy provides fuel to the engine of development and economic growth. The per-capita consumption of energy is a useful index of per-capita income, which in turn is a good indicator of economic and social well-being of the people. The per-capita consumption of commercial energy in the sub-continent is well below the average of the developing countries (UNDP, 2014). Over the past both India and Pakistan has been relying excessively to meet energy demands via energy imports. It is taking heavy impetus on the current account deficit of the countries. With ageing infrastructures, half-hearted efforts in Exploration and Production (E&P), regulatory inconsistencies and dysfunctional pricing regimes nothing concrete has helped in turning fortune of the energy dynamics of two countries.

Turkmenistan and Iran relies on the revenue from the hydrocarbon sector to run social welfare programs. With new supplies in the global gas market in the glut and prices down, it is taking heavy toll to find secure markets that could drive the growth engine of both the countries.

Technological Factors

TAPI and MEIDP both have been mooted over the decades and technology has been a key bottleneck in maneuvering sub-sea pipeline project. But over the years, technological progress has allowed the successful commissioning of numerous similar pipelines. Some examples are worth mentioning: Nord Stream project 1222 km long sub-sea pipeline is the longest pipeline in the world with this type of facility. Gazprom's 1,213kilometreslong BlueStream pipeline – which traverses mountain passes as well as the Black Sea – has helped Russia deliver natural gas to Turkey without having to go through Ukraine, Moldova, Romania and Bulgaria. The Langeled pipeline project 1166 km long pipeline is connecting North Sea fields with UK is successfully transmitting gas to UK.

Legal Factors

In the last few years, all four countries involved in the project have already signed most agreements required for its commencement. These include: an Inter-

Governmental Agreement (IGA), a Gas Pipeline Framework Agreement (GPFA), a Gas Sales and Purchase agreement, and a broad agreement on transit fees (CACI, 2013).To accelerate the project, the parties have formed a ministerial level Steering Committee and Technical Working Group. The selection of a consortium leader has proved problematic in the TAPI project. U.S. oil majors Chevron and Exxon Mobil initially expressed interest in the role but owing to Turkmenistan law, which precludes the private ownership of land, both companies withdrew from consideration after Asghabat's refusal to issue an equity stake in the Galkynysh field in exchange for assuming the risk of construction.

Total S.A., after Chevron and ExxonMobil's withdrawal, was considered the leading candidate. The French energy giant may be willing to take the lead in constructing the pipeline in exchange for a modified Technical Services Contract (TSC) that would give Total the right of first refusal over the gas extracted from Galkynysh. In this manner, the Turkmenistan government would retain ownership of the land, while Total would possess a sufficient profit share in the gas to warrant its assumption of the risk of the pipeline construction (Diplomat, 2015).Recently TAPI Steering committee has now selected Turkmengaz as Consortium Leader for TAPI Gas Pipeline Project.

MEIDP route surpassing Pakistan territory secured geopolitical and safety reasons. The sea route was outside Pakistan's exclusive economic zone (EEZ) from Chabahar in Iran and Ra's al Jifan in Oman to Porbandar in Gujarat state with a spur line to Mumbai later. However, that situation has changed after the United Nations Convention on the Law of the Sea (UNCLOS) extended Pakistan's seabed territory by another 150 kms. The extension of the continental shelf from 200 nautical miles to 350 nautical miles would give Islamabad special rights with regards to exploration and use of marine resources, including energy production in the area under its jurisdiction, also described EEZ. (IndianExpress, 2015)

Another problem hinges on the offshore gas compression station on Qualhat Seamount (Murray Ridge), about 300km from the Omani coast. The seamount could now fall under Pakistan's control and the station can be set up with Islamabad's approval courtesy UNCLOS resolution.

Environmental Factor

Gas import reduces reliance on import of oil, which is subject to price fluctuations in the international market. Sharp rise in the oil price causes shocks to the economy of each country with varied intensity. As natural gas costs less than oil for the same energy content, it would reduce the energy import bill that constitutes a big burden on the economy of importing countries. The substitution of oil based installed capacity by natural gas in Pakistan and addition of gas-based electricity capacity in the place of coal-based option in India will substantially reduce CO_2 emissions and the potential damage to the environment.

The improved supply of gas through imports will help Pakistan to substitute gas for oil in power generation. It will enable India to go for more economical CCGT based (as compared to the coal- based) installed capacity for meeting the peak electricity demand. This will result in substantial savings in capital, operating and fuel costs, and reduction in the sale price of electricity for greater economic activity (UNDP, 2014).

Recent Developments

April, 2015 UNCLOS decision on Pakistan

- In a UNCLOS decision, Pakistan's Continental shelf was extended by 350 Nm.
- Impact: Although the coastal state cannot stop or hinder the installation of a subsea marine cable or pipeline across its shelf, it has the right to be consulted on the route.
- Post this development, SAGE is considering the alternate route to avoid Pakistan EEZ and pass through international waters.

Nov, 2016 Route & Cost update

- Cost estimates for the pipeline were being updated after the latest budgetory quotes were received from the suppliers.
- Cost estimates for alternate routes proposed to avoid the Pakistan EEZ were also made.
- The project cost increases by 18% and 43% in case of an extended route (where pipeline remains on international waters) and alternate route (where an arm to Oman is also connected) respectively.

Conclusion

As India ramps up its growth ambitions, it will need fuel to stoke those aspirations. Among all the fuel options available, India imports large quantities of natural gas for its petrochemical, fertilizer, and power generation units. While domestically produced gas is prioritized to specific sectors, most of the industries are using imported RLNG.

Large gas reserves of Oman has played its part in developing gas explorer portfolio and LNG renaissance, country witnessed decade ago has provided rich benefit to the hydrocarbon run economy.

With the diversification through pipeline linkages, country will be returned with rich dividends. Relaxing of international economic sanctions against Iran, which is expected to allow the country to freely trade its naturally-occurring oil and gas resources, will certainly help the project to flourish as Iran is looking to capture for new markets. Though most of these reserves are undeveloped it is expected that the country will make its critical presence in the world oil and gas market.

Technology which was the bottleneck in executing such complex projects has now witnessed successful commissioning of numerous similar pipelines. The paper has highlighted statistics of sub-sea pipeline projects.

TAPI, IPI and MBI have witnessed geopolitical and security considerations outweighed economic compulsions. MEIDP presents a technologically viable option to connect gas deficit India with gas rich Middle East via a route that bypasses the politically sensitive regions of Pakistan and Afghanistan. It remains to be seen how the new government in New Delhi assesses India's energy security matrix, and how the geopolitical situation will be handled to define modern India's energy security landscape through transnational pipeline connectivity.

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Infrastructure status of proposed trans-shipment Indian ports for Maritime transport

Pradeep Chauhan*, Rohit Sindhwani**

**Assistant Professors, CoMES, University of Petroleum & Energy Studies*
*** Assistant Professors, CoMES, University of Petroleum & Energy Studies*

Abstract

India has emerged as a major manufacturing outsourcing hub which has seen tremendous growth of its marine industry. With 95% of the country's trade by volume moving through the maritime transport of India's long coastline of about 7517 km, India has significantly gained traction among the largest merchant shipping fleets in the world. The cargo traffic is expected to reach 1,758 Million metric tonnes (MMT) in 2017 through the 12 major and 200 notified minor and intermediate ports across Indian coastline. The capacity utilization stood at 63% in the major ports for fiscal year 2015 while the capacity addition in 2016 was 94 Million tonnes which is the highest in the history of major ports. When we compare with the global counterparts, Shanghai Port in itself handled 755 Million tonnes of cargo traffic in 2014 which is more than the combined traffic handled by the 12 major ports of India. The transshipment cargo from India is still dependent on the ports of Colombo and Singapore. It is important to analyse the infrastructure status of strategic locations identified for international container transshipment hub at Enayam and Vizhinjam through Indian Government's Sagarmala Project. The viability, location, capacity, operations and traffic congestion for the proposed trans-shipment hubs has been critically analysed in the research paper with the major focus on building global standards and sustaining India's competitive position in global trade through maritime transport. The locational advantage of Indian Ports is compared with Colombo port to get a holistic preview.

Keywords: Maritime transport, Trans-shipment hub, Traffic congestion, Sagarmala Project

Introduction

The lifeline of the bulk cargo sent to various parts of the world is driven by trans-shipment hubs located in strategic and economically viable locations. These hubs then transfer the cargo requirements to

subsidiary ports that reduce the transportation cost as well as meet the demand in the locations served by these ports. The availability of a trans-shipment hub is not just a matter of strategic advantage to the country but also provides cost advantage by improving economies of scale of port operations. Inspite of a having a large coastline, India has still not been able to build a robust infrastructure for a trans-shipment hub. Investment opportunities are plentiful and the financial acumen of the leadership is also aligned with the goal of improving the bottom line through the country's Sagarmala project. The government has proposed two trans-shipment hubs in Enayam and Vizhinjam districts of Kerala to compete with hubs in Colombo and Singapore and also to improve standard operating practices of other major ports. The scope of this research paper is limited to benchmarking the infrastructure requirements of these port locations, risk aversion against competitive forces and performance measurement of port operations. The application of game theory through a two stage game to examine the two competing ports', Enayam and Vizhinjam investment in facilities considering the uncertain market demand has been developed in coherence with a two stage game applied to Colombo and Singapore trans-shipment hubs. The impact of service cost and congestion cost is taken to inspect the optimal pricing. The long term strategy of the ports is established based on the risk taking capability of the Government and the Private firm involved. The previous research is focused on risk averse and risk neutral ports. This research paper will further dwell into risk taker ports and identify the investment levels.

Literature Review

This section will compare our set-up with that in the literature. (Chen, 2016) investigate whether ports should expand their facilities under congestion and uncertainty by considering risk neutral and risk averse ports under uncertain demand. (Anderson, 2008) use game theory to investigate two competing hub ports Busan and Shanghai and discover that investment depends on the cost structure. (Ishii, Lee, Tezuka, & Chang, 2013) portrayed game theoretical analysis of port competition using stochastic demand to analyse port charging price. (Borger, Dunkerley, & Proost, 2007) studies pricing and investment decisions on a congested transport corridor which are of strategic importance for the government. (Song, 2002) elucidated the

impact of competition and cooperation from Chinese ports on the container port of Hong Kong. (McLean & Biles, 2008) shows the liner shipping network's simulation model that considers multiple destinations, schedules and routes. (Park, Do, & Choi, 2015) applied uncertain two-person game model between Hong Kong port and Shenzhen port where an uncertain factor of demand is involved. (Zhang, 2008) devised an analytical model to understand the effect of hinterland access conditions on the rivalry between the ports. (Xiao & Zhiming, 2014) realized the importance of cooperative strategies between ports and developed a static game for coalition between two major ports and N shipping lines.

Need of Transshipment port

Trade is increasingly important for continued growth of the Indian economy. Policymakers in India have nurtured a dream of making India a global hub of manufacturing and trading. But due to inadequate poor logistics infrastructure, especially poor port infrastructure and poor logistics management practices, the transactional cost for doing business is one of the highest in the world, making it unfavorable destination for the investors (Singh, 2015).

Greater transport costs lead to lower levels of foreign investment, a lower savings ratio, reduced exports of services, reduced access to technology and knowledge, and a decline in employment. It is estimated that a doubling of transport costs leads to a drop in the rate of economic growth of more than half a percentage point (Dwarakish, 2015).

Presently, around 60 per cent of India's trans-shipment cargo is handled by Colombo, Singapore, Salalah and Jebel Ali. Only Colombo handled more than 16 per cent of India's container trans-shipment cargo. Trans-shipment through other countries, not only increases substantial cost but also, increases transit time of cargo by five-seven days. The rise of major shipping alliances and more integrated vessel sharing agreements has boosted traffic at Asia's transshipment hubs. The study conducted by Kowalczyk (2012) agrees that the recent world tendencies in cargo transport are heading towards deployment of large and fast container ships and reducing the number of ports of call. As a result of reduced number of calls, the total costs of cargo handling in the sea ports can be substantially decreased and the total time required for port operations can be shortened (Dwarakish, 2015). But to accommodate

those bigger vessels, there is an immediate requirement of having strong port infrastructure, with suitable draft with mechanized handling

India needs to consider the growing presence of China in the region's ports through investments in Colombo Port (Sri Lanka), Gwadar Port (Pakistan) as a part China-Pakistan Economic corridor and Chittagong Port (Bangladesh). At a time when revolutionary changes are being made in international maritime trade, there is an urgent need for India to make fundamental infrastructural and policy reforms in this sector. If the government and private sector can continue to collaborate in taking the right steps, an 'ocean' of opportunities lies before India.

Infrastructure investment decisions

The major ports in India have seen a growth rate of 6.7% year on year in 2014-15 despite the congestion and infrastructure woes. It is important to understand that both Vizhinjam and Enayam have been proposed as trans-shipment hubs and the focus is on building these greenfield ventures taking into consideration the environmental, economic and social factors and also focusing the manpower and material resources through timely deployment. The planning for these port locations have been carried out through a series of techno-managerial feasibility tests and also understanding the risks associated with the strategic investment. The Government of Kerala hired IFC (International Finance Corporation) to organize a well-structured bid transaction of Vizhinjam Port. It was projected that Vizinjham would need to aggressively price its container handling services to be able to take away the traffic from the competing ports like Colombo and Vallarpadam. Also, Landlord model has been considered where all the construction works like quay well; dredging, reclaimation, breakwater, etc. will be developed by special purpose government company, VISL (Vizhinjam International seaport Ltd.). The key advantage of this port location is the proximity to the East west shipping channel and also the availability of naturally deep water. Similarly, when we consider the case of Enayam, the union government has given a nod of whooping Rs. 25000 crore investments for the development of major transshipment hub since it has an advantage of a natural deep draft. The port is part of the Government's plan of building three major Greenfield ports in Maharashtra, Bengal and Tamil Nadu as a part of its port development programme termed Sagarmala.

The Enayam port is expected to save trans-shipment time by 3 to 4 days and will cut the Logistics cost down by 10%. Also it is expected to save 18 to 24 hours of waiting at inter-state check posts.

Currently, the trans-shipment requirements of India are fulfilled by the port of Colombo. The major consideration here is that transshipment cost per teu through Colombo is $100. This causes a per annum loss of Rs. 350 crore through cost of logistics and Rs. 1500 crore revenue loss to ports. Also it is estimated that the trans-shipment burden has Rs. 5000 crore indirect impact on the economy annually with a loss of 4000 direct jobs in ports. India's potential in the maritime sector will also benefit in the medium to long term.

There are certain factors that have been enlisted by Indian think tank while considering the feasibility of the proposed trans-shipment hubs. As per the Indian ports association, India's 12 major ports handled 581.3 mt of cargo traffic in 2014-15 as against a capacity of 871.5 mt with a utilization of 63%. Also, there is a capacity addition of 94 million tonnes in 2016 which is the highest in the history of Indian ports. Considering lower capacity utilization, the NITI Aayog expresses concern of overcapacity resulting from the development of two trans-shipment ports. Secondly, the proximity of Enayam and Vizinjham (Enayam is 30-40 km from Vizinjham) and the competition with proposed port at Vallarpadam further raises concern over exceeding capacity and redundancy of one of the trans-shipment hubs. Also, the coast of Enayam is vulnerable to natural calamities and the marine ecology will be destroyed if the project was implemented.

Why Vizhinjam and Enayam?

India is keeping its hopes on deep-water, greenfield site at Vizhinjam, about 10 miles southwest of Trivandrum, and Enayam – a hamlet on the west coast of Tamil Nadu in Kanyakumari district of Tamil Nadu to build container transshipment terminal to retrieve some of the domestic cargo currently relayed over foreign hub ports in the region, especially Colombo. There is a lot of hue and cry that is prevailing on the proximity of the Enayam project to Vizhinjam port in Kerala, which is just 40 km away and is being developed with the same objective. Why two ports in the same area doing the same business, they argue. But should proximity be a problem? But if we look at the global experience: successful

transshipment and container hubs tend to develop in clusters. Singapore and the Tanjung Pelepas and Klang ports in Malaysia are part of the South East Asia cluster and handle as much as 60 million TEUs. Similarly, Salalah, the Jebel Ali, and King Abdulla ports are also located close by in the West Asia cluster and handle more than 40 million TEUs. Ports in Los Angeles and Long Beach in California perhaps serve as the best example of a large port cluster ecosystem. If these clusters can work, why can't Enayam and Vizhinjam? (Krishnamoorthy, 2016) From a location perspective, these ports have some distinct advantages.

Advantages of Vizhinjam and Enayam ports are:

- Availability of 20m contour within one nautical mile from the coast.
- Minimal littoral drift along the coast, hardly any maintenance dredging required.
- Links to national/regional road, rail network
- Flexibility in design and expansion being a Greenfield project
- Proximity to International shipping route

Assessment of competition with Colombo

Colombo is commanding the majority share of India's foreign transshipment cargo followed by Singapore and Malaysia. The credit goes to the relative proximity of Colombo to India's southern, west and east coast markets, also improved efficiency and capacity of handling large vessels gives huge advantage to Colombo against its competitors. Colombo port serves via feeder connections on the east coast of India — Tuticorin, Chennai, Kattupalli, Visakhapatnam, Kolkata, Haldia, Krishnapatnam and Cochin while, Mangalore, Nhava Sheva, Pipavav, Hazira, Mundra and Kandla are served on the west coast.

Although the port's enviable geography as the last Asian gateway before Europe has made it a maritime force since the Portuguese used it as a trading hub in the early 1500s, much of its success rests on other South Asian ports' inability to handle volumes discharged by mega-vessels, both at the dock and in the hinterland. The shipping fraternity throngs at Colombo simply because of its locational advantage located on the Key East-West International trade route and close to India has made it logistics hub in South Asia. Colombo also

possess adequate infrastructure can accommodate larger vessels across all three terminals, a strong feeder system and it is free from congestion. Colombo certainly enjoys few advantages when compared with Indian ports. Colombo certainly enjoys an upper hand when it comes to location and strong infrastructure. Hence, the Indian government needs to definitely chalk out a clear plan to make these ports a success by giving a long term relaxation in applicable port duties, and easing of prevailing cabotage policy.

Government Initiatives

The Indian ports and shipping industry plays a vital role in sustaining growth in the country's trade and commerce. India is the sixteenth largest maritime country in the world. The Indian Government plays an important role in supporting the ports sector. It has allowed Foreign Direct Investment (FDI) of up to 100 per cent under the automatic route for port and harbor construction and maintenance projects. It has also facilitated a 10-year tax holiday to enterprises that develop, maintain and operate ports, inland waterways and inland ports. The government has also come out with ambitious Sagarmala and Bharatmala projects to enhance connectivity with other ports through development of coastal shipping and highways respectively. To be competitive, the Indian ports need to keep up with the changing trends in International trade. Dedicated Freight Corridor is also needed to ease connectivity, enabling faster movement of cargo throughout the country.

The possible initiatives that our policy makers should take in order to strengthen our port infrastructure are first creating a single window for all regulatory and financial clearance. Foreign investors usually get distracted due to plethora of overregulation from various agencies which cause delay in port development activities. There is an important need for labor reforms at Indian ports, especially when it comes to mechanization of stevedoring operations by some private sector investments, the labor unions protests to such initiatives. Labor laws governing Indian ports are archaic and outdated; hence government should focus in this direction (Singh, 2015)**.**

The Model

We consider a two stage game for Vizhinjam and Enayam which are in nearby locations with an overlapping hinterland and they wish to provide similar trans-shipment services to their customers and liners.

Table 1: Searoute advantages for Sri Lanka and disadvantages for India

Advantage for Sri Lanka	**Disadvantage for India**
Located on the key East-West trade route, ideal for cargo destined for South Asia, Europe and the Americas	Dependent on Colombo for shipping cargo to the west
Apart from India, it also gets cargo from Pakistan, Middle east and Myanmar	The ICTT at Vallarpadam is still unable to attract mainlines sailing to Colombo
located on the key East-West trade route, ideal for cargo destined for South Asia, Europe and the Americas	Diversion from Colombo to any Indian port will cost shipping line an additional four to twenty four hours costing them an additional $25000 to $50000 per hour per vessel.
Major shipping lines and alliances such as 2M, PIL, CKYHE and G6 favor Colombo	Indian ports are not as cost competitive as Sri Lankan ports
Since it liberalised the ports sector in 2000, Sri Lanka has seen very little unionisation and disruption from its work force- the two issues that continue to halt operations frequently at Indian ports	Cargo from east and west coast ports is transshipped in lightly loaded 10000 TEU ships as all not Indian ports can berth fully loaded big vessels
Tariff Structure I guided and has not changed dramatically since 1987 assuring constancy in business.	Indian ports are plagued with congestion and lack of good connectivity.
Every year the cargo handled by Colombo is rising by 10% despite the shipping industry to recover from the global meltdown	Tariff structure at Indian ports has been one of the most contentious issues with terminal operators calling for abolishing TAMP
Throughput at Colombo is over 5 million TEU, while JNPT falls short a tad by handling 4.8 million TEU annually	India needs to cut transit time, broaden cargo catchment area and offer economies of scale for bigger ships.
**Source Maritime Gateway August 2016*	

Similar studies have been conducted by (Chen, 2016) where liner market demand is considered to build on a robust model

$$p = 1 + \theta - Q$$

Where p is the price of the unit cargo charged by Vizhinjam and Enayam, Q = q1 + q2 is the total cargo amount handled by these two ports and θ represents demand uncertainty.

From (Borger, Dunkerley, & Proost, 2007) setting of the congestion cost, port i's total service cost for handling throughput qi>0 given new facility Ki is

$$Ci\ (qi, Ki) = [ci + di*qi/\ (1+Ki)]qi$$

where i=1,2

Where ci ϵ (0,1) is port i's marginal service cost(equipment rent, labor wages, etc.) and di ϵ (0,1) is marginal congestion cost under no new facility, which is the delay due to congestion at port hinterland.

Port i's profit function without considering the investment costs is given by

$\pi i\ (qi,qj) = [1 + \theta - qi - qj]qi - [ci + di*qi/(1+Ki)]qi$

Where i,j ϵ {1,2 such that i$\neq$j}

To add to growth and competitiveness, ports will invest in facilities to lower their congestion costs. It is important to understand that facility investments are risky as the future demand is uncertain

From (Anderson, 2008) we generate payoff matrix in the Vizinjham, Enayam investment game to understand the investment decisions
Table 2

Where $\pi i\ (qi,qj)$ captures the payoff or profit mentioned above and cargo handling amount q refers to investment decisions (invest, not invest). The investment cost is referred by (Cv,Ce) for ports at Vizinjham and Enayam.

We can further build on this model from the research outcomes of (Chen, 2016). The investment costs proposed by the Government for the ports at Vizinjham and Enayam will decide the future course of action for developing the Game and the decisions will help in decision making. The above model is robust and caters to both the service costs and the congestion costs in uncertain market.

Cooperation vs. Competition

The dynamic behavior of the business environment results in expanding the current performance levels of major ports in India. The performance has been linked to large scale cost reduction efforts and also improved portfolio optimization of the major and minor ports. The capacity utilization and long term implications of Indian ports have been elucidated to bring forward a strategy that caters to the needs of all the shareholders who are being provided the supply from these ports. The important scenario here is to analyze the impact of competition that will emerge if both the ports, i.e., Enayam and Vizinjham operate as transshipment hubs. Another important factor is vicinity of these ports with each other and timely coordination of resources

that could actually help in sustaining there competitive advantage against the current hubs in Colombo and Singapore.

The strategy that we propose is of building a multiecheleon shipment optimization by significantly raising the standards and also choosing between these two hubs by applying Game theory and building a robust model. The competitive framework will not suffice as both the ports need to work in tandem and focusing on a cooperative approach while making investment decisions will help in shaping a better framework and sustaining the national requirements proposed through the Sagarmala Project.

Challenges Ahead

Indian ports lack a lot in terms of robust infrastructure and efficiency in comparison to ports around the world. World major ports are handling container ships of 16000 TEUs (twenty foot equivalent units), whereas Indian major ports still not able to accommodate more than 9000 TEUs. In terms of efficiency the average turnaround time of a vessel is more than one day against four to six hours in case of Singapore. Some of the major ports are handling cargo manually even today. It is leading to delayed evacuation of cargo from ports. Either the ports function much lower than their actual capacity, or handle higher volume of cargo than their capacity, leading to congestion due to infrastructural deficits. Mechanisation and evacuation infrastructure is the need of the hour, but the same require additional investments. This should be done through the PPP model at ports for terminal handling on design, build, finance, operate and transfer basis(BOFT).

There is an immediate need for holistic development at ports if India has to be competitive and to meet international standards. Central and state governments should also work in tandem and stop putting roadblocks for each other, especially when it comes to allocation of land. Infrastructure deficits at the ports like low draft, poor mechanization and hinterland connectivity also need to be addressed. Building port is an easy task, while making it sustainable is a big challenge as annual dredging incurs a huge cost of the order of approximately 450 crores for one of the port. This sum has to be regularly invested if India wants to call mainline vessel on its ports. Lessons can be learnt from India’s largest private port, Adani's Mundra Port in Gujarat, which carries out maintenance dredging throughout the year to ensure the presence of adequate

draft of 17.5m, the highest in the country. It is hoped that the success story at Mundra port, in terms of technology, efficiency and management shall be replicated at Vizhinjam to make sure that it does not become another Vallarpadam. India's reluctance to ease cabotage rules that require India-flag vessels to ship cargo between the country's ports is also one of the reason which has resulted into low penetration of foreign vessel into coastal shipping and acting as a road block in this direction. Strikes frequently cripple Indian port operations, and are most severe at the country's largest container gateway, Jawaharlal Nehru, on the west coast. India's port labor is disrupting more than just daily operations.

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Evolution of retail supply competition in distribution of electricity: A choice to Mumbai consumers.

Prafulla Varhade* Dr Anil Kumar** Dr. Tarun Dhingra***

** Director (electrical engineering),MERC*

***Senior Associate professor, CoMES, University of Petroleum and Energy Studies*

****Senior Associate Professor, CoMES, University of Petroleum and Energy Studies*

Abstract

The purpose of this paper is to bring the current scenario of retail supply competition in the distribution of electricity, taking the case of parallel distribution licensing in Mumbai and to identify crucial bottlenecks in the implementation of retail competition in India.

Since 1926, the City of Mumbai and its suburban (except Bhandup and Mulund areas) has three licenses which are Brihan-Mumbai Electric Supply and Transport Undertaking (BEST), Tata Power Company (TPC) and Reliance Infrastructure Ltd (RInfra-earlier BSES Ltd). In the year 2008, the regime of parallel distribution licensees in Mumbai the Electricity Act, 2003 Tata Power's distribution license entitled it to distribute and supply of electricity in retail directly to consumers apart from its entitlement to supply in bulk within its area of supply. Tata Power's area of supply for distribution of electricity covered BEST and R Infra. Further, Supreme Court on the issue of TPC not having its full distribution network remarked that the concept of wheeling was introduced by the Electricity Act,2003 to enable distribution licensees that are yet to install their distribution lines to supply electricity directly to the retail consumers, subject to the payment of a cross-subsidy charge.

Following the Supreme Court judgment, the Maharashtra Electricity Regulatory Commission (MERC) issued an interim order dated October 15, 2009 evolving a mechanism for facilitating choice to the consumers using the distribution network of

the existing Distribution Licensee with the long-term objective of introducing retail supply competition, thereby providing choice of selecting cheaper tariff to consumers situated in the area common to both TPC and RInfra. Given the prevailing circumstances, a large number of consumers, especially high-value consumers, exercised their choice of supplier and migrated from RInfra to TPC in a short duration. This Regulatory framework of facilitating retail competition in the distribution of electricity in Mumbai poses several regulatory and implementation challenges such as network development and tariff.

Keywords

Retail Supply Competition, Utility, Operational efficiency, Parallel Licensees.

Background

Maharashtra is the second largest State in India in terms of population and has a geographical area about 3.08 lakh square km. It has a population of 11.24 crore (Census 2011) which is 9.3 percent of the total population of India and is highly urbanized with 45.2 per cent people residing in urban areas.

Mumbai is the capital city of Maharashtra. It is the most populous city in India and the fourth most populous city in the world. Mumbai is the commercial and entertainment capital of India; it is also one of the world's top 10 centers of commerce in terms of global financial flow. The city houses important financial institutions and the corporate headquarters of numerous Indian and multinational corporations.

Municipal Corporation of Greater Mumbai (MCGM) is a local authority and it has two revenue Districts (Mumbai District and Mumbai Suburban District). The city of Mumbai is not just characterized by the relative importance of aforementioned sectors but more importantly, by the high density of population. The sizable population lives in slums and slum-like areas. An overwhelming majority of 81%, of slum households in Mumbai, had electrically lighted.

Energy is one of the key elements necessary for the socio-economic development of any country. The success of key initiatives such as 'Make in India', along with growing urbanisation and social upliftment of rural India will depend on the availability of uninterrupted quality electricity supply to consumers at economical cost, at least for the

city which has almost 40% of total electricity consumption towards air conditioning and has highest service sector industry.

Due to climate conditions, high population density, rapid urbanization, and the presence of various economic activities, consumers in Mumbai have always expected reliable, continuous power supply at economical cost. A continuous supply of electricity forms the basis for providing various lifeline services in Mumbai. It shall be relevant to mention that various literature suggest that statutory bodies like Government of Maharashtra, Maharashtra Electricity Regulatory Commission, MCGM and Electricity Utilities in the State have been directly/indirectly ensuring that consumers in the Mumbai and its Suburban Districts/region in the Mumbai get reliable, quality 24 x 7 supply at economical cost. However, due to various reasons in the Mumbai region somehow affordability of power supply was lagging to the highly uninterrupted power supply.

Geographically Mumbai consists of two distinct regions: Mumbai revenue District and Mumbai Suburban District, which form two separate revenue districts. The district region is commonly referred to as the Island City or South Mumbai. In these two districts, three distribution Utilities distributes and supply electricity, namely Bri-than-Mumbai Electric Supply and Transport Undertaking (BEST), Reliance Infrastructure Ltd. (RInfra) and Tata Power Company (TPC). BEST distributes electricity to Mumbai revenue District; RInfra distributes to Mumbai Suburban revenue District (except Mulund and Bhandup areas) and Mira Bhyander Municipal Corporation (MBMC) and TPC distribute Mumbai revenue District, Mumbai Suburban revenue District (except Mulund and Bhandup areas) and Mira Bhyander Municipal Corporation areas. TPC's distribution overlaps with distribution areas of BEST and RInfra.

Mumbai Power Scenario

Situation prior to commencement of Retail Electricity Supply Competition in Mumbai

TPC has been supplying electricity to the city of Bombay, now known as Mum-bai. Since, early 20th century TPC has been generating and supplying a substantial, if not entire quantity of generation, to the city of Mumbai. TPC has also been described as a bulk Licensee. The limits of supply have been delineated in its various Licences granted from the time to time. TPC has an area of supply in Island City & Mumbai suburbs.

BEST had got its License from 1905 and started buying power from TPC though agreement dated back in 1915 which was renewed from time to time for meeting all power requirements from Generation of TPC. BEST apart from serving consumers in Island city also catering to the Mass public transportation in the city of Mumbai as well as extended suburbs. BEST's area of supply is the Island City of Mumbai. It has now approximately 10 lakhs electricity consumers.

Since 1926 BSES Limited has been a Licensee in the suburbs of Mumbai and till 1995 for approximately 70 years has been purchasing the requirement for its entire quantity of energy from TPC which is bulk Licensee having Generation stations. In 1995 BSES commissioned its 500 MW plant at Dahanu, Maharashtra which generated power to be distributed in BSES (now RInfra) area of supply in suburbs of Mumbai which constitutes now more than 30 lakhs electricity consumers.

So, it can be seen that prior to the Electricity Act, 2003, electricity industry in Mumbai (Island City and Mumbai Suburban area (except Mulund & Bhandup)) are being catered by the BEST, TPC and RInfra through their respective Generation, Transmission, and Distribution business. BEST does not have electricity Transmission and Generation business and undertakes only electricity Distribution functions. Further, TPC could also supply to a few selected bulk consumers like oil refinery companies, Rashtriya Chemical Factory, Indian Railways (Central and Western) and Textile mills.

Further, as stated earlier due to the commissioning of 500 MW generating power plant at Dahanu (Maharashtra) business dynamics related to electricity generation activities in Mumbai started to change leading to the dispute. In addition to this, there was also conflict around the distribution of electricity between TPC and BSES. In July 2002, BSES (now RInfra) filed a petition (Case No. 14 of 2002) before MERC alleging contravention by TPC of their licenses and supplying select consumers. It requested MERC that TPC is restrained from supplying electricity within the area of supply of BSES and discontinue the sale of electricity of TPC having energy requirement below 1000 kVA.

On 3rd July 2003, MERC issued the Order in Case No. 14 of 2002 restraining TPC from offering new connections to any consumer with energy requirement below 1000 KVA (Maximum Demand). However, MERC directed TPC and BSES that if they wish to

supply energy to any consumer to whom they have no obligations to supply even before the completion of the above process, they are free to approach MERC under section 42(4) of the Electricity Act, 2003.

MERC's Order was challenged by both RInfra and TPC before the Appellate Tribunal for Electricity (ATE).

While setting aside the Order and findings recorded by MERC, APTEL holds that TPC has not been granted Licence to undertake retail distribution of electricity in the area within which BSES has been distributing power in retail to customers directly. TPC appealed ATE's decision to the Supreme Court.

Supreme Court's landmark Judgment

The Supreme Court in its landmark Judgment while quashing the Orders of both MERC and ATE ruled that:

- TPC-D is entitled to supply electrical energy in retail, directly to all consumers within its area of supply, as stipulated in its Licences, thereby confirming TPC-D as a Distribution Licensee for supplying electricity at the retail level for the supply area common to BEST and BSES (RInfra).
- Regarding that not having a distribution network in place, TPC was not in position to supply electricity to any consumer, the Supreme Court held that the concept of wheeling has been introduced in the Electricity Act 2003, to enable distribution licensees who are yet to install their distribution line to supply electricity directly to retail consumers, subject to payment of surcharge in addition to the charges for wheeling as the MERC may determine. In other words, TPC can use RInfra distribution network to supply consumers.

Situation after commencement of Retail Electricity Supply Competition i.e. post SC Judgment

June 2009 Tariff Orders

Post issuance of Supreme Court Judgement on 8th July 2008 (i.e. restoration of TPC as a second distribution licensee for retail supply for Mumbai's electricity consumers), MERC issued Tariff Orders for TPC and RInfra determining the distribution tariffs for FY 2009-10. From these Tariff determined, media/consumers observed that retail tariff determined by the MERC for various consumer categories of TPC is lower than

RInfra and option for opting TPC cheaper supply required to be facilitated by MERC.

In order to facilitate the benefit of TPC's lower tariff to consumers in common supply area of RInfra and TPC, MERC ,on proactive basis, issued an Order and ruled that the consumers can shift/changeover from one Distribution Licensee to another and both the Licensees were directed to allow the consumers for exercising their choice easily by using other distribution licensees' distribution network in accordance with Supreme Court judgement. The Order also provided a representative example of how consumers would be benefited once they exercise a choice of taking supply from TPC by using RInfra-D's wire network.

Savings: It was observed that there were an around 13%-35% savings in case of LT residential and LT commercial category consumers, whereas 37% in case of consumers of HT Industrial and HT Commercial category.

It is also relevant to note that cross-subsidy level (ratio of average billing rate to the average cost of supply in %) determined by the MERC in 2009 Tariff Orders, in the case of TPC-D was from 94%-131% whereas in the case of RInfra-D same was 74%- 162%.

TPC-D and RInfra-D entered into the discussion to effect supply to changeover consumers. The discussions culminated in TPC-D filing a Petition before MERC (Case No. 50 of 2009). MERC issued an 'Interim Order' dated October 15, 2009 (Case No. 50 of 2009), through a consensual process of discussion thereby evolving a mechanism for facilitating changeover by the Consumer from one Distribution Licensee to another Distribution Licensee to effect supply to changeover Consumers using the distribution network of the existing Distribution Licensee with the long-term objective of introducing competition, thereby supplying cheaper electricity to consumers situated in the Licence area common to both TPC-D and RInfra-D.

Since BEST being a local authority was not obligated to provide open ac-cess/wheeling to its distribution wire, MERC issued an Order directing TPC to lay its own distribution network in BEST's supply area for providing cheaper tariff options to Consumers. BEST challenged this Order before ATE and Supreme Court and restricted TPC for laying its distribution network. Supreme Court in May 2014 removed the restriction and held that TPC being the second distribution in BEST's ar-ea

required to lay its own wire for fluffing its Licence universal service obligations.

By an Order in Case No. 72 of 2010, MERC accorded approval for levy of Cross-Subsidy Surcharge (CSS) on migrated consumer who was using RInfra-D wires/distribution network for receiving supply from TPC-D. This Order was appealed to the ATE (Appeal No. 132 of 2011) and ATE through its Judgment dated 21.12.2012 upheld the Order/ruling of MERC of giving in-principle approval of levy of CSS on the Consumers who are using/wheeling RInfra's Distribution network. Subsequently, MERC in Case No. 43 of 2010 determined the Cross Subsidy Surcharge (CSS) figures to be levied on changeover consumers from 1st September 2011.

While the choice to choose suppliers of electricity was being made to Consumers of Mumbai, Licence of RInfra-D to distribute electricity was due to expire on August 15, 2011. For this MERC invited applications for electricity Distribution Licence for RInfra-D area of supply. It is observed that these applicants were requesting to apply SC landmark Judgment in their case for allowing dispensation of using RInfra-D wires to them, as allowed for TPC-D. However, MERC on 11 August 2011 based on the legal opinion of Sh. Gopal Subramanium (the Learned Former Solicitor General of India) took a view that the SC Judgment is case specific and rejected Licence applications (except RInfra-D) as they were required to fulfill the mandatory criteria of owning their own distribution network.

Subsequently, RInfra-D filed a Petition (Case No. 151 of 2011) seeking relief on account of certain issues affecting RInfra and its financial viability as it felt that more cross-subsidizing /high-value consumers were leaving to RInfra'-D and this resulting in an increase of cross subsidy burden on cross-subsidized consumers. It suspected that TPC while allowing consumer for the changeover from RInfra to TPC they are selectively permitting changeover of consumers and by laying its network in a selective manner and hence TPC is not complying with its Universal Supply Obligation (USO) as required under Section 43 of EA2003. In order to protect the low end consumers from impact of loss of high value consumers of RInfra ,MERC in the ruling calibrated the migration of consumers from RInfra to TPC and restricted consumer shift/changeover for the residential category of consumers who consume electricity up to 300 units a month for a period of one year, which will be

reviewed at the end of one year. In respect of TPC's readiness for fulfilling USO, they were directed to focus all its energies on laying distribution network where they are lacking and ensure they are in a position to provide supply through its own distribution network to existing and prospective consumers within the timeframe specified under the MERC SOP Regulations.

Savings: It was observed that residential consumers consuming below 300 units per month by shifting from RInfra-D to TPC-D can achieve benefit ranging from 18% to 29% in case of changeover consumers, and the savings increasing even further in case of switchover consumers (with TPC's own wire), ranging from 45% to 50%, depending on the consumption level.

MERC had given certain directions to TPC-D (in its Order dated August 22, 2012, in Case No. 151 of 2011), and had also directed TPC-D to submit Quarterly Reports regarding the progress of changeover and switchover in TPC-D's license ar-ea. Similarly, RInfra-D was also directed to submit the Quarterly Reports. MERC felt necessary to intervene vide proceeding (Case No. 85 of 2013) to ensure compliance of its earlier directions. In order to ensure that there was no policy vacuum in this regard, the MERC decided to extend the validity of earlier issued directions.

Situation from June 2009 Tariff Orders to August 2013 Tariff Orders

While these proceedings were going on, the MERC issued Multi-Year Tariff Orders approving Tariff for FY 2012-13 to FY 2015-16 for RInfra-D on 22 August 2013 and for TPC-D on 28 June 2013. Based on comparison of the tariffs determined for RInfra-D and TPC-D, it was observed that the changeover consumers in most of the consumer categories including HT I Industry, HT II Non-domestic, HT III – Group Housing Society, HT IV Temporary Supply, LT IV Industry (above 20 kW), LT II Commercial category, etc., would benefit by taking supply from RInfra-D. However, the residential category consumers would still benefit by changing over to TPC-D from RInfra-D. This situation has arisen primarily on account of the Slow progress of TPC-D in laying their own distribution network which has, in turn, resulted in the levy of CSS and Regulatory Asset Charge (RAC) on changeover consumers, which was making changeover economics unviable for high-value consumer categories. This situation was due to lower Power Purchase Cost of RInfra-D as compared to TPC-D due to tying up of

cheaper power sources by RInfra-D and high cost of TPC-G's generating Units, from where TPC-D sources bulk of its power requirement and higher share of HT consumption (subsidising) in case of TPC-D, enabling TPC-D to charge lower tariffs from the residential category (subsidised).

Cross-subsidy level (ratio of average billing rate to the average cost of supply in %) determined the MERC in these Tariff Orders, for TPC-D was around 83%-137% as against 94%-131%. However, in the case of RInfra-D MERC fixed cross-subsidy from earlier 74%-162% to 52%-161%.

MERC issued Order dated 30 October 2013 in Case No. 85 of 2013. In the Order MERC based on information analyzed the progress of changeover and switchover and the status of creation of network in TPC-D's licence area and has observed that there were discrepancies between the submissions made by TPC-D and RIn-fra-D, and also that the progress of changeover and switchover consumers and the creation of network appears to be quite slow and needs to be taken up expeditiously. The MERC directed both TPC-D and RInfra-D, to now form the permanent mechanism for discussing and sorting out the operational issues, rather than periodically bringing it up before MERC. It also ruled that in the identified 11 Clusters, all residential category consumers in the 0-300 units consumption slab (whose 'average' monthly consumption over the previous 12 months up to and including 300 units per month) shall be treated as direct consumers of TPC-D for the purposes of the tariff. From November 1, 2013, TPC-D shall charge such consumers the tariff approved by the MERC in TPC-D's MYT Order (Case No. 179 of 2011) for TPC-D's direct consumers, comprising of Fixed/Demand Charges, Energy Charges, and Wheeling Charges. This Order was challenged by both RInfra-D and TPC-D, which was set aside by ATE in November 2014.

Meanwhile, MERC received large numbers of written representations from various members of the public in regard to their grievances against TPC-D pertaining to the supply of electricity on request. Although the MERC took note of these representations by initiating separate proceedings, these proceedings were found to be infructuous at a later stage in view of various ongoing developments with the MERC and ATE. Though most of the objections received are in the form of an inability of consumers availing choice being provided MERC, one thing is clear from such objections is that they

originated due to choice provided to consumers and competition forces are at work.

Since the TPC's Licence was expiring on 15 August 2014 based on the Application under Section 15 of the EA 2003, the MERC granted Distribution Licence to TPC for Mumbai District, part of Mumbai Suburban District and, Mira Bhayandar Municipal Corporation areas. The MERC, however, did not approve the Network Rollout plan proposed by TPC finding it inadequate for fulfilling universal service obligations and directed to submit the revised Rollout plan within six weeks.

In November 2014, ATE set aside Appeal filed by TPC against MERC's Order Case No. 85 of 2013 in which MERC observed regarding slow progress in laying down the network in the 11 clusters continuation of restriction on Tata Power imposed in Case No.151 of 2011. ATE also set aside appeals filed by RInfra against MERC directions in Case No. 85 of 2013 for treating all residential consumers in 11 clusters as TPC direct consumers. While ruling on another set of appeals against Order in Case No. 151 of 2011, ATE ruled that it is not conclusively proved that TPC was indulged in cherry-picking. It also observed that TPC may be allowed to lay down its network in areas where there is the reliability issue. There is no restriction for supply to new consumers, and changeover may be permitted.

Situation from August 2013 Tariff Orders to June 2015 Tariff Orders

MERC while issuing Mid-term review tariff Orders on 26 June 2015 for TPC-D and RInfra-D, on the aspect of the network rollout plan held that the impact of the roll-out plan and the revised protocol may be felt in the next year, i.e., FY 2016-17.

Cross-subsidy level (ratio of average billing rate to the average cost of supply in %) determined the MERC in these Tariff Orders, for TPC-D was around 83%-130% as against 83%-137%. However, in the case of RInfra-D MERC fixed cross-subsidy from earlier 52%-161% to 80%-135%.

MERC in Case 182 of 2014 subsequently formed a Committee on approval of network rollout plan in respect of who should lay distribution network and fulfill its USO and finalize the operational specifics in the matter. The Committee recommended various situations/scenarios under which TPC should lay its distribution network and avoid the duplicity of the distribution

network in line with the principals of ATE Judgement. It further recommended an institutional mechanism processing of capital investment schemes in case of the parallel licensing regime and avoiding wasteful duplicity of the distribution network in accordance with ATE Judgment in November 2014.

Situation from June 2015 Tariff Orders to Multi-Year Tariff Orders in October 2016

MERC issued Multi-Year Tariff Orders for TPC and RInfra determining tariff from 1 October 2016 to 31 March 2020. Based on the comparison of the tariffs, inclusive of charges approved for RInfra and TPC, it is observed that residential category of consumers would benefit from changing over to TPC, while most of other category consumers may not find it particularly advantageous to do so. MERC has indicated that large disparities in tariffs of the same category of the consumer being supplied by different Distribution Licensees ought to be progressively reduced to the extent possible, as the sustained reduction in tariff differentials between TPC and RInfra will increasingly promote competition and choice to consumers on the basis of the quality of service.

The MERC had earlier fixed cross-subsidy level (ratio of average billing rate to the average cost of supply in %) for TPC-D in the range of 83%-130%. In these Tariff Orders, MERC determined cross-subsidy for the first year of the Control Period i.e. for FY 2016-17 from 55% to 141% which has been further envisaged up to 75% to 141% in FY 2019-20

In the case of RInfra-D, MERC had earlier fixed cross-subsidy in the range of 82% to 135%. Now in this Order, MERC determined cross-subsidy for the first year of the Control Period i.e. FY 2016-17 from 71% to 122% which has been further envisaged up to 79% to 116%.

Till date, Out of total consumer base of 7 Lakh, TPC has more than 5.50 Lakh of consumers are changeover (from RInfra-D to TPC-D) consumers.

Findings

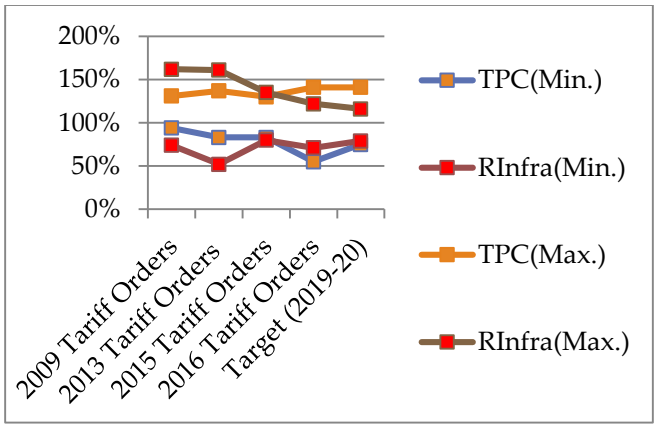
- The Licence of TPC for supply at the retail level has substantially commenced with the issuance of Supreme Court Judgment. Prior to that, RInfra was the main electricity distributor in Mumbai Suburban District (except Mulund and Bhandup areas and few small pockets distributed by TPC). Historically, unlike

TPC, RInfra has well spread distribution network at Low Tension distribution level in terms of consumer outreach. Consumers got benefited by opting for supply from TPC using the network of RInfra, in the situation when RInfra's Tariff was highest.

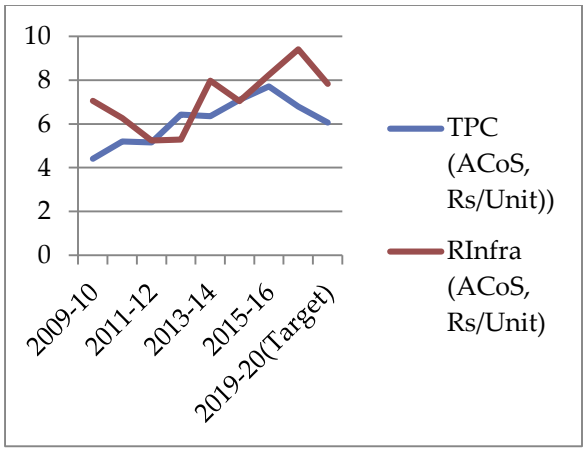
- The arrangement initiated by MERC based on Supreme Court's Judgment (of using the network of another licensee) is in furtherance of the objective of avoiding duplication of expenditure in retail supply and so as to optimize the capital expenditure by the Distribution Licensees. The key intent behind the proposed amendment in the EA 2003 is to allow competition at retail supply and better customer service without significantly increasing tariff. The proposed amendment seeks to segregate the distribution network business and the electricity supply business and introduces the scope for multiple supply licensees in the market.

- The MERC has initiated retail supply competition in 2009 by providing choice to choose electricity service provider to Mumbai consumers. However, from the discussion in the paper above, it can be seen that the speed at which competition is increasing is very slow. One major reason or hurdle for the introduction of full-scale competition is historically built in cross-subsidies in the Tariff. Abrupt removal of cross-subsidies shall result in an abnormal increase in Tariff and shock to Consumers. The Graph depicted below indicates variations in cross subsidy level, which is built in tariff, and reduction (i.e. ratio of average billing rate to the average cost of supply in %) from 2009 Tariff Orders (commencement of retail supply competition) to 2016 Tariff Orders, which also provides the outline for 2019-20.

- This Graph clearly shows that reduction in cross subsidy level (i.e. ratio of average billing rate to average cost of supply in %) varied ,for TPC in the range from 94%-131% to 75% - 141% and for RInfra it varied from 74%-162% to 79% - 116% , as against band of ±20% of average cost of supply. MERC has been carefully reducing/determining the cross-subsidies over the years. Ideally, in the case of Tariff with minimal cross-subsidies, competition shall be based on the quality of supply and network. The Graph below depicts the average cost of supply trend for TPC and RInfra from 2009 to 2019-20.



Figure; 1



Figure; 2

Distribution Tariff alone is the main factor which is driving the competition in Mumbai. As per the tariff principles, utility recovers various expenses as well as gets return on Equity on investment/network, which is recovered through tariff determined. However, slow progress of TPC in laying their own distribution network vis-à-vis duplication of network aspects, in turn, resulted in various charges such as CSS and RAC thereby increasing overall charges and domestic category of TPC-D contribute 16% of sales and 11 % of the revenue of TPC-D. Also, industrial sales including Railways is around 43% of sales mix of TPC-D contributing to 45 % of revenue, whereas sales to commercial consumers is 40 % of sales mix contributing around 43% of revenue of RIn-fra-D and hence sales and revenue mix of RInfra-D and TPC-D is distinct and heterogeneous in nature and fixing ceiling tariff would require homogeneous sales and revenue mix of the Licensees for whom ceiling needs to be fixed.

Conclusion

This paper attempted to understand the evolution of retail electricity supply competition in Mumbai. The MERC is a pioneer and unique in introducing such a model of retail electricity supply competition. The Regulator has over the years, in spite of numerous litigations/dispute, carefully attempted to provide the choice to choose electricity service provider to Consumer within the legal framework. Further, the Regulator has also from time to time ensured calibration in the migration of consumers from one Distribution Licensee to another so that various categories of consumers especially low-end consumers get the benefit of such choice.

Implication

Retail Competition would uplift all, retailers, generators and distributors to develop technologies to increase efficiency to cut the costs and increase the reliability of supply. This situation has touched the issues of large cross-subsidy built in tariff, which is historical, and vast difference of consumer mix and cost of supply are prominent issues when multiple licensees operate in the single area. It will be more towards protecting consumer's interest and would move to bring performance-based tariff rather than cost plus basis.

Limitations

Cross Subsidy issues and concerns regarding change over consumers that are affecting the utility revenue mix.

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Background Paper:
Modal mix of Indian transport sector

L. Takru*

**Industry Fellow, CoMES, University of Petroleum & Energy Studies*

The Indian transport sector is at the cross roads again. On one hand we have increased emphasis on the use of road transport (with all the attendant baggage) necessitated by the need for supply chain responsiveness and on the other we have the very real need for reducing costs of transportation within/ outside the country. Since the second half of 2014 the priorities had been lost sight of because of the sharp drop in international crude prices which resulted in a drop in road transport cost, but this was too good to last and the long term trend in fuel prices is likely to see a hardening.

The dominant modes of transport are:

- Air
- Road
- Rail
- Sea/ Coastal or Inland Water
- Pipeline

For the purpose of a study, we can omit a detailed study of air transport because it is used only in cases of perishability (where transport delay may result in a sharp drop in the value of the goods) or incases of goods of high value density (where the longer transit time associated with another modes causes financial loss of interest cost) or where there are issues related to security/ safety of the goods or in an emergency situation (such as spares for a breakdown). Pipelines will also be omitted because they are specifically used for liquids (crude oil or petroleum products)/ gases (LNG or CNG or LPG)/ fluids or solids in some very special cases (such as coal for power plants).

Internationally, the Railways are the dominant mode for transporting commercial freight. This is achieved through a combination of realistic pricing of rail freight and service. The Government needs to understand that commercial freight traffic will make rail the preferred mode only if the quality of service provided is improved. Unfortunately, the bulk of rail freight

consists of commodities such as Cement, Steel, Coal and Food grains where the service quality is hardly critical. While this may suit all concerned, it has created a freight culture where service is neither expected nor delivered and has led to a proliferation of inefficiencies in the system. The corporate sector will prefer to use rail as a mode of transport if, in addition to a competitive freight structure, they can get a certain basic level of service.

When India became independent, almost 60% of all freight was carried by rail. Over a period of 60 years the modal mix of freight has undergone a drastic change and the current modal mix is Road – 60%, Rail – 33% and Water about 6% with a small fraction being carried (as always) by air. If the Government carries on with this indifferent attitude towards rail freight, there can be no greater example of complete lack of foresight.

It can be argued that the modal mix of transport has progressively skewed in favor of Road transport because it provides a better quality of service compared to the rail sector. While this is a testament to the fact that the service quality provided by the rail sector is actually worse, it should also be recognized that, given the nature of our road transport industry, the service quality of our road transport sector is hardly comparable to that provided by this sector in other countries around the world. All in all, if the rail sector were to provide even marginally better service quality for commercial traffic it would work wonders for the growth of this sector. Unfortunately, the government's financial and social objectives are satisfied by increasingly taxing this sector with rate increases designed to keep the freight rate high and providing fare subsidy to passenger traffic.

In 2007, India's freight modal mix was road – 57%, rail – 36% and water – 6% on a total traffic volume of 1325 Bn.T.km.. Given the current trajectory, in the next 5 -10 years the modal mix is likely to be road - 69%, rail – 25% on a total freight volume of over 5000 Bn.T.km. Some will argue that the rail sector performance is creditable since it carries over 1200 Bn.T.km. compared to the 100 Bn.T.km. it carried at the time of independence and laudable considering the fact that the rail network essentially remains unchanged but that has been primarily due to:

- Better quality of rolling stock and higher haulage

- Technology improvements in track construction

The implications of higher modal mix, skewed in favor of road, also need to be understood in the context of problems which have chronically impacted this segment of the transport industry.

- While the road transport industry is considered to be the most responsive in terms of customer service, it is characterized by a fragmented structure, lack of trained and competent manpower, an unprofessional service culture and low profitability.
- It is used to transport goods over large distances (in excess of 1000 Km.), which has an adverse impact on the efficiency of the supply chain because of enhanced cost – at larger distances rail/ water transport are more efficient.
- The use of overloaded rigid body trucks of low carrying capacity has a negative impact on the cost of transportation and also results in severe damage to roads due to poor road quality / maintenance.
- High transit times caused by low speeds and large number of stoppages at border and other check points.
- Barring air, road is the least fuel efficient means of transport and is also the highest generator of atmospheric pollution. Consequently it has the greatest impact on degrading the environment.
- It is responsible for a large fraction of the transport related fatalities due to poor driver training and high driver fatigue.

Rail transport is plagued by poor customer service leading to low responsiveness primarily on account of the following factors:

- Preferential treatment given to passenger traffic which results in uncertain transit times and therefore lack of dependability.
- Low haulage capacity due to quality of rolling stock.
- Poor track technology and upkeep.
- High tariff because of cross subsidy for passenger traffic which makes it uneconomical.
- Lack of last mile connectivity, which is a common feature with all rail transport but becomes a factor given the other constraints.

- Lack of automatic block signaling which results in poor track utilization.

Inland Water transport is the least preferred mode of transport accounting for less than 0.5% of the commercial freight traffic due to the following factors:

- Lack of regularly scheduled services which results in poor service quality.
- Lack of proper freight terminals with facilities such as separate areas for passenger and freight traffic, material movement and storage area, freight handling equipment designed for commercial traffic, customs facilities and other terminal facilities.
- Seamless connectivity to other modes of transport such as road and rail which is essential for efficient multimodal transportation.
- Availability of year round draft of at least 3.5m in designated shipping channels.
- Lack of all - weather navigation aids.
- Lack of River – Sea vessels which are necessary for integration with coastal shipping.

While coastal shipping handles about 6% of the commercial freight, it is hampered by:

- Uncertain transit times due to lack of dedicated berthing facilities at major ports, which give preference to foreign ships.
- High impact of duties and taxes on bunker, spares and personnel.
- Small capacity fleet.

Pipelines are the best means of transporting liquids and gases over long distances but suffer from:

- Right of way issues connected with land acquisition.
- Lack of flexibility in terms of location, leading to widespread use of the hub and spoke model.

Let us compare each mode of transport on some objective criteria.

- Water transport is the most energy efficient (it has the capability to transport the highest tonnage per unit of power of the propulsion system), followed by rail transport and then road transport.
- Water transport is also the most fuel efficient compared to rail and road transport (it consumes the least fuel per unit ton km. transported).
- Water transport has the least negative impact on the environment I

terms of generation of emissions (15 gm. CO_2 equivalent per ton km. against 28 gm. for rail and 64 gm. for road).

Water transport has the capability to undertake transport of larger parcel sizes in comparison to both rail and road.

Considering the above factors, it is evident that India must increase its dependence on water (both Inland and Coastal) transport as the way forward, particularly since our transport needs are increasing rapidly and large investments are yet to be made in this sector. By 2020 it has been estimated that our total transport needs would be about 3000 billion ton km. and the trajectory we are on will see a further deterioration in the modal mix, such that almost 70% of our freight will be transported by road.

Given that India imports more than 70% of its energy needs in the form of Crude Oil, Natural Gas and Coal, it should be a national imperative that the future of commercial transport needs to be defined in the most energy effective way possible. A GDP growth projection of 8% necessarily implies an increase in the energy basket at the rate of about 6.5% considering an energy elasticity of about 0.8. If India has a limitation in terms of indigenous Oil and Gas reserves (and quality coal too), surely it strengthens the case for an energy efficient transportation system, because GDP growth and transportation are positively correlated.

The need of the hour is to define a long term growth plan for building up and integrating India's transport infrastructure such that the, sometimes contradictory, priorities of supply chain efficiency and responsiveness are met without adversely impacting India's energy security. It has been estimated that greater use of rail and water as a means of transport within the country would result in a direct saving of more than 10 million tons of oil, which, at current prices, would lead to a direct saving of about $ 4 bn. per annum. The indirect impact on transport speed and on the environment itself makes it an attractive proposition. Obviously, the Government must not only make rail transport more customer service focused, but also ensure that financially, use of rail transport is more attractive. It is an internationally accepted fact that rail transport is more economical over medium distances of between 400 to 1000 Km. after taking into account the cost of last mile delivery. Similarly water is the preferred

mode of transport for distances over 1000 Km.. Since transport in India requires movement over large distances (given the size of the country), it follows that the Government much ensure use of the correct mode of transport. That is the only way to ensure that fuel economy is achieved.

A quick comparison of the development of transport infrastructure over the last 2 decades shows that China has based its growth of freight traffic on Rail and Water transport, while India continues to focus on Road transport. Both in China and the US (large geographical areas) rail transport carries more than 45% of the cargo, and while the US transports about 15% of its cargo by water, China water transport accounts for about 30% with coastal shipping accounting for 20% and Inland water taking up 10%. This significant difference surely contributes to the considerable price advantage enjoyed by Chinese manufactured goods. The Chinese economy is more transport intensive than the Indian economy because it is more manufacturing dependent than the Indian economy, but if we want India to emerge as a major manufacturing hub under the "Make in India" initiative, we will have to ensure that our transport sector is competitive in comparison to China.

During the past two decades, China also undertook substantial expansion of its road transport infrastructure but, unlike India, it focused on developing an arterial road network while India spent resources on rural connectivity which do not substantially contribute to manufacturing sector cost effectiveness.

Various studies have highlighted the deficiencies of each sector of transport, but what is needed is a look at the entire transport sector of India such that seamless connectivity for multimodal transport is facilitated. Unless India achieves development of its transport infrastructure in a manner which is designed to ensure efficient intermodal transfer at the intersection points, we cannot hope to emulate the growth story of the Chinese manufacturing sector. The saving in fuel consumption (and hence on imports/ trade deficit) show us the obvious advantages of adopting a more balanced modal mix. The positive impact of this on the environment is only the icing on the cake.

What are the concrete steps required to be taken by the Government so that the consumer of transport services abandons his preference for road transport and

increasingly adopts rail and water as means of commercial transport? For this to happen, the Government should adopt the following sectoral actions:

- Inland Water/ Coastal – develop NW 1 as a model waterway and extend the scope of this waterway to NCR region via the Ganga and the Yamuna and adopt a regular freight service (conveyor belt) on this route to encourage movement of time sensitive and value added cargo. From Haldia synchronized service to East coast ports would be needed. Since resources are limited this would involve stopping any development activity on other waterways so that the success of this model can be established. Simultaneous action would be required to acquire river/sea vessels and integrate the inland and coastal waterway route to ensure time bound delivery of cargo to/ from ports. Minor tweaking of tax laws would ensure the success of this model. The land based development of terminals should be on a PPP model. The final success factor would be the integration of the EW DFC and the Golden Quadrilateral along NW1.
- Railways – Top priority development of the 5 DFCs so that Exim cargo moves in a time bound manner, without any interference from passenger traffic.
- Coastal – develop the 2 coastal freight corridors to ensure integration with Inland water/ rail and road network.
- Road – facilitate last mile connectivity of inland water/ rail/ coastal and ports at the cost of some rural roads.

These steps would ensure reversal of the change of modal mix away from road and in favour of rail and water, with the attendant benefits of lower transport costs; time bound services and lower environmental degradation.

Modelling Impacts of Road maintenance policies on vehicular emissions and fuel consumptions at Network Level

Harish L Reddy*

**Assistant Professor, School of Construction Management, National Institute of Construction Management and Research*

Abstract

India's transportation sector, having the 2nd largest road network in the world has significant impact on the nation's economy as well as its environment. It is required for the government to invest huge sums of money for continuous maintenance and upgradation of the existing and proposed road networks. In the present scenario of limited budgets, the natural tendency is to give preference to the projects which are more economically viable thus ensuring returns on investments. In such a process the economy gets an upper hand while the environment will be a letdown.

The present study tries to address this situation. In the present study, a SH network in Andhra Pradesh is evaluated using the World Bank's HDM-4 model. The impact of choosing a particular maintenance policy, on the fuel consumption and vehicular emissions are investigated. The model is calibrated to simulate the Indian conditions and a life cycle analysis is carried out for a period of 10years. It is found from the study that the choice of maintenance alternative has significant impact on vehicle emissions and fuel consumptions in the road network. It is recommended that the methodology adopted in the study should be followed by the engineers while optimizing maintenance alternatives for a road network.

Background

Introduction

The Indian road network consists of approximately 54.72 Lakh kilometres of road length. Quantitatively, India has a density of 1.66kms of roads per square kilometre of land. However, the surfaced length of the road constitutes approximately 61.05% of the total road length in India [(1)]. Road sector is also the largest consumer of energy within the transport sector from petroleum products. The road transport sector, comprising both passenger and freight transport, accounts for nearly 72 percent of High Speed Diesel (HSD) consumption in India [(2)]. It is also estimated that the road sector contributes to nearly 87% of the total emissions from the transport sector. A life cycle cost analysis carried out for 30 year period on a

NH (4-lane with service road) indicated that the energy consumption for one Km length of road will be 39.1 TJ and 27.8 TJ for construction and maintenance activities respectively. It is also found that the embodied CO_2 emissions will be 3442.4 T and 1072.9T for construction and maintenance activities respectively.

Overview of existing studies

Many emission and fuel consumption models have been developed and utilized for studying the environmental impacts of transportation systems. These models are both macroscopic and microscopic in nature applicable to regional or national levels. Hong Zhang [(3)] successfully estimated emissions and fuel consumptions during asphalt paving operations on an activity object-oriented simulation platform. Hesham Rakha et al.,[(4)] developed macroscopic emission models using average speed as a sole traffic related variable to study impact of stops on vehicle fuel consumption and emissions. Imen Zaabar et al., [(5)] through field investigations determined that trucks driving on asphalt pavements during summer consume about 4% more fuel as compared to when driven on concrete pavements. Elizabeth et al.,[(6)] did a case study analysis on a bridge replacement project and developed new metrics that reflect the relationship between the economic and energy components of a project, as well as the economic and environmental aspects. Micheal Bienvenu et al., [(7)] successfully carried out field experiments to calibrate HDM4 fuel consumption model to be used for state of Florida. Charinee Limsawasd et al., [(8)] developed a new pavement performance algorithm to forecast the deterioration in pavement conditions and estimating fuel consumptions for different Highway rehabilitation programs. Chandrama Prasad et al., [(9)] carried out studies and developed calibration factors for HDM-4 emission models to represent Indian conditions.

However, it is found from the literature review that limited studies have been carried out in studying the impact of a road maintenance decisions on the fuel consumption and vehicular emissions. This needs to be done both at the project level and at network levels. This study was carried out to address this issue.

Objectives of the study

The following are the objectives of the study

- To collect road network data from the site
- To calibrate the HDM-4 model for Indian conditions

- To assimilate different road maintenance policies
- To study the impact of road maintenance policies on emissions and fuel consumptions

Data collection

Road Network data:

The data from road network was collected as part of ongoing AP Road sector project commissioned by GoAP. A total of 30 SH comprising of length 677.15Km within the administrative boundaries of Anantapur district was surveyed and data was collected. The network was divided into manageable pavement sections on the basis of various characteristics associated with them. Categorization was done on the basis of homogeneity w.r.t traffic volume, pavement type and thickness and pavement condition characteristics. All sections were given a unique 'Section ID' and 'Section Name' for easy identification. The layout of the selected road network is shown in Figure 1.

Vehicle fleet data:

Traffic surveys were carried out on the road stretch to identify the different categories of vehicles plying on the road and their composition. The Non-motorized vehicles were exempted from the study. Econometric models were developed to estimate the traffic growth rates for each category of vehicle. In addition vehicular characteristics were collected through secondary sources as per the requirement of HDM-4 Model. The vehicles considered in this study are shown in Table 1 below. The calculated growth rates are shown in Table 2 below.

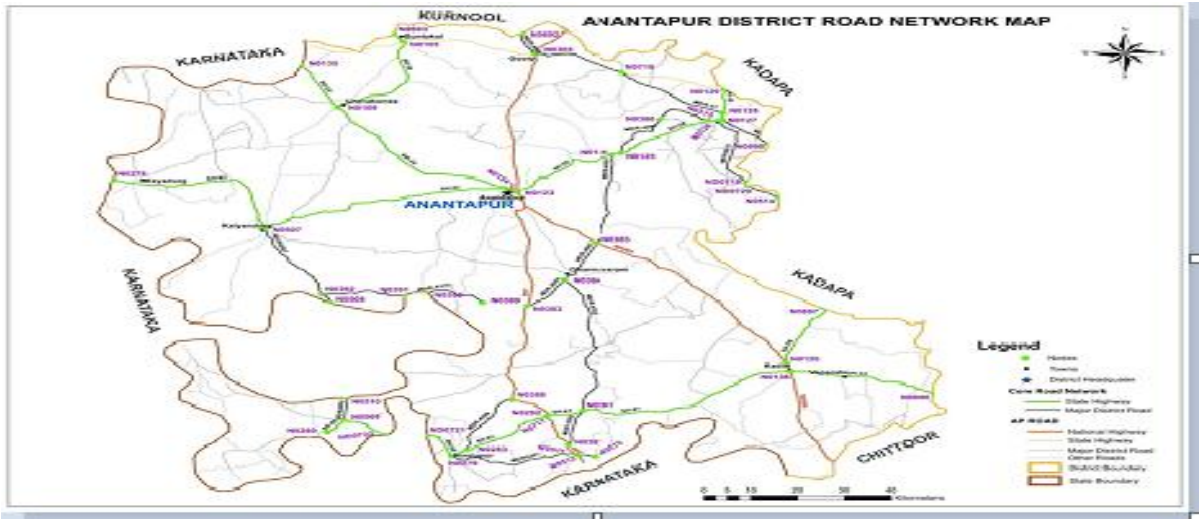

Fig. 1: Layout of the Selected Highway Networks

Table 1: Vehicle categories considered in this Study

Sl. No.	Base Type	Model	Company
1.	Multi Axle Vehicle	3718 iL	Ashok Leyland
2.	3 Axle Vehicle	2516 iL	Ashok Leyland
3.	2 Axle Vehicle	1616 iL	Ashok Leyland
4.	Full Bus	Lynx School Bus	Ashok Leyland
5.	Tractor With Trailer	Bhoomiputra 275 DI	Ashok Leyland
6.	Tractor	Bhoomiputra 275 DI	Mahindra
7.	Mini Bus	Mitr	Ashok Leyland
8.	Light Commercial Vehicle	Trax Cargo King	Force Motors
9.	Car	Indica BS4	Tata Motors
10.	Auto Rickshaw	Compact 4S	Bajaj
11.	Motor Cycle	Glamour Programmed FI	Hero Moto crop

Table 2: Projected annual traffic growth rate (%) by econometric modelling

Sl. No.	Vehicle Type	2015-2024	2025-2034	2035-2044
1.	Two Wheeler	7.5	6.6	5.2
2.	Car	7.1	6.3	5.0
3.	Three Wheeler	4.6	4.1	3.4
4.	Bus and Mini bus	6.0	5.3	4.3
5.	LCV	6.5	5.4	4.1
6.	2-Axle Truck	4.7	4.0	3.0
7.	3-Axle Trucks	5.9	4.9	3.7
8.	Multi Axle Truck	6.5	5.4	4.1
9.	Tractor	5.9	4.9	3.7

Calibration of hdm-4 model for Indian conditions

In order to calibrate HDM-4 model for Indian conditions a minimum of three year pavement studies are required. However, such studies have already been done and are published in reputed journals. The same have been used for model calibration. Sanjiv aggarwal et al., [10] give the following calibration factors for pavement performance prediction models.

Table 3: Calibration factors for pavement performance prediction models

Sl. No.	Model Description	Average Calibration Factor
1	Cracking Initiation	Kcia = 0.43
2	Cracking Progression	Kcpa = 1.25
3	Ravelling Initiation	Kvi = 0.37
4	Ravelling Progression	Kvp = 0.52
5	Potholing Initiation	Kpi = 0.45
6	Potholing Progression	Kpp = 0.95
7	Roughness Progression	Kgp = 0.85

Chandrama Prasad et al.,[9] have given the following calibration factors for emission models. The same have been used.

Table 4: Calibration factors for emission models

	Traffic Type	Calibration factor			
		HC	CO	NOx	PAR
Arterial Road	2W	0.14	0.11	4.07	1.01
	4W	0.15	0.13	1.03	0.76
	LCV	0.57	0.21	0.74	46.37
	Truck	0.72	2.33	0.82	2.2
	Bus	1.06	0.84	0.84	0.68
Main Road	2W	.014	0.11	4.13	0.87
	4W	0.18	0.14	0.71	0.96
	LCV	0.41	0.14	0.50	37.34
	Truck	0.64	2.49	0.82	2.7
	Bus	1.51	1.23	1.26	1.25
Feeder Road	2W	0.07	0.07	1.50	0.78
	4W	0.07	0.06	0.81	0.2
	LCV	0.94	0.32	0.52	43
	Truck	0.71	3.57	0.86	2.84
	Bus	2.47	2.66	1.77	1.89

Road maintenance policy

Serviceability Levels

The road network data showed that all sections of the SH do not carry equal amount of traffic and as such all sections cannot be maintained to the highest level of serviceability. Maintenance serviceability level is a qualitative rating of the effectiveness of a highway in terms of operating conditions such as traffic volume, speed, comfort and safety [10].

Hence, as per MoRT&H guidelines, based on limiting levels of surface defects such as roughness, cracking, rutting etc., three levels of serviceability are defined as shown in Table below.

Table 5: Serviceability levels and limits of distress

Sl. No.	Serviceability Indicator	Level 1	Level 2	Level 3
1	Roughness, IRI	2.8m/km	4.0 m/km	5.2m/km
2	Potholes per km	Nil	2-3	4-8
3	Damaged area	5%	10%	10-15%
4	Rutting	10mm	15mm	20mm
5	Skid number	50SN	40SN	35SN

Maintenance intervention technique

It is generally found that; depending on the road condition; the experience and assessment of the engineer, a particular treatment technique is selected for road maintenance operations. The maintenance is mostly carried out on a scheduled interval technique which is found to be inferior as compared to responsive intervention technique [(10)]. However, in the present study both techniques are employed for road maintenance operations. The maintenance operations can be broadly grouped into routine and periodic maintenance activities. The periodic maintenance activities can be further grouped into preventive and corrective maintenance techniques. IRC codes on maintenance of roads are referred, to determine the different maintenance operations required for the selected road network. These operations are grouped and applied, based on the requirements of three serviceability levels as shown above.

Model development and analysis

The road network data, vehicle fleet data and maintenance policy decisions were keyed into the HDM-4 model. Calibration factors were introduced for pavement performance prediction and emission models. The whole network was subjected to life cycle analysis for a period of 10years. All costs were discounted to the base year 2016 with a discount rate of 12%. Analysis was carried out with an unconstrained works programme and then with a prioritized works programme.

Discussions & conclusions

From the results of the study, it was found that there exists a consistent variation in fuel consumptions and vehicular emissions such as HC, NOx, CO and PAR, for the whole network considered, when different

maintenance policy options are applied. The calibrated HDM-4 model is capable of estimating fuel consumption and vehicular emissions at a project level as well as at the network level. The existing condition of the pavement, traffic on the road, progression of deterioration and choice of maintenance treatments, play a key role in determining the fuel consumptions and vehicular emissions of the road network. It was also found that budgetary constraints accelerate the pavement deterioration and lead to an increase in emission and fuel consumptions of the network. Hence, it is recommended that, as a best practice to follow this particular methodology in arriving at maintenance treatment technique which will result in an overall minimum vehicular emissions and fuel consumptions in the road network.

Acknowledgement

The author wishes to acknowledge the efforts of Mr. J Janardhan, Assistant Highway Engineer, AECOM and Mr. Vijaykumar, Chief General Manager, AECOM for their contributions in collecting the data, compiling and modelling using the HDM-4 software. Without their efforts this study would have not been possible.

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Role of ORDC in managing operations of industrial infrastructure

Vishal B Singh*, Dr. Rajeev Sharma**, Dr. B P Panda***

**Power plant operations lead, Chevron-Kuwait Gulf Oil Company*
***Assistant Professor(SG), CoMES, University of Petroleum and Energy Studies*
****Associate professor, CoMES, University of Petroleum and Energy Studies*

Abstract

Operators Routine Duties and Checks (ORDC) are critical for managing the operations of industrial infrastructures such as power generation plants, oil refineries, chemical plants, food processing plants and gas compressor plants. This paper studies the influence of ORDC activities on a gas compressor plant in Kuwait. The paper highlights that a standardized ORDC program enhances the useful life by ensuring that the equipment is in good working order, operated in safe and controlled conditions and abnormal conditions are identified and addressed.

The ORDC contributes to a decrease in operating cost by cutting on unnecessary maintenance, reduction in energy consumption through efficient operation and lower cost of spare parts. The ORDC improves operational reliability and plant availability and mitigates the risk to plant personnel and assets by providing a strong safeguard to potential catastrophic incidents.

Keywords

Operators Routine Duties and Checks, Gas Compressor, Reliability, Availability, Preventive Maintenance, Condition Based Maintenance, Useful Life, Operating Cost

Introduction:

What is ORDC?

In industrial infrastructures such as power generation plants, oil refineries, chemical plants, food processing plants and gas compressor plants, the operator's role is not restricted to common operations such as plant equipment startup, shutdown and response to alarms enunciated by the control and monitoring system. They are considered the first line of intervention to prevent potential failures of equipment and thus are the fundamentals of business. Operators Routine Duties and Checks (ORDC) program involves strict adherence to performing documented routine duties that set the proper mental discipline, prevents incidents in complex operations

and thus maximizes reliability and efficiency of operations. These routine duties include:

- Physical walk around and visual inspection of plant systems,
- Equipment readings and status checks (monitoring of equipment condition),
- Response to deviations of plant operating parameters,
- Follow written procedures such as start-up, shutdown, emergency response,
- Check and add lubricants,
- Perform minor maintenance work that does not require specialized tools,
- Maintain a neat and clean environment (Housekeeping).

Controlling Operations through ORDC:

With the advent and availability of user-friendly, PC-based spreadsheet, word processing, and database programs, it is very easy to generate log-sheets and checklists for the collection of large volumes of data. However, in the absence of a standard ORDC process, many routine duties and checklist programs are found to have following shortcomings/gaps:

- The standardization of the checklists,
- Review and error checking,
- Timely analysis of the data collected,
- Feedback loop and continuous improvement.

This paper assesses the role of ORDC activities on the operations of industrial infrastructure by exploring them in terms of key benefits. The association between the ORDC program and the expected benefits are examined through a case study on a Gas Compressor Plant in Kuwait. The influence of ORDC on the equipment useful life, the safety of plant equipment and personnel and operating cost is studied qualitatively. Also, the effect on operational reliability and plant availability is studied before and after implementing the ORDC program.

ORDC PROGRAM IN A GAS COMPRESSOR PLANT (GCP):

The study is conducted on a gas compressor plant (GCP) in Kuwait, where the ORDC program was implemented in 2008-2009 as one of the sub-elements of Process Safety Management (PSM). The ORDC process standardized the plant log-

sheets & checklists, defined operational ranges of parameters, stated frequency of monitoring of critical equipment, and outlined ORDC review by Supervisors, audit, analysis and feedback to GCP operators by ORDC Champion.

The GCP receives natural gas (fuel gas) from an onshore oilfield at Kuwait and delivers to combustion turbine plants for power generation after boosting the pressure. The gas is compressed by 2500HP Electrical Motor Driven Dresser-Rand make, and Allen Bradley PLC controlled fuel gas compressors. The GCP has three reciprocating type fuel gas compressor units, namely Unit-1, Unit-2 and Unit-3 of 30MMSCFD (OEM-Dresser-Rand Performance Test Report, 2004) capacity each.

Two of them are usually in service, and the third unit remains on operations standby. The suction pressure to the compressors is set at 70 PSIG and discharge is delivered to the combustion turbine units at 270 PSIG. The key equipment of a gas compressor unit under ORDC programs are listed in the Table A and shown in Figure A.

Table A: List of GCP Equipment under ORDC Program

Source: (PGP Joint Operations, Kuwait, 2014)

S/N	Equipment	Quantity	Checks Performed
1.	Electrical Motors	5	Motor current, Winding temperature, Lube oil parameter
2.	Scrubbers	2	Liquid level
3.	Heat Exchanger	3	Inlet and Outlet temperature
4.	Cylinders	4	Gas and Coolant temperature
5.	Pistons/Piston Rings	4	Wear- Monitoring of clearances through rod- drop probes
6.	Lube Oil /coolant Pumps	4	Discharge pressure, Flow

Figure A: Fuel Gas Compressor Unit

Source: (Energy Transfer Technologies, 2016)

THE ROLE OF ORDC IN MANAGING OPERATIONS OF GCP:

The role of ORDC program is difficult to determine in terms of economic value as no specific statistical methods exist and no empirical studies have been performed. It is hard to quantify the extended life of a gas compressor component if its condition is monitored through a proper ORDC program than it would without ORDC. However, an effective ORDC program is an investment that generates real returns in terms of enhanced useful life, lower operating cost, risk mitigation and asset protection, improvement in availability and operational reliability.

ESTIMATED ANNUAL COST OF ORDC PROGRAM FOR GCP:

It is reasonable to assume that the hourly wage of a gas compressor plant operator in Kuwait is almost same to an operator of Natural Gas Distribution Company in the USA. Also, one gas compressor plant operator is adequate to execute ORDC (ORDC- Logsheet Checklist PGP Joint Operations, 2016), the estimated cost of ORDC program at the rate of $47.94 per hour (Occupational Employment Statistics, USA, 2015) comes out to be $0.14 million per year.

Initial Capital Cost of GCP and Influence of ORDC on Useful Life:

The capital cost of a heavy duty gas compressor unit depends on the capacity and type of drive. For reciprocating gas compressors with an electrical motor as the prime mover, the capital cost is estimated to be $1500 per BHP (Energy Transfer Technologies, 2016). Accordingly, the capital cost of each fuel gas compressor unit (2500BHP) is $3.75 million, and total cost of the gas compressor plant (GCP) with three gas compressor units is $11.25 million.

Obliviously, the useful life of this costly equipment is linked to how it is operated and maintained. Heavy machinery, especially industrial equipment, requires constant maintenance to keep it in good working order. According to Dassault Systems, (Dassault Systemés - Maintenance Tips to Extend Equipment Life and ROI, 2014), the below five steps can significantly extend the useful life of heavy machinery:

- Overseeing the correct operation of the equipment,
- Add and test lubricants frequently,
- Check for signs of wear.
- Keep machinery clean, and maintain a tidy environment,
- Have maintenance and repair schedule, and keep good records.

GCP operators perform the first four of the above five maintenance activities as part of ORDC program. Consequently, ORDC contributes to enhancing the useful life by ensuring that the equipment is always operated in safe and controlled conditions and within the design and environmental limits (SNS Pool- Operational Excellence, 2009).

The ORDC makes sure that the machines are in good working order and protects the assets by confirming that the safety devices are in place and functioning, abnormal conditions are identified in time and addressed through work order execution process. Thus, ORDC program plays a vital role in increasing the useful life of the equipment.

The Impact of ORDC on Operating Cost:

Managers in industrial infrastructures continually improve profitability by seeking ways to reduce expenses, and

common cost-cutting targets are operating expenditures (Opex) that include preventive maintenance and electricity expenditure. ORDC program serves as an effective tool towards this goal by reducing the cost of maintenance, energy consumption and cost of spare parts.

The Impact on Cost of Maintenance and Energy Consumption:

As indicated in Table 3-1, the cost of maintenance and the energy bill are two major components of the operating expenditure of a gas compressor. As part of ORDC, operators monitor the condition of equipment through periodic checks. ORDC helps in reducing the amount of planned preventive maintenance by envisaging the maintenance need of machine through in-service supervision. Operators take readings of online operating parameters, visually inspect the equipment for abnormal conditions during a physical walk around and respond to any deviations from acceptable operating limits. Thus, the fixed time interval based preventive maintenance can be replaced with condition based maintenance with inputs from ORDC program. The machines are repaired only when their performance is less than optimal eliminating expenditure on unnecessary maintenance (Hai Qiu and Jay Lee, 2007). The annual operating cost of GCP is $2.95 million with a 15-year outlook.

Performing preventive maintenance and condition monitoring reduces energy consumption in industrial equipment (Tips for Energy Saving in Industrial Equipment, 2016). The ORDC process ensures that equipment functions within safe limits of operating parameters (Temperature, Pressure, Level, Speed, Vibrations). According to Operations &

Table B: Operating Cost of Gas Compressor Plant (15- Year Outlook)

Note: 8000 hours per year, 6.5 cents/KWH, 15 years cover one major overhaul

Source of Data: (Energy Transfer Technologies, 2016)

Driver	Maintenance Life Cycle Cost (BHP-Hr.)	15 Years Maintenance Cost (Millions)	Electricity (BHP-Hr.)	15 Year Electricity Cost (Millions)	15 Year Total (Millions)	Annual (Millions)
Electrical Motor (3X2500 BHP)	$0.0012	$1.08	$0.048	$43.20	$44.28	$2.95

Maintenance Best Practices, a Guide to Achieving Operational Efficiency (Pacific Northwest National Laboratory, 2010), a well-maintained equipment that functions within the operating range is more efficient and hence consumes less electricity resulting into the lower operating cost.

The ORDC process ensures timely analysis of the data collected, feedback and continuous improvement. An operator who is focused on improvement can get the same amount of work done in less time and with less fuel/energy than an operator who is not (Ways To Lower Owning and Operating Costs- KOMATSU, 2016). Therefore, ORDC is a significant operating cost optimization tool.

The Impact on Cost of Spare Parts:

The reduction in the random breakdown events not only improves the reliability and availability of the machines but reduces the cost of spare parts (ReliabilityWeb.com- Total Productive Maintenance, 2016). The results are similar at GCP, as indicated in Table 3-2, the annual cost of gas compressor spare parts reduced by 0.56 million (69.4%) (Joint Operations PGP-Warehouse, 2014). The reduction in the cost of spare parts has been achieved by implementing the recommendations of the Root Cause Analysis (RCA) of the breakdown incidents through the ORDC process and adopting better compressor maintenance practices. Annual saving due to reduction in cost of spare parts: $809,081-$247,500= $561,581 (~0.56 million), (69.4% reduction)

The annual saving due to reduced cost of the spare part is $0.56 million which is four times of the annual cost ($0.14 million) of ORDC program for GCP.

Table C: Cost of Gas Compressor Spare Parts (3- Year Outlook)

Source of Data: (Joint Operations PGP-Warehouse, 2014)

Cost of Spare Parts	**Gross**	**Average per Year**
Spare part cost for the years 2007,2008 & 2009	$2,427,242	$809,081
Spare part cost for the years 2012, 2013 & 2014	$742,500	$247,500

The indirect cost due to loss of gas supply to downstream customers is not considered in the study as it is assumed that sufficient redundancy in the compression capacity at GCP and availability of alternate fuel is incorporated into the facility design. However, in general, the revenue loss due to non-availability of the system would be much more than the cost of the failed equipment (EEP - Electrical Engineering Portal, 2016).

The Impact of ORDC on Safety of Personnel and Equipment:

A gas compressor plant (GCP), processing highly flammable substance is a source of hazard. A catastrophic failure of GCP equipment involves potential consequences of fire, explosion and human fatality. The ORDC program serves as a high-quality safeguard for mitigation and prevention of occurrence of such incidents. The operators trained on ORDC skills, can detect a potential failure during a physical walk around, using four senses (Vision, Hearing, Smelling, Touching) or observation of deviations in process parameters.

The compressor unit can be removed from service for investigation and troubleshooting, and necessary actions can be taken to protect vital installations and plant personnel. A process hazard analysis (PHA) study (PGP Joint Operations, Kuwait, 2014) carried out on GCP identified multiple scenarios that can result in potentially catastrophic failure incidents, however, with the safeguards in place including ORDC program, the likelihood of any such incident is very low.

This benefit of ORDC program applies to many process industries like chemical plants, oil refineries, power plants and nuclear installations where loss of containment can lead to loss of assets and human fatality. Several events related to observation of deviations in online operating parameter value recorded through ORDC program at GCP during the year 2014 are listed in Appendix-A.

The Impact of ORDC on Operational Reliability and Availability:

Equipment reliability begins with the operator who plays an essential role in maximizing equipment life, enhancing equipment reliability and achieving processing goals (Job Performance Systems, 2016).

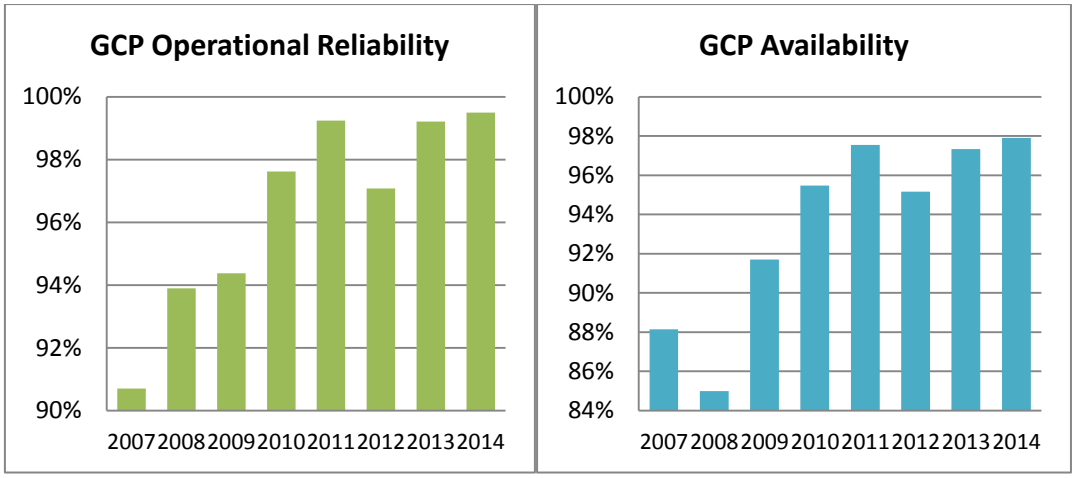

Figure B : Fuel Gas Compressor Plant Operational Reliability & Availability

Source of Data: (PGP JO Gas Compressor Plant RAM Data, 2007-2014)

The ORDC is an integral part of any operator driven reliability based maintenance program that ideally aims at zero unpredicted equipment breakdown. The Breakdown Maintenance Management (BMM) is the most expensive method of maintenance management (EEP - Electrical Engineering Portal, 2016) and shall be eliminated to maximize equipment operational reliability.

At GCP the ORDC program was implemented in 2008-2009 and the process matured from 2010 onwards as the operators developed the skills through experience, bore a sense of ownership and realized the importance of the program. The results are clearly reflected in a significant improvement in operational performance of GCP with a reduction in failure events and equipment downtime. Consequently, as plotted in Figure 3-1, the reliability of the plant increased phenomenally from less than 95% in 2008 to 99.5% in 2014 and the availability of the plant increased from less than 90% in 2008 to nearly 98% in 2014.

Conclusion

The ORDC process standardizes the way operators monitor the condition of equipment in an industrial infrastructure such as power generation plants, oil refineries, chemical plants, food processing plants and gas compressor plants. In the absence of an effective ORDC process, routine duties and checklist programs lack the consistency of documents, neglect

review & analysis of the data and feedback for improvement.

The role of ORDC in managing operations of industrial infrastructure is explained through a case study on a Gas Compressor Plant (GCP) in Kuwait. The study demonstrates that the effective ORDC program produces substantial returns in terms of key benefits. The ORDC program plays a critical role in enhancing the useful life by ensuring that the equipment is operated safely within design limits and abnormal conditions are identified and addressed.

Also, the ORDC reduces the operating expenses by cutting unnecessary maintenance, lower electricity consumption and a decrease in cost of spare parts. The study determines that the annual saving due to lower cost of the spare part is $0.56 million which is four times of the annual cost ($0.14 million) of ORDC program for GCP.

The ORDC program serves as a high-quality safety measure for risk mitigation and protects the plant employees and assets from catastrophic incidents. Finally, the ORDC helped in the improvement of operational reliability from less than 95% in 2008 to 99.5% in 2014 due to a reduction in random failures and enhancement of plant availability from less than 90% in 2008 to nearly 98% in 2014 by a decline in equipment downtime.

Glossary

The definitions of specific terms used in the paper are provided below:

1. Availability is the probability that the system is operating satisfactorily at any time, and it depends on the reliability and the maintainability. Following formula is used to calculate availability.

$$Availability\ (\%) = \left(\frac{Service\ Hours + Standby\ Hours}{Unit\ Period\ Hours}\right) * 100$$

2. Reliability is the probability that an engineering system will perform its intended function satisfactorily for its intended life under specified environmental and operating conditions. Following formula is used to calculate reliability.
3. Preventive Maintenance (PM) is maintenance that is regularly performed on a piece of equipment to lessen the likelihood of it failure.

PM is planned so that any required resources are available. The maintenance is scheduled based on a time or usage trigger.

4. Condition Based Maintenance (CBM) is a maintenance strategy that monitors the actual condition of the asset to decide what maintenance needs to be done. CBM dictates that maintenance should only be performed when certain indicators show signs of decreasing performance or upcoming failure. Compared with preventative maintenance, this increases the time between maintenance repairs, because maintenance is done on an as-needed basis.

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Appendix – A : Significant ORDC Observations on GCP in 2014

i. 31 Dec-2014: Gas Compressor Unit-3, Cylinder-1 temperature deviation was observed. The compressor was removed from service, and the damage was limited to loss of piston rings only.

ii. 11 Nov-2014: Gas Compressor Unit-2, Cylinder-3 temperature deviation was observed. The compressor was removed from service to prevent piston/cylinder failure. The damaged/worn-out variable volume pocket rings that caused high temp were replaced.

iii. 31 Aug-2014: Gas Compressor Unit-3, Cylinder-3 temperature deviation was observed. The compressor was removed from service, and the damage was limited to loss of piston rings only.

iv. 18 Aug-2014: Gas Compressor Unit-2, Cylinder-1 temperature deviation was observed. The compressor was removed from service, and the damage was limited to failure of a piston.

v. 22 May-2014: Gas Compressor Unit-3, Cylinder-3 temperature deviation was observed. The compressor was removed from service, and the damage was limited to failure of a piston.

vi. 12 Feb-2014: Gas Compressor Unit-3, Cylinder-34 temperature deviation was observed, and the Operator aborted eminent failure of Compressor internal components by shutting the unit.

vii. 14 Jan-2014: Gas Compressor Unit-3, Cylinder-4 temperature deviation was observed, and the Operator aborted eminent failure of Compressor internal components by shutting the unit.

Role of Smart Cities in the future of urban India, the road ahead

Dr. Ashish Tripathi* Dr. Anil Kumar** Mr. G. Uday Shanker***

** Associate Professor, CoMES, University of Petroleum and Energy Studies*
*** Professor, CoMES, University of Petroleum and Energy Studies*
**** Student, , CoMES, University of Petroleum and Energy Studies*

Abstract

Globally it has been observed that the urban centres are the major contributors to the nation's economy. In addition, there is an accelerated pace of urbanization across the globe. It thus becomes imperative to gear up to the challenge and creates urban centres which are efficient, modern and sustainable. The idea of a smart city first came up at the height of the global economic meltdown beginning 2008. It was an outgrowth of the smart planet initiative of IBM. At a very rapid pace, the concept of smart cities has diffused across the world. Already it has been executed in cities like Malta, Vienna, Amsterdam and the Songdo business district near Seoul in Korea. There is no unique definition of a smart city applicable across the globe. Each city has its own vision and picture of a smart city depending on its nature and level of existing infrastructure. However certain common features can be – sustainability, innovation, efficiency, use of latest ICT, modern amenities and social infrastructure. India has also taken up this idea and announced a smart city mission of developing 100 smart cities across the nation. There are many challenges in the way of transformation to smart settlements for the Indian cities. The crucial among them, which need the urgent attention of the planners, are financing and availability of trained manpower.

Keywords

Urban, Smart City, Infrastructure, Planning, Financing

Introduction

There is a constant flow of migrants from the rural landscape to the urban cities across the globe. It is estimated that in 2050 approximately 70% of the people will be residing in the cities, including in India. Thus India would require around 500 new cities to house this influx. Currently, the urban populace in India makes up nearly 31% of the total population and produces

around 60% of the national GDP. This will progressively rise to a level of 75% in the coming 15 year period (Census of India 2011). Thus it is obvious that the lion's share of economic activity will be housed in the urban centers in the foreseeable future. It thus becomes urgent to ensure that the city structures and processes are efficient. This poses a daunting challenge in the twin aspects of managerial and policy challenges for India. The fundamental shift towards urbanization needs a national level dialogue and discussion in India which has not yet picked up pace.

Typically the urban centers are affluent and densely populated leading to urgent demands for amenities like sanitation and sewage management, water and urban mobility. In addition, there will be a spurt in the demand for affordable housing by 5 to 7 times in cities of all hues. Smart cities need to be planned which can effectively meet the spiked up demand of energy, cheap and effective healthcare, planned housing, potable water and extensive infrastructure (in terms of roads, educational facilities, and transportation). The existing urban centers are creaking at the edges in the face of the above immense pressure. They are incapable of providing the requisite economic growth opportunities and social life. There has been an exponential advancement in the ICT (Information and Communication Technology) across the globe. It has resulted in massive cost reductions, inexpensive mobile apps, zero cost social media facility, efficiencies in handling big data and cloud computing. This provides the cities with a minefield of opportunities in terms of effective planning and organizing so that the urban challenges can be effectively dealt with, head on. It is imperative for India to develop smart urban centers with all the modern amenities which can provide solutions to deal with the challenges of urban life in addition to serving as the engines of the Indian economic growth through large-scale investments. The Indian government has announced the plan of 100 smart cities to meet with the above imperative.

Smart City Concept

A smart city is a relatively novel concept that emerged in the throes of one of the worst meltdowns in the recent economic history. IBM took up the ambitious initiative of the Smarter Planet and included the Smart Cities program within the ambit of this plan. Within a year this idea became viral and by

the beginning of 2009, it caught the attention of all the major economies across the globe. Advanced economies like UAE, South Korea, and China piled up heavy investments into research related to the concept and the plan for the formation of smart cities. Due to the execution of the smart city projects, there are a lot of precedents for India to learn from and emulate. Prominent among them are Malta, Lyon, Malaga, Aarhus, Cairo, Vienna, Amsterdam, Verona and the Songdo District near Seoul. However, as of now, there is no universally accepted precise definition of what constitutes a smart city.

A few of the characteristics of a smart city can, however, be described. It is supposed to be a sustainable habitation which has innovation as its bedrock. A smart city utilizes the latest Information and Communication Technology to the maximum in its attempt to deliver the best quality of life to citizens. This is coupled with the highest order of efficiency in its operations again achieved through ICT. Thus these are highly competitive urban centers which are capable of catering to the needs of the present as well as the foreseeable future. In addition, these are balanced and holistic with respect to all the three requirements, economic, environmental and social.

The various smart city initiatives can be classified into two categories – Greenfield and brownfield. As far as the current majority are concerned, they are predominantly in the nature of smartly intervening in the existing city infrastructures and can thus be termed as brownfield interventions. In addition, there have been a few greenfield smart city projects where the entire city has been planned and built from scratch. Songdo, Fujisawa, Masdar, and Kashiwa-no-ha are a few of them.

Global Smart Cities Scenario

Smart City Infrastructure

The basic elements/amenities of a modern city consist of, among other things, water supply, housing, sewage, sanitation, power, communication, mobility/transportation, waste management and distribution. However, a smart city has the additional inbuilt capability to respond to the changes in the requirements imposed by the ever-evolving environment, like the user expectations, through its smart infrastructure in order to be capable of delivering high

performance on all major counts. The six key units/themes of a smart city are smart living, smart people, smart economy, smart mobility, smart governance and smart environment. These are made possible through the smart infrastructure of the smart cities.

However, the smart infrastructure required is a function of the existing level of development of the cities where it is being planned. Thus it is dependent on the context of the city. The particular developmental challenges being faced by the city would classify what is a smart initiative and what is not. As far as a developing country is concerned the pressing need is for the urban centers to have adequate infrastructure and provide all the modern amenities in a planned fashion. This can be effectively achieved by smart interventions and applications which can enable these cities to leapfrog and attain smart city status within a short span. This has been adequately demonstrated in the case of Africa. The initial smart infrastructure applications can aid and abet the subsequent innovations by acting as a foundation in the process of achieving stellar efficiency and improved resource management. A case in point is that of smart mobility infrastructure which can generate vital information to remodel the networks of transportation and develop apps for attaining smart mobility.

The case of developed countries is somewhat different. The legacy infrastructure in these countries is very big and cannot be entirely replaced and renovated due to considerations of space and cost. Thus smart interventions in these cases would mean better utilization of the legacy systems through real-time monitoring of their operations. A striking example is the case of Paris, where there is already an existing huge metro network system. Through smart interventions, the introduction of automated trains was carried out on Line 1 of the existing Metro. In addition, the latest audio-visual and information control systems were installed in the metro network. As a result, the existing legacy system was able to cater to the needs of an added 70,000 passengers per day. It also reduced the delays substantially. The key in both the cases of developing and developed nation contexts is the ability of the smart cities to rise to the challenge of meeting the changing needs of the society in a sustainable, efficient and effective manner.

Smart Cities in India

The concept of smart cities in India is still in the nascent stage and has a long way to go in the future. There is a twin-pronged strategy for the development of smart cities in India comprising of focused and chosen area transformation followed by complete city development.

As per Smart City Mission guidelines, the strategy of area-based development would include improvements through the process of retrofitting wherein modern components are added, development of these areas leading to a sort of complete renewal or greenfield development of extension areas to the existing cities. In contrast to the area based development strategy, the pan-city initiative would aim at applying smart solutions to large parts of the cities.

The process of retrofitting would involve initiating planning for smart city features in an already existing built up area so that the area becomes akin to a smart settlement by becoming effective, efficient and more liveable. In the case of redevelopment, the existing facilities would be replaced by a new layout of infrastructure on the lines of smart cities involving mixed land use and a higher density of human settlement. The third strategy of greenfield development would involve new construction of smart infrastructure in an area which was previously vacant (in excess of 250 acres) employing innovative methods of planning, financing, and implementation using land reconstitution and land pooling. In addition, there should be low-cost housing area for the poor.

In the case of pan-city smart strategy, the aim would be to apply the smart ideas to the entire city infrastructure. This can be achieved through the better application of technology solutions across the entire city. In addition information and data can be used to improve the infrastructure and delivery of services.

Desirable Features of the Indian Smart Cities

- A competitive smart city is one where there are a plethora of employment options, conducive environment to attract large scale capital, a large number of people with expertise and firms. This, in turn, is determined by the ease of doing business there and the social life it offers to its inhabitants.
- A sustainable smart city should have social, environmental and financial systems which can be continued over long periods in the future.

- The smart cities should be able to offer its citizens high-quality of life in terms of efficient and effective public services, high-quality healthcare services at reasonable cost, high security, and safety, inclusive opportunities, entertainment facilities, high-quality education, good governance, transparency and accountability.

Smart City Mission of India

As per GoI-MoUD, Special Purpose Vehicles will be instituted for the implementation of smart city mission at the level of the cities. The projects for the development of the smart cities will be planned, appraised, approved, funded, implemented, managed, operated, monitored and evaluated through these SPVs. At the apex of each SPV for the smart city will be a full-time CEO aided by a board of officials nominated by the Central Government, the State Governments, and the concerned Urban Local Body (ULB).

The exalted mission of the Smart City Program in India is to involve the people in both, the formulation and execution of policy. The entire blueprint as far as policy and implementation is concerned would be laid out in the form of a Smart City Proposal or Plan. This, in turn, would be generated by a competitive process for the first time in India, in case of a program of such immense size and scope. Once the competitive bids by various cities are submitted, the winners would ultimately qualify and receive funding to initiate the process to become smart cities. This competition is made up of two stages. In the first stage, an intra-state competition is organized which led to the shortlisting of 100 smart cities based on the merits of their proposals. The second stage was organized on an all-India basis by the Central Government. The aim was to capture the uniqueness of each of the cities participating in the competition in terms of their suitability to be modelled as smart cities.

The Challenge enabled the city teams to brainstorm over their definition of a smart city and the suitability to transform their city into smart ones and also decide on the roadmap or the innovative approaches that could be employed to turn the possibility into reality. All the classes of the key stakeholders were actively engaged in the process of planning and gave them a sense of ownership in the process of building their cities of the future. The various stakeholders that played important roles included common citizens, professional, politicians,

experts and private players as well (Vanolo A-2014)

Each of the potential smart cities was asked to submit a proposal to the Government of India. The proposal was directed to include one area-based development – it could be a retrofitting plan for a minimum of 500 acres, a redevelopment plan for a minimum area of 50 acres or a complete Greenfield plan spanning over a minimum of 250 acres. In addition, the stakeholders were also asked to submit one or two pan-city development plan (for transformation into smart cities) which could bring in substantial improvements in the delivery of municipal services and as a consequence improve the quality of life for its inhabitants.

In order to bring in comparability of the various disparate proposals, a common standard template for the submission of the proposals was devised. The template was also devised to bring out the merits of all the proposals. An innovative feature was introduced wherein there was a blank standard template consisting a list of 43 questions with word limits for the responses to the questions. In addition, there was a ceiling on the number of pages that could be included as enclosures. The complete list of 43 questions covered the three broad areas of – vision, goal, and strategy for the city, plan for area-based development and plan for pan-city smart solutions execution.

Financing of Smart Cities

The Urban Local Bodies in the developing countries are strapped for funds. In the case of smart city projects, the fund requirements are huge. They are not able to refurbish even the existing urban infrastructure, its operations and maintenance and the delivery of essential urban services, let alone develop new ones. By their very nature, the smart city projects are hugely capital intensive as they involve huge size, technology, materials and area (Panagariya -2001). In addition, these projects have a large lifespan requiring an, even more, capital infusion periodically. It is nearly impossible for the local governments to be able to raise such mammoth capital from their own revenue resources. Thus, the process requires ingenious strategic planning within the framework of effective and efficient regulations. Even then, it is a locally driven development process and thus urgently entails the need for the local bodies to be able to generate adequate revenue from own resources for long-term funding and thus

ensure the viability of the smart city projects.

To address the above funding issue, the mission of smart cities would be run through central sponsorship to the extent of Rs.48,000 crores spread over five years, at the commencement of the scheme. Thus, it works out to roughly Rs.100 crores per city per year contributed by the Central government. In addition, there is the requirement that an equal amount of a matching corpus will have to be contributed by the concerned State/ULB. In the aggregate, there is thus an amount of approximately one lakh crore available for the entire project of smart cities in India.

It is required that in addition to the one lakh crore of initial contribution there should be equal exploitation of all the potential sources of revenue available to the local governments and urban local bodies. This has to supplement the financial resources already shared by the central and state governments. Only then can the model be self-sustainable financially. Further, new, innovative and unconventional financial instruments have to be deployed to garner additional resources for the mission. Among such financial tools public-private partnerships, the government led financing and development exactions can be explored in the future (World Economic Forum-2013). However, in all these modes it is the money of the public sector which plays a dominant role. Ways and means would have to be explored to somehow attract private investment capital to the smart cities mission through the medium of the financial markets. In order to finance these projects aimed at improving the living conditions in the modern cities and creating vibrant economies there, it is thus crucial to be able to involve private sources of capital which are potentially much larger pools of finance.

The financial challenges of mopping up resources for implementing smart city initiatives are really mammoth and daunting. It is useful to outline at the very outset the models for urban services that are planned, the baseline projects that are required and their schedules during the development of the land use master plan itself and the requirements in terms of the ICT interventions (Datta -2015). If these models for urban services are clearly outlined in the very beginning it helps the private sector to envision the roadmap for the project. This helps is specifying the key deliverables on the part of each of the various parties

involved. It, in turn, smoothens the process of arriving at service level agreements and contracts with clearly laid out metrics for performance evaluation over multi-year contracts related to operations. Since the projects related to smart cities are huge with complex risks it is imperative that these be shared in the right manner so that the stakeholders are exposed to their desired risk-return profiles. Only then can the business models be sustainable.

Some of the innovative financing mechanisms which can be resorted to, for the execution of the smart cities mission in India are as follows:

- Securitization through structured finance
- Pooled finance development fund
- Public Private Partnership (PPP) models and performance contracts
- Municipal bonds / Sector Specific bonds
- Land use financing

Key Issues in Implementation of Smart City in India

The scale and complexity of the smart city projects are of a different order of magnitude when compared to the conventional ones. These are much larger. Thus the challenges are also commensurably greater. The smart city plans would involve process re-engineering of multi-business processes. It will entail the establishment of world class infrastructure. A few of the challenges are in the execution of the smart cities mission are listed below:

Refurbishing the legacy infrastructure through retrofitting

The development of a strategy for smart city mission would involve visiting many concealed issues. The existing infrastructure which is creaking at the edges will have to be retrofitted with a modern one. The areas which need urgent consideration should be dealt with initially, like 100% sanitation and 24x7 supply of water. The key challenge would be to integrate the isolated mechanisms previously existing into an integrated whole so that efficiencies can be achieved citywide.

Raising finance for smart cities

It is estimated by the high-powered expert committee that over a 20-year period there would be a requirement of Rs.43,386 of per-capita investment cost with regard to the investment requirements in urban infrastructure. On an average, considering a population of 1 million in each of the 100

smart cities, the aggregate investment requirements in all the smart cities put together will work to an astronomical 7 lakh crore in the next 20 years. Thus the annual requirement can be computed to be in the range of Rs.35,000 crore. It is thus crucial to raise these finances for the mission and the methods can be either through entire private investment or through PPPs.

Need to develop master plans

There is an absence of the master plans for the majority of the Indian cities. These are indispensable for the purposes of planning and execution of the smart city mission. The master plans serve as beacons which list all the things that the city has to improve and provide to the inhabitants. The number of cities with such a plan is miniscule

Municipal Constraints

It is anticipated that the crucial limitations in the execution of the mission will surface at the municipal level. The Urban Local Bodies in India are strapped for funds; do not have technical expertise and trained/talented manpower. As a consequence, if these limitations are not addressed immediately, it can lead to defects in implementation, time and cost overruns, poor delivery of services in terms of quality, poor maintenance of infrastructure set up, inappropriate expenditure and investment, inadequate tariff fixation, poor recovery of costs and ultimate failure of the entire project. The financial condition of the majority of the urban local bodies is very weak. In addition, the tariffs charged from the consumers are not at all commensurate with the costs incurred. This mismatch has resulted in the poor financial health of the urban bodies. As a result, they are quite short of the finances required. The existing loss burden would serve as a drag even if the new investments are better managed and recovered gradually. Further, the ULBs lack the technical and managerial expertise to execute the projects in a timely and cost effective manner. It would also be impossible for them to subsequently ensure effective operations and maintenance. They lack adequate manpower due to patchy recruitments over the years. In addition, they could not attract the best available talent because of the inability to offer market-based competitive compensation (Dahlman-2006).

The albatross of the political system

In India, the political establishment is constituted of three tiers – the central, the state and local governments. Urgently required is an efficient and effective communication across the three tiers (both horizontally and vertically) of government institutions responsible for providing municipal amenities. Thus the success of the smart cities venture is contingent on the Central Ministry of Urban Development coordinating with state and local government institutions. They should work together in the areas of raising finances, assimilating and disseminating best practices and sharing the best service delivery processes. Only such an eventuality can ensure the success of the smart cities vision.

Timely Acquisition of Requisite Clearances

One key requirement for the success of the smart cities if the ability to secure the requisite clearances on time. It is necessary to thus put the clearance processes online with the officials being held accountable for any undue delay. One possible option is to have a single window regulatory body for all utility related requirements. This can ensure a level playing field to the private players as well. Also, the tariff determination should be based on commercial considerations so that quality and financial sustainability are achieved.

Provision of reliable utilities

By the very nature of the definition of a smart city it should have a facility of 100% reliable utilities like telephone, electricity, water and broadband. The existing electricity supply and distribution infrastructure in India is incapable of delivering on the promise 24x7 universal electricity access. There is an urgent need for the cities to focus on the renewables. In addition, concerted efforts have to be made in the direction of promoting green transport and green buildings so that the energy requirements are minimized.

Resource Conservation

A smart city is supposed to have the highest levels of energy conservation measures implemented. Thus the residents, visitors, and entrepreneurs of a smart city have to partake actively in the conservation measures. The latest technologies have to be employed for the purpose. Using technology is one way of making sustainable spaces; however, behavioural modifications can also contribute substantially to energy savings.

One instance is by replacing all the bulbs and lights by LEDs. This alone can deliver savings to the tune of nearly Rs.50, 000 crore annually.

Capacity building

It is of utmost importance to have trained and expert manpower to deliver on the ambitious smart city projects. Most of the projects at the center and the state levels are delayed because of lack of capable manpower. The requirement is to at least earmark around 5 percent of the central government contribution to the capacity building initiatives. Thus there should be comprehensive training, building of large-scale databases, research and exchange of knowledge. One unit of money spent on the capacity building can provide manifold returns by way of its multiplier effect. The projects can be completed in a timely fashion. The above impacts of capacity building are only manifested with a time lag and thus this process needs to be started and strengthened at the very beginning.

Conclusion

It has been nearly one year since the launch of the smart city mission in India; however, many cities have yet to witness is full-fledged implementation. In cities where the implementation has been kicked off, the project is still in quite a nascent condition beset with a plethora of challenges. The intention was for the cities where the program has been initially implemented to act as role models for the laggards. The remaining cities have to replicate it in the future. Few cities which have made some headway in this direction are Pune, Bhubaneswar, and Jaipur. In the major cities of Chennai and Delhi, the project management consultant has also not been finalized. At the ground level, the project initiation has not yet taken place. In capital intensive projects like this, time is of utmost significance. Thus the cities which have lacked pace in execution need to understand this and accelerate the work. In the city of Bhopal, there was mass agitation related to the issue of shifting the location of the development area which delayed the process. Guwahati, on the other hand, has faced the issues related to the financial incapability of conducting a project of this magnitude.

To realize its full objective, it is imperative to keep a tab on the progress of the mission and prevent inordinate delays. The existing and potential hindrances have to be quickly

taken care of to ensure smooth progress. In the case of a few cities, the costs have been far in excess. As of now, the average cost of development is Rs.2.2 crore per acre which is far too high. The size of the areas selected by the cities is also quite small. At this rate, when the project scope would be widened to the entire cities and then to the whole country the total level of financial resources required will be unimaginably high. At this juncture, the success of the smart cities mission crucially depends on the ability to keep the costs down by efficient and effective execution of the plans.

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Semiconductor manufacturing in India: A policy review

Tripti Singh*, Alok Agarwal**, Arun Barun***, Deepesh Tiwari****

*****Assistant Professor, *Motilal Nehru National Institute of Technology Allahabad*

*** Motilal Nehru National Institute of Technology*

**** Director, National Institute of Technology Sikkim*

*****Industry Fellow*

Introduction

Semiconductor devices have been at the center of the digital revolution and have been rightly called as "crude oil" of modern era (Graham, 1996). The consumption of semiconductors is expected to grow from US$ 2.8 billion in 2005 to US$ 36 billion by the end of 2015 for various electronic goods.

Inspite of several policy measures by Indian government to initiate semiconductor-manufacturing facility, "Indian semiconductor policy expired without attracting any fab investment" (etimes2008). With two failed attempts and more than a decade later, the government is now readying a third attempt to lure SCM (Semiconductor Manufacturing) firms to India. (Economic Times 2011).

Research Objectives

The identified impediments have motivated the researcher to undertake an in-depth look into SCMI in India and to analyze its strengths, and weaknesses, and to suggest policy for successfully establishing SCMI eco-system in India.

Literature Review

An extensive literature review is carried out for the identified research objectives for the factors that would lead to competitiveness of Indian SCMI. Competitiveness Indices have been developed by reputed International organizations and are widely accepted by researchers, academicians and policy makers alike (Schwab and Porter, 2007; Pillania, 2009), to benchmark the competitiveness of nations, viz Global Competitiveness Index (GCI) of World Economic Forum (WEF), World

Competitiveness Scoreboard (WCS) of International Institute for Management Development (IMD) and Global Manufacturing Competitiveness Index (GMCI) by Deloitte and the U.S. Council on Competitiveness. These indices form the basis for the present research. The GCI and WCS focuses on the key drivers and indicators of competitiveness whereas GMCI measures countries competitiveness in the context of manufacturing. A list of 89 sub-variables grouped into 10 variables have been identified, viz, basic infrastructure, goods market efficiency, institutional framework, higher education & training, business sophistication, entrepreneurship & innovation, technological infrastructure, financial institutions, labor market efficiency and macroeconomic environment.

Policy Review of Indian SCI

The Government programs and policies on infrastructure, software technology parks and imports & exports have led to a dramatic growth of Indian IT industry establishing a competitive edge in software industry (Drozdowski et al, 2007). However, when it comes to the SCI, we see it's a completely neglected sector (Saxenian, 2002). India has a very large base of electronic products but it still imports most of the semiconductors.

The current Indian SCI comprises of semiconductor design, board design and embedded software companies only. SCI is primarily limited to the area of design and lacks in manufacturing, test, package and assembly. With no commercial SCMI, Indian semiconductor design companies get the chips fabricated in Taiwan, China, Singapore and other countries and India's total semiconductor consumption is serviced by imports (ISA, 2008).

According to the Feedback Study, 2008, of Indian Semiconductor Association (ISA), across the value chain of semiconductor industry, the core strength of India remains in semiconductor design, while other aspects are absent. This is an important inference because it further provides a direction for competitiveness of Indian SCMI.In 1990; Department of Electronics (DoE) introduced Software Technology Parks (STP) focusing on reliable power, better basic & telecommunication infrastructure. In 1991, new industrial policy (NIP) permitted foreign direct investment (FDI) in all sectors. The government's focus and a host of supporting policies established India's competitiveness in the software industry. In 1998, the Special Manpower Development Program (SMDP)-I was started to address the growing need of quality of skilled human resources in the

area of VLSI Design and related software, followed by SMDP II in 2005. SMDP-I & II helped in building a skilled human resource pool enabling the VLSI design industry to germinate and grow rapidly.

It was an effort of Department of IT, to provide top tier educational institutions with the facilities to acquire relevant knowledge and skills The SMDP program has been has been successful in addressing the target numbers of various types of manpower. In 2006 when Intel initiated to setup a semiconductor fab in India due to lack of semiconductor policy and a well-documented plan, it was forced to leave India and establish its $2.5 billion fab in China. In March'2007, Semiconductor policy of India was notified, providing capital subsidy to the investors for setting up chip manufacturing units in India. The government expected to attract an investment of Rs 24,000 crore (Rs 240 billion) in the next three years. Further in Sept'2007, special incentive package was announced to attract investments for setting up fabrication and other micro and nanotechnology manufacturing industries. In 2010, this policy expired without attracting any fab investment. In 2012, a new policy for Electronics System Design manufacturing aka National Policy on Electronics 2012 was introduced to attract investments and to create a globally competitive electronics design and manufacturing industry. This umbrella policy included various aspects of SCM, wafers, fabs, assembly, test and packaging. Most of the strategies in this policy were focused in development of Electronics manufacturing in India.

The review of the policies of Indian Government, clearly suggests that it is in a very nascent stage and the major concentration lies on electronics industry as a whole. The government instead of acting as a pivot is just framing policies. India needs to be competitive at all stages of value chain in the industry. The development of a comprehensive eco-system consisting of major stakeholders needs to be duly established. These issues will be further studied and validated to suggest policy for competitiveness of India in the context of SCMI.

Research methodology

Two rounds of Delphi method of survey is used to gauge the perception of expert panel on the identified variables to assess the competitiveness variables (with high, medium, low impact), for India in the context of SCMI. The panel consisted of 14 members viz: 4 policy planners, 4 academicians and 6 experts from the industry.

After two successful rounds of Delphi survey, 33 sub-variables achieved consensus as high impact sub-variables, 25 with medium impact and 16 low impact variables. These were further ranked by the expert panel to indicate the position of India (out of scale of 10) vis-à-vis other countries. Those variables that ranked higher than 7 were taken as strengths for India and those ranked below 7 were identified as weaknesses and challenges for Indian SCMI as shown in Table 1. India s Rank vis-a-is other countries

Table 1; India s Rank vis-a-vis other countries (Source: Delphi Survey)

Variables	Sub-Variables	Average Marks	S/W
Basic Infrastructure	Maintenance & development	3.36	W
	Ongoing investment in infrastructure	4.21	W
	Cost & quality of water supply	5.57	W
	Cost & quality of electricity supply	5.64	W
	Ports transport infrastructure	7.43	S
	Air transport infrastructure	7.43	S
Goods market efficiency	Custom procedures	5.29	W
	Trade barriers (imports & exports)	5.43	W
	Domestic market size	7.50	S
	Market size for consumer goods	8.86	S
Institutional Framework	Intellectual property rights	4.07	W
	Government investment in science & technology	4.36	W
	Tax & Other incentives	5.00	W
	Pace of economic development	6.71	W
Higher Education & Training	Availability of specialized training	4.43	W
	Quality of technical education	6.21	W
	Availability of scientist & researchers	7.50	S
	Availability of Qualified engineers	8.07	S
Business sophistication	State of cluster / ecosystem	3.79	W
	Production process sophistication	4.86	W
	Proximity with consumers	8.21	S
	Value chain breadth	8.36	S
Entrepreneurship & Innovation	Patents productivity	4.29	W
	Quality of research institutions	4.50	W
	Total expenditure on R&D	4.57	W
	Capacity for innovation	7.71	S
Technological Infrastructure	Technology transfer	4.43	W
	Ongoing Investment in telecom infrastructure	5.14	W

	Access & use of latest technologies	5.36	W
Financial Institutions	Foreign Direct Investment (FDI)	4.21	W
	Venture capital availability	4.57	W
	Rules of capital flow	5.14	W
Labor market efficiency	International experience	7.64	S

These formed the basis for giving policy recommendation for the identified industry.

Policy Recommendations

The thorough analysis of the competitiveness of SCMI in India, suggest active involvement of the Government along with the corresponding policy measures. Two parallel approaches is suggested. The Government on one hand has to be actively involved through its ownership and then on the other hand, adopt various policy initiatives for growth and to enhance technological leadership in the SCMI.

Government Ownership and Capital Investment

The current international competitive environment requires Government to play a crucial role in stimulating the economy and aiming at strategies for a long-term value with active ownership.

Collaboration for Importing Technology, its Diffusion and R & D development

Initially India can pace up by importing the SCM technology through collaborations, because its development is time consuming. It is not advisable to invest in a state-of-art technology due to cost concerns but it is important to invest in mature technology.

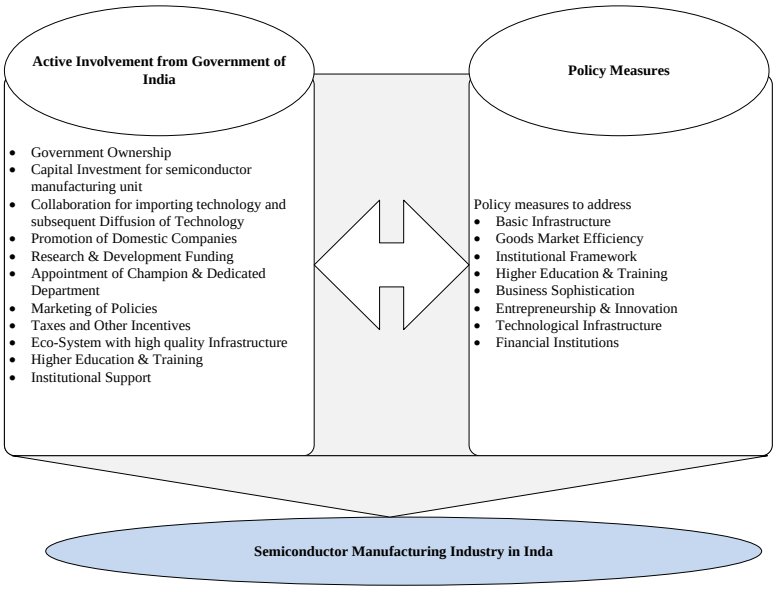

Figure 1: Policy Recommendations

The Government should felicitate and promote technology-licensing agreements and technology-purchase agreements with MNC have to push the entry of the new companies. After the initial investment, the diffusion of the technology to other public and private sector domestic companies is required.

A regular R&D funding allocation and dedicated research institutions are needed for success of the SCMI. Establishment of Incubation/Innovation centers with collaboration from the industry would ensure commercialization of the innovations.

Support for Domestic Companies

The procurement of indigenous products in Government projects should be done to encourage the domestic players & with limited imports. The Government can also limit foreign penetration of domestic market, where significant international competition exists, and neutralizing foreign competition. However, this should be for a limited time frame and will help to secure a strong base, promote export and competitiveness in international market.

Government needs to needs to set up a task force to study the investment incentives offered by various competing countries and propose or better fiscal measures to lure investment in SCM Eco-System with High Quality Infrastructurewith round the clock, quality and cost effective, electricity and water supply. These technology parks can be augmented by forward and backward linkages and locating semiconductor design,

electronics manufacturing and other related industries in the same vicinity.

This will help in lower logistics costs, better supply chain linkages, operational efficiencies & effectiveness and easy access to technology. The knowledge transfer from research institutions to industry is also critical, and can be taken care by locating research institutions in the close proximity of these companies. There are numerous evidences that such ecosystems have helped SCMI in other countries as well.

Dedicated Department

There is a need for appointment of champion and dedicated department explicitly for the promotion of SCMI in India. These departments should have a board of advisers from academia, industry and other stakeholders including expatriates who have experience in SCM which will be a single point of contact for any clearances for setting up of the SCMI leading to ease of doing business, reduce delays in regulatory approvals and thus will attract investment.

Marketing of Policies

The industry experts have unanimously voiced their views about marketing of these policies. There is an awareness deficit and very less is known about the existence of these policies & its incentives. In order to compete with other Asian countries like China and Taiwan for investments, an aggressive marketing of policies s needed. The recent "Make in India" promotion is an example of what is being recommended.

Higher Education & Training

India needs to improve on the quality of technical education through industry participation, particularly in a periodic curriculum review. The Government should also invest in specialized training for the diffusion of technology to public and private sector. Indian Government's vision for developing technical manpower using SMDP I & II programs resulted in India having a sufficient base of skilled resources for the semiconductor design industry.

Dedicated training institutions of global standards should be setup with collaboration with the premier technical research institutions which is lacking in the current scenario.

Concluding Remarks

The present policy recommendations will help the planners to address these variables and sub-variables & strengthen the competitiveness of SCMI in India. In the words of Ajay Kumar, Jt. Secretary, Department of IT in ISA Summit 2011,

'Time has come to demonstrate our leadership position by building our own capabilities in IC design, IC fabrication and design & manufacturing of electronics products'.

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Smart mobility challenges for India's smart cities.

Rakesh Kulshreshtha*, Dr. Anil Kumar **, Dr.Ashish Tripathi ***

Dinesh Kumar Likhi ****

**Research Scholar, University of Petroleum & Energy Studies*

***Professor .,CoMES, University of Petroleum and Energy Studies*

****Associate. Professor, CoMES, University Of Petroleum and Energy Studies*

*****Chairman & Managing Director, MishraDhatu Nigam Ltd, Hyderabad, India.*

Abstract

In line with the growing urbanisation trend and recognising that cities are critical to India's future, Government of India has taken an initiative to develop 100 smart cities. In order for a city to be liveable and productive, it is necessary to provide efficient, affordable and environment friendly mobility to people. Share of public transport in India is only 22 percent. Inadequate public transport and growth of private vehicles has resulted in extreme congestion, long commute times, choking air pollution and deadly traffic accidents. A few cities have introduced bus rapid transit corridors and a number of them are constructing metro systems to improve public transport. Smart city initiative has brought into focus passenger and environment friendly mobility solutions including non-motorised transport and intelligent traffic management systems (ITS).

The paper reviews smart city initiative launched by Indian government and tracks the journey of Singapore in developing one of the best integrated traffic management systems in the world. Singapore provides a perfect example of transition from a problem driven transport planning to a vision driven planning. It has established an example of how, by adopting an integrated approach to transport, it is possible to achieve easy mobility without compromising quality in urban living. The lessons that can be learnt from the Singapore experience by Indian aspiring smart cities have been brought out.

An analysis of the smart mobility solutions included in smart city portfolio by the twenty cities selected in the smart city challenge round one shows that Indian

cities are following the strategy of avoid (unnecessary generation of vehicles kilometres), shift (traffic from private vehicles to public transport and NMT) and improve (public transport and traffic management) for cleaner, efficient mobility. Majority of smart city proposals of the sixty cities selected so far are based on area development. While aiming for integration of land use and transport planning, due attention has been given to NMT and intelligent traffic management (ITS) with ITS being proposed as pan city solution by some of the cities.

Based on the facts and figures and case study of Singapore integrated traffic management system, the paper infers that urban transport planning has to take into consideration land use, energy conservation, and last mile connectivity. A new paradigm of urban mobility reflected in smart city portfolios of some of the cities which focus on walkable corridors, restriction of motor vehicles and preservation of heritage can be a path bearer to other cities for tackling the chaotic traffic situation on their roads. Models selected by these cities will show other aspiring smart cities a sustainable, environment friendly path to develop a city with a reliable and affordable public transport and at the same time leaving enough space for people rather than vehicles occupying most of the space. While the impact and extent of these initiatives in improving urban mobility is a subject of further study, successful implementation even in a few cases can be truly transformational for India's cities.

Keywords: Smart City, Public Transport, Urban mobility, Intelligent Traffic Management System

Introduction

This paper attempts to review the smart city roll out by government of India in the context of urban mobility challenges faced by Indian cities. The role of urban mobility in urbanization strategy has been explored through literature survey and case study of Singapore in successfully developing an integrated sustainable transport system. Mobility solutions proposed by the twenty smart cities selected in the first smart city challenge have been highlighted.

World over cities have proved to be the nuclei of growth for a nation's economy. Since trend for urbanization is growing, the developing economies are focusing on creating a conducive environment for economic activities, employment generation and for improving the quality and standard of urban services to make its cities more livable and productive.

As per census 2011, there are 53 million plus cities up from 35 in 2011 accounting for about 43 per cent of India's urban population and there will be 87 such cities by 2031. Class-I cities with population over 3 lac accounted for about 56 per cent of the urban population and cities with a population ranging from 1 lac to 3 lac accounted for another 14 per cent while 15% of the population lives in megacities (>8 million).

The population is expected to grow at the rate of 1.8-1.5% per annum by 2030. Therefore, the estimated population of India by 2040 will be in the range of 1.5-1.7 billion. (Tiwari, 2011) In view of the nature of urbanization challenges facing India, Ministry of Urban Development set up High Powered Expert Committee (HPEC) for estimating the investment requirement for urban infrastructure services in India. The Committee's projections suggest that India's urban population as presently defined will be close to 600 million by 2031, more than double that in 2001. (HPEC, 2011)

Government of India as an urbanization strategy announced a plan to develop 100 smart cities. A carefully planned city will attract investments, create jobs, have strong infrastructure, and most importantly, enhance the standard of living of its citizens. As per Census 2011, 31% of India's current urban population contributes 63% of India's GDP. As the urban population continues to rise the contribution of urban areas to India's GDP may go up to 70 to 75% by 2030. (MoUD, 2015)

The objective of smart city mission is to promote cities that provide core infrastructure and give a decent quality of life to its citizens with a clean and sustainable environment. A comprehensive development of infrastructural, institutional, social and economic growth constitutes the major part of sustainable development and this can be achieved by integrating the city development plans to suit the requirements of the urban dwellers, and technology plays a major role in this integration. To adequately leverage agglomeration economies, India needs to focus on livable and productive cities. Managing the urbanization process, augmenting the capacity and improving the standards of urban services for a higher livability quotient of cities is likely to be the single biggest challenge for the Indian Governments and its urban local bodies over the next decade.

Smart mobility and access to public transit are essential for success in development of a smart city. Urban transportation systems significantly affect cities' quality of life. Smart city aspirants need to formulate

transport policies which promote cleaner, more efficient public transport systems in order to reduce congestion and minimize travel times. Measures to address negative externalities such as road traffic injuries and death and greenhouse gas emissions and local air pollutants must be part of city's transport planning. Sustainable urban transport can have measurable positive impacts and externalities, but in order to realize its full potential to transform cities into smart cities, a transport project must be planned, implemented and operated effectively. Hundred Indian cities which participated in smart city challenge have attempted to more or less address the urban mobility issue along with host of other infrastructure issues albeit on a small scale. Urban mobility has figured prominently in the smart city portfolio projected by the twenty cities which won the challenge round and became eligible for Central assistance during this financial year. As these cities are expected to showcase replicable models and act as light house to other aspiring cities, it is expected that smart mobility solutions, once implemented in these cities, will change the face of urban mobility in India.

What is a Smart City?

The Business Dictionary defines smart city as " A smart city is a developed urban area that creates sustainable economic development and high quality of life by excelling in multiple key areas; economy, mobility, environment, quality of life and governance through strong human capital, social capital, clean technologies and ICT framework". While acknowledging that there can be no single definition of a smart city and that a smart city will have different connotations in European context and Indian context, the Government of India smart city mission guidelines state "in the imagination of any city dweller in India, the picture of a smart city contains a wish list of infrastructure and services that describes his or her level of aspiration. To provide for the aspirations and needs of the citizens, urban planners ideally aim at developing the entire urban eco-system, which is represented by the four pillars of comprehensive development — institutional, physical, social and economic infrastructure. This can be a long term goal and cities can work towards developing such comprehensive infrastructure incrementally, adding on layers of smartness".(MoUD, 2015)

An integrated smart city framework consists of the following key enablers (Deloitte, 2015):

- Smart People: Includes a culture of life-long learning, social and ethnic

diversity, flexibility, creativity, and community participation. .

- Smart Economy: Includes entrepreneurship and productivity, economic progression, flexibility in the labor market, and an overall culture of innovation.
- Smart Governance: Includes the involvement of the public in decision making, public and social service, and government transparency.
- Smart Mobility: Includes local and national accessibility, safe and sustainable transportation systems, and access to ICT-infrastructure.
- Smart Environment: Includes attracting natural conditions, reduction in pollution, and increase in environmental protection, and sustainable resource management.
- Smart Living : Includes cultural and educational facilities, quality health conditions and public safety, accessibility to quality housing, tourist attractions, and social integration

A Smart City inherently comprises multi-disciplinary elements, and there is a need for an anchor to integrate the different elements instead of each element being implemented in a piecemeal manner.A non-integrated approach significantly impacts the efficiency of the smart city concepts

Smart city project can be splitted into three components, basic infrastructure such as water pipelines, network level sensors to monitor water flow and prevent leakage such as through supervisory control and data acquisition tools (SCADA), and infotech solutions for data mining. If data collected through a SCADA system can be integrated through a back end ICT solution with customer / stakeholder feedback collected through other sources like social media, service delivery call centres, websites, etc. and a set of automated responses can be generated, we achieve a complete smart water solution.(Deloitte, 2015)

India's Smart City Initiative

Indian government in June,2015 announced Smart city Mission guidelines which define the process and a framework for selection of 20 cities through a two-pronged competition. In the first round 100 cities were selected (97 proposals were finally received) The competition is based on points given for a city's vision, proposal, financing ability, cost effectiveness of a project, innovation and so on.

While a public-private participation model will be the backbone for resource mobilisation, the project will be operated through 50-50 special purpose vehicles(SPVs) between states and urban

local bodies. To avoid delays states and union territories will be required to indicate resource tie-ups under state-level action plans.

The core infrastructure elements in a smart city would include adequate water supply, assured electricity supply, sanitation, including solid waste management, efficient urban mobility and public transport, affordable housing, especially for the poor, robust IT connectivity and digitalization, good governance, especially e-Governance and citizen participation, sustainable environment, safety and security of citizens, particularly women, children and the elderly, and health and education. The idea is that cities are encouraged to provide core infrastructure and innovate in the application of 'smart' solutions to give a decent quality of life to its citizens. The focus is on clean, sustainable and inclusive development. Through such exercise pockets of urban compact areas would be rejuvenated, replicable models will be created which will serve as best practices to be adopted by other aspiring cities.

The mission guidelines issued by Government of India have highlighted following features of comprehensive development in smart cities (MoUD, 2015) :

- Selection of an area for development through mixed land use.
- Housing for all specially for economically weaker sections
- Transit oriented developments to reduce travel trips by creating walkable localities. Promoting local economy. Refurbishing road network giving due consideration to non-motorized transport. and making available necessary administrative services within walking or cycling distance;
- Offering a choice of multi-modal transport options. Improving public transport and last mile connectivity;
- Promoting eco-balance through green belts, leaving adequate open spaces for children parks etc. for a good quality of urban life.
- Enhancing transparency and efficiency in governance through e-governance and making it citizen-friendly and cost effective. Offering municipal services on mobiles, creating e-groups for enhancing awareness and for feedback
- Finding an identity to the city based on its main economic activity, such as local cuisine, health, education, arts and craft, culture, sports goods, furniture, hosiery, textile, dairy, etc;
- Improving infrastructure and urban services in area-based development through application of smart solutions.

The mission which will cover 100 cities provide flexibility of designing schemes based on the needs of identified cities. States will only submit state annual action plans to the centre for broad concurrence based on which funds will be released. The Centre's role will be that of a facilitator and hand holding. An outlay of Rs.48, 000 crore and Rs.50, 000 crore for the smart cities mission and Atal Mission for Rejuvenation and Urban Transformation (AMRUT) respectively by GoI will see over Rs. 2 lac crore flowing into urban areas over the next five years (2015-16 – 2019-20). It is expected that states and urban local bodies would mobilise matching resources through monetising land assets, user charges, municipal taxes etc. Substantial private investments would be mobilized additionally by states and urban local bodies through PPP model as required to meet project costs.

In Jan,2016 the result of challenge round has been announced naming the 20 cities that have become eligible for central assistance this financial year. Subsequently the list was expanded, 13 cities in second list and 27 cities in third list bringing the total to 60. A total investment of Rs.1,44,742 Cr has been proposed by the 60 cities selected so far. Now that, these cities have made it to the list of smart cities, the next stage of making them smart has to kick in.

For smart city proposal choice was given to cities to base their proposal either on a retrofitting or redevelopment of an existing urban area and/or a Greenfield development. In addition, each city was to include in its proposal a smart solution to existing infrastructure issue a for pan-city deployment. For retrofitting a minimum area of 500 acres, for redevelopment a replacement of the existing built-up area of more than 50 acres were to be identified by urban local bodies (ULBs) in consultation with citizens. It was expected that more intensive infrastructure service levels and a large number of smart applications will be packed into the retrofitted Smart City. For redevelopment, it was envisaged that a new layout plan will be developed with relaxation in land use, higher floor area ratio etc in consultation with stakeholders. An example of the redevelopment model is the Bhendi Bazaar Project developed by the SaifeeBurhani Trust in Mumbai. The rebuilding and renovation of government quarters by redeveloping the entire area belonging to government in East Kidwai Nagar in New Delhi by National Building Construction Company is another example of redevelopment.

For green field development a vacant area of more than 250 acres 250 acres around city was to be identified. It was expected that a proposal for green field development will consider land pooling, innovative financing and other planning tools while providing for affordable housing including for economically weaker section. An example of green field development is Gujrat International Financial Tech City (GIFT) City being developed between Ahmedabad and Gandhinagar.

Pan-city solution under a smart city development proposal envisaged that a smart solution to an existing infrastructure bottleneck will be proposed for city-wide application. Such a smart solutions will demonstrate the use of technology, information and data to provide a solution to an infrastructure problem and to improve urban services. For example, any transport solution which reduces trip length and average time spent by citizens while keeping costs within affordable limits can greatly improve productivity and quality of urban life. Another example can be improving water management in a city through rain harvesting, waste water recycling and reducing non metered water. The aim would be to employ smart technologies across city wide systems that could bring the smart 30% through targeted investments. (MoUD, 2015)

Why Smart Urban Mobility is essential for a Smart City

Smart mobility is not to provide mobility to vehicles but to people. Urban planners have to design an integrated seamless transport system that allows people a convenient, safe and affordable means to access offices, colleges, hospitals, theatres and other places. However, often such access is accompanied by negative externalities, such as vehicle emissions, road accidents, and traffic jams. The challenge for a smart city, then, is minimize these externalities while planning for improved access.

Based on the response of 522 stakeholders in 25 cities across world as to what is the most serious challenge facing cities infrastructure, a Siemens sponsored research project concluded that transportation is the most serious challenge facing city's infrastructure across cities of the world. There is also a general consensus of largest proportion of 85% of the population which put investment requirements in coming 5-10 years highest in transportation sector with transportation ranked much higher above housing, water, healthcare, environment etc. (GlobeScan, 2007)

Arthur D Little analysed the mobility performance of 66 cities and found that most not just falling well short

of best practices but in a state of crisis. As per author it would not be putting it too strongly to say that many cities mobility systems are standing on a burning platform and if action is not taken in the very near future they will play a major role in slowing down the growth and development of their host nations. (Little, 2011)

Rudyard Kipling wrote that "transport is civilization" but today's transport policies deliver the opposite of a civilized quality of life. Cities are sprawling with the 'haves' escaping to areas with better living conditions and the 'have nots'trapped and increasingly marginalized. (ADB, 2009)

Global future urban mobility scenario would be characterized by the following key changes (IEA, 2012):

- Passenger travel distance to double by 2050 — over 70 trillion kms per year
- Per capita commuting delay to double by 2050 to over 100 hours per year
- Urban transport energy consumption worldwide will increase by 30% reaching 890 million tons oil equivalent per year in 2025.
- Oil-based fuels will still make above 95% of the energy mix.
- GHG emissions from urban transport will increase by 30% reaching 3 billion tons CO2 equivalent per year in 2025, in total contradiction with efforts to limit global warming to 2 C°.
- The number of urban traffic fatalities will increase by 30%.
- Reaching 500,000 deaths per year in 2025.

Transportation is also one of the most significant contributors to climate change, accounting for 25 percent of global emissions (IEA, 2012).

It has also been observed that as the income level increases the number of motorized trips of the people also increases. So the general growth of economy worldwide is only going to add to the woes of urban motorized transportation. It is, therefore, necessary that both rich and poor nations gear up to challenges in meeting urban transportation requirements.

As cities develop and expand, one of their priorities is to ensure that their spatial footprint is supported by a strong public transport network. Providing public transport is more expensive than building roads, but public transport and individual transport are imperfect substitutes. (WB & ADB, 2012). In densely populated and congested Indian cities, public transportation is not only necessary for common citizens from affordability point of view and with nil or little additional cost there could be substantial

environment benefits. Public transportation includes buses, metro, mono or light rail, trams, bus rapid transit corridors or standard bus services.

Table 1: Strategy of Avoid, Shift and Improve for Urban Transportation Sector.

Strategy	Developing Countries in Asia and the Pacific
Avoid	Avoid unnecessary generation of Vehicle Kilometres (VKM) through integration of land use and transport planning. Develop new urban areas around transit corridors (Transit Oriented Development)
Shift	Enable conditions for the lowest-emitting modes (both freight and passenger). Prevent shift from NMT (such as walking and cycling) and public transport (such as buses, rickshaws etc.) to private vehicles via improving the quality of public transport including paratransit.
Improve	Ensure future vehicles / fuels are cleaner, encouraging small efficient vehicles (including 2 wheelers which are used frequently in Asian countries). Design innovations for traditional NMT such as cycle rickshaws.

Table 1 gives avoid shift and improve strategies in developed vs. developing countries as suggested by Energy Technology Perspective and can serve as guidelines to India's aspiring smart cities.(ETP2012)

The sketch shown in Figure 1 represents an ideal urban transportation system which can serve as guidelines for a smart city-clean, green, sustainable and affordable. The emphasis is on integrated multi-modal transport system, passenger friendly online information sharing, smart parking, non-motorised transport, integrated fare management etc.

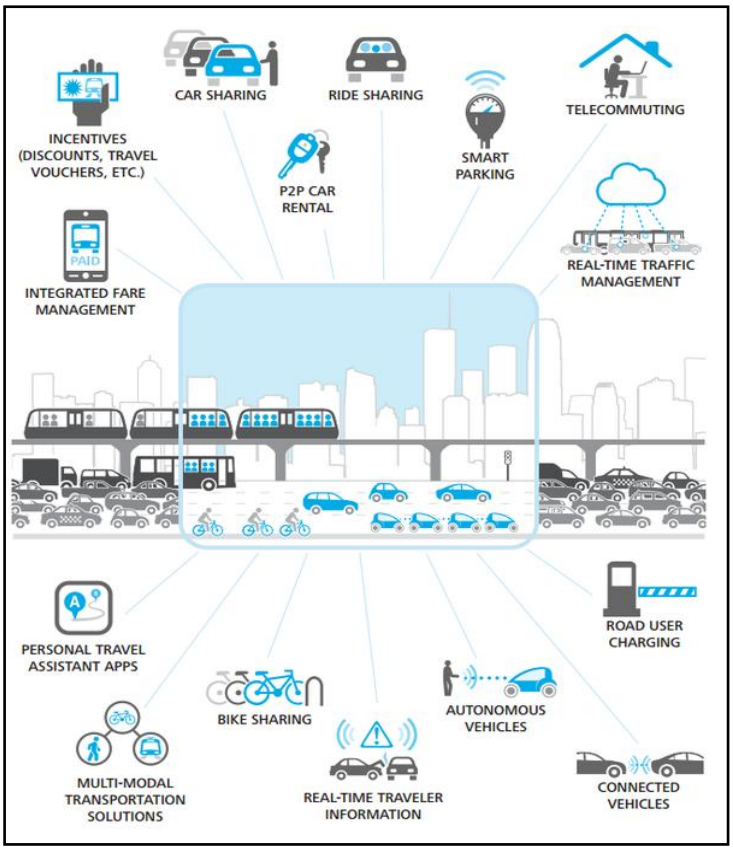

Figure 1: Ideal Urban Transportation System (Source: IEA 2012)

Indian Urban Mobility Scenario

In Mumbai, Delhi, and Kolkata or for that matter any mega-city in the developing world, the problems are the same. Transportation in mega-cities with population of 10 million or more is in a state of crisis. Extreme congestion, long commute times, choking air pollution, deadly traffic accidents, and inadequate public transport are the norm. Recently, the problem got national attention when Delhi government introduced 'Odd-Even scheme' on a trial basis to tackle deteriorating air quality and unmanageable traffic jams. Long hours spent in commuting add to enormous losses in economic productivity. Air and noise pollution severely impact health and quality of life. The poor lack affordable or comfortable means of mobility.

Urban transport sector is a state subject in India. In absence of any guidelines, investments are distributed and not coordinated. The focus so far has been mainly into increasing road space or shifting congestion.

As per working group on Urban Transportation for 112th FYP, "the present scene of urban transport across India is categorized by sprawling cities; declining share of public transport and non-motorized transport; focus on supply side

yet with low investments; sheer neglect of pedestrians, cyclists and public transport users; and increased motorization leading to pollution and high road fatalities/injuries. The problem is getting further aggravated by multiplicity of authorities/departments involved in urban transport often with conflicting agenda as well as a lack of understanding of the authorities as well as public of various issues relating to urban transport. Such a scenario is neither desirable nor sustainable even for the present and needs to be proactively reversed on urgent basis." (WG 12th FYP, 2011).

Public transport accounts for only 22 percent of urban transport in India. In comparison other lower and middle-income countries it ranges between 40-49%. Instead of improvement, the share of public transport shows declining trends in most of the cities. Since the frequency and quality of available public transport is far from satisfactory, only poor people with no other alternative travel by public transport. In India, out of 423 Class I cities, only 65 have a formal city bus service as of 2012 and that too owing to the intervention of the Central Government through the program of funding of buses for city transport. In 2006, formal bus service was available only in 20 cities. (HPEC, 2011) The present backlog in service level in Urban Transportation has been calculated by HPEC as given in Table 2.

Under Urban Infrastructure and Governance (UIG) component of JNNURM, 15,260 low-floor and semi–low-floor buses enabled with intelligent transport system were sanctioned to 65 Mission cities with admissible central assistance of 2,089 crore (JNNURM,2014). As a result of the scheme, 34 cities across India have organized city bus services for the first time. (HPEC, 2011)

The high powered expert committee has estimated that Rs 30,00,000crores will

Table 2: Service Backlog in Urban Transport.

Service Backlog in Urban transport			
City Size Class	**Population Size**	**Rail Based MRTS**	**Road Based MRTS**
IA	>5 M	80%	100%
IB	1-5 M	80%	100%

have to be spent on Urban Infrastructure during next 20 years and relative share of urban transportation of infrastructure spending would be 14.5 % i.e. 4,50,000 crore. (HPEC, 2011)

To meet urban demand India needs to pave roads to the tune of 19000 to 25000 Kms per year equal to what it built during last decade and build 350 to 400 kilometres of metros and subways more than 20 times the capacity built by India in the past decade (Mckinsey, 2010). Working group on urban transportation for 12th FYP has projected a capital expenditure of Rs 388,000 crore. Other recommendations include introduction of organized city bus service in all cities having population in excess of two lac; building of BRTS corridors and metro projects in cities having more than one million population. While advocating suburban rail services in cities with four million or more population it states that cities having more than two million population should start planning metro projects and construction should start in cities having more than three million population. As per working group India should add 50 kilo meters of metro rail in existing mega cities at the rate of ten kilometres a year. (WG 12th FYP, 2011)

As per a report by MoUD, desirable modal split for transport in various classes of Indian cities should be as shown in Table 3. India has grown rapidly in the past and this has necessitated development of efficient public transport services. Not only such services should be able to carry high volumes of passengers but they should be designed considering operation in densely populated, congested urban areas. These figures indicate a huge gap in the present scenario and the target percentage share of mobility aimed with public transportation in India.

Table 3 :Desirable Modal Split for Indian Cities (as a % of Total Trips)

City Population (In millions)	**Mass Transport**	**Bicycle**	**Other Modes**
0.1 - 0.5	30 -40	30 – 40	25 – 35
0.5-1.0	40 – 50	25- 35	20 -30
1.0- 2.0	50 – 60	20 – 30	15 – 25
2.0 - 5.0	60 – 70	15 – 25	10 – 20
5.0 +	70 – 85	15 – 20	10 – 15

Urgent action in implementation of urban transportation systems is required by civic institution agencies duly backed up by State/Central Government and research /planning bodies to solve the transportation problems being faced in cities. Smart city initiative has provided a framework for addressing key issues of urban infrastructure including that of public transport.

Singapore Smart City: Successful Integrated Urban Transport Planning

Juniper Research gave rankings to top five smart cities of the world based on analysis of each city's 'smart' capabilities, using metrics such as use of smart grids, smart mobility and smart street lighting, breadth of technology deployment in design of smart solutions and social harmony among others. While Barcelona was adjudged the top smart city of 2015, Singapore which is an example of vision driven smart public transport system found a place among top five smart cities of the world. (Juniper, 2015)

Singapore made great economic progress and emerged from one facing serious problems of survival on account of socio-economic problems to becoming one of the Asian economic tigers within less than 30 years of independence. The city today is a metropolis thriving with urban life.

Singapore provides a perfect example of transition from a problem driven transport planning to a vision driven planning. It has established an example of how, by adopting an integrated approach to transport, it is possible to achieve easy mobility without compromising quality in urban living.

Singapore government realized early that addressing transport supply and demand deficit is essential for the overall development of Singapore. It focused on the land use developments along designated corridors and built a comprehensive network of expressways and arterial roads to facilitate transportation between zones of high traffic generation. This was supported by a mass rapid transit system encircling the central portion of the island as well as airport.

However, easy accessibility and good roads providing fast mobility led to proliferation of number of private cars. Social status symbol attached to owning a car and inadequacy of the public transport contributed to this trend. Since the limited amount of land is available in the island city, fiscal measures were taken to curb the

growth in vehicle population such as increase in taxes on use of cars in the form of higher import duty, additional registration fees, road tax and petrol tax. Other measures to reduce traffic congestion included area licensing scheme, reserved bus lanes and computer control to coordinate the traffic signals.

In order to fulfill the need for a mass transit system to cater for future demand the Singapore mass rapid transit ltd was set up as a private company in 1987 which worked on augmenting the metro network in city. A land transport authority (LTA) was constituted in 1995 with the purpose of bringing together the various organizations involved in planning, development and management of land transport policies and infrastructure into one central and coordinated body to facilitate integrated planning and development. (Chia, 2014)

Today Singapore presents a successful model for a vision driven urban transport planning. The two broad transport strategies adopted by LTA are integrated transport system and a "constellation concept" strategy.

Singapore integrated transport system ensures seamless travel from origin to destination minimizing number and length of trips. Apart from network integration, the system offers fare integration, information integration and physical integration.

The system was integrated with land use plan and four regional centers were planned to decentralize commercial activities to relieve the congestion in the city centre and to have more uniform spatial distribution of traffic as well coupled with reduction in trip lengths. The pedestrian network for the new Downtown, underground walkways, covered ground-level walkways, interconnected second-storey pedestrian links and travellators providing connectivity to MRT stations in the downtown area are examples of seamless transportation system. (Sun, 2013)

There are lessons that can be learnt from the Singapore experience by Indian aspiring smart cities planning for smart mobility solutions:

- There should be political will to solve the transport problems supported by sound institutional and governance structures.
- Transport planning to provide a safe, efficient, affordable and environment friendly mobility of people not just vehicles
- A right mix of managing transport supply and demand, transit oriented development.

- Stakeholder engagement for formulating generally acceptable and consistent transport policies with a long-term perspective and flexible approach to anticipate change and introduce new measures.
- Integrated planning with land use involving all levels of administration for effective monitoring of plan implementations.

How Aspiring India's Smart Cities are tackling Urban Mobility Challenges.

Government of India's guidelines for smart cities provided for stakeholder consultation for smart city development plan. All cities which participated in the first round conducted opinion survey among its citizens to identify the pain areas. A glance at the main features of city development plans for the twenty cities that made it to the winning round, show that lack of public transport and waste management figured as the most painful areas identified by the citizens. Accordingly improving mobility figure predominantly in the smart city portfolio of almost all the twenty cities

On examination of city development plans of the selected cities, it is heartening to find not only creation of additional pedestrian zones but also promotion of non motorised traffic; cycling, bike sharing or e-rickshaws in a large number of cities e.g. Bhubaneswar, Bilaspur, Ludhiana, Moradabad, Ranchi, Tiruchirapalli and Vadodara. In Ludhiana, city enagement process revealed pollution as a major pain area resulting in choosing "Ludhiana: the clean and green bicycle capital" as the smart city theme. The city has included a plan to develop bicycle tracks and public bike sharing stations.

Cities were allowed the purchase of buses and other means to augment public transportation under area based development. However, improving public transport through bus or rail based mass transit system on 500 acres, the maximum stipulated area under area development, is not practical. This resulted in very few cities such as Surat or Tiruchirapalli to include Bus Rapid Transport or feeder buses under their area development plans. Bhubneshwar, where the city's population voted urban mobility as the top most challenge, is planning to triple its existing fleet of 150 buses through its own funds to be able to provide bus services at 5' interval. Many cities are planning procurement of buses to augment public transport under the Atal Mission for Rejuvenation and Urban Transformation (AMRUT), while keeping technology enablement of mobility systems under smart city mission.

Table 4 presents a summary of how the twenty cities declared winners in the first round have addressed urban mobility. Almost all cities have presented, as pan city initiative, an ICT based traffic management system to improve efficiency of public transport by

Table 4 : How winners of India's First Smart City Challenge are working for Smart Mobility

City	Smart mobility solution proposed under area based development	Smart mobility solution under Pan city initiative
Ahmedabad		Creating an integrated transit management platform with a common card payment system
Belagavi		ICT based solutions for improving mobility
Bhopal		
Bhubneshwar		Integrated city operations system including traffic management
Chennai		ICT based solutions to improve public transport network
Coimbatore		Improving traffic management system including CCTV surveillance
Devanagere		Improving Public transport through ICT based solutions
Guwahati		ICT based solutions for improving traffic management
Indore		Intelligent Transport System
Jabalpur		Setting up intelligent transport system
Jaipur		Improving mobility through ICT based solutions
Kakinada	Pedestrian Facilities & NMT Facilities • Bicycle and Bicycle stations • smart signalization Junction improvement • Elevated sky	

	walk • Smart bus shelters with e-toilets • Redevelopment of bus terminus	
Kochi	Integrated Water Transport project between Fort Kochi and Central City Area.	Integrated Smart card and Kochi App integrated multi modal transport system comprising of metro under construction, bus and ferry services
Ludhiana		GPS enabled e-rickshaws to replace diesel auto rickshaws
New Delhi	To make Cannaught Place area no vehicle zone	
Pune		ICT based solutions for improving mobility
Solapur		
Surat		Improving transport & connectivity through citizen friendly measures
Udaipur	Heritage walk, Battery operated vehicle for tourists	ICT based solutions for improving mobility
Visakhapatnam	Bicycle Super Highway along Beach Road. Solar powered Bus stops with LED display. Rent a bike from bus stop. Efficient street network connecting all public places from nearest transport node Restriction on Use of Auto Rickshaws	

reducing transaction cost and travel time and for providing real-time traffic information to commuters.

Out of the twenty smart cities in the first round, New Delhi and Jaipur are already operating metro systems. Metro system is under construction at Chennai,

Ahemdabad and Lochi. Ludhiana and Indore are planning to implement metro system as separate projects in near future. New Delhi has proposed smart parking as pan city development plan for tackling the increasing volume of private vehicles. Kochi has mooted the 'One City, One Card' for cashless transaction across multi-modal transport systems from waterways to metro. It has also done it on PPP mode converting an expense item to revenue item by awarding the contract for such a card to a private bank which will also be used for other commercial transactions. Agra, figuring in third list of smart cities, intends to follow kochi model of one city: one card for public transport as well as museums and other tourist attractions.

Two examples of how smart mobility challenge has been addressed by Pune and Udaipur cities is covered in ensuing paragraphs.

Smart Mobility under Pune City Development Plan.

Pune city conducted a citizen's survey as a part of exercise to develop Smart City Development Plan, where each citizen was asked to rank the various infrastructure services according to their priority. Public Transport emerged as the top most concern of citizens. (PMC, 2015)

Pune has developed 36 point program to tackle infrastructure issues in a phased manner. Figure 3 presents a snap shot of short term, medium term and long term measures proposed under city development plan to tackle mobility challenge.

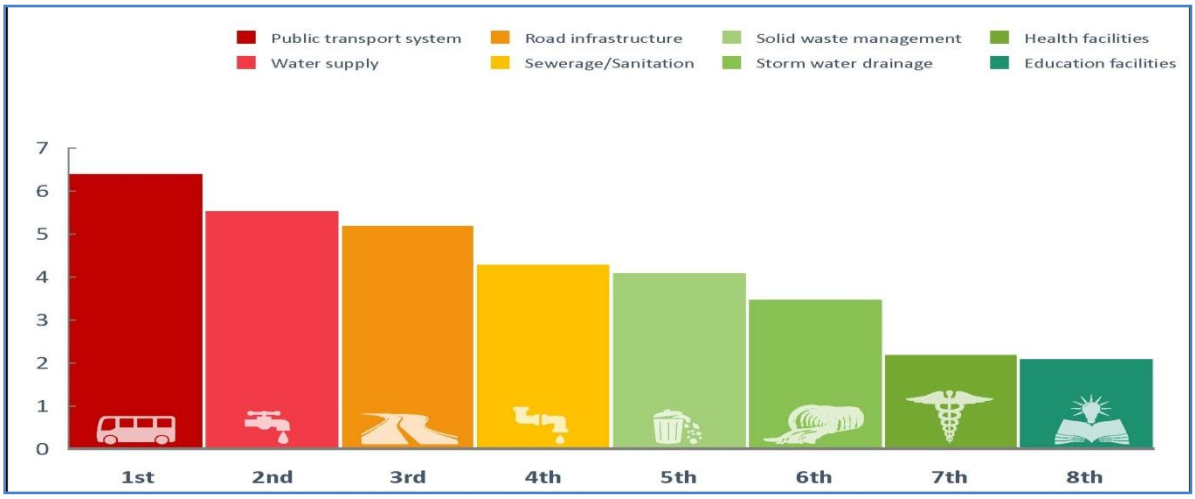

Figure 2 : Pune Citizens Survey on Ranking of Infrastructure Issues

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Figure 3: Short Term, Middle and Long Term Programme to Tackle Mobility Challenge in Pune City

Smart Mobility under Udaipur City Development Plan.

Udaipur City selected 828 acres of walled city area for transformation into smart urban area through retrofitment and which made it to the final list of 20 cities, envisage restoration of 85km of road network, 8km of heritage walks, improved traffic circulation through restrictions on personal vehicles, promotion of cycling and battery-operated public vehicles for tourists within the walled city, smart parking outside walled city boundaries for residents &visitors etc.

Udaipur city has also included an Intelligent Traffic Management System as a Pan City solution in their smart city portfolio. A provision has been made for augmenting City Bus Service with GPRS fitted 100 buses, 90 numbers of smart bus shelters, smart metering and parking lanes for off and on-street parking, Traffic Information & Management Centre including optical fibre communication, closed circuit surveillance etc.

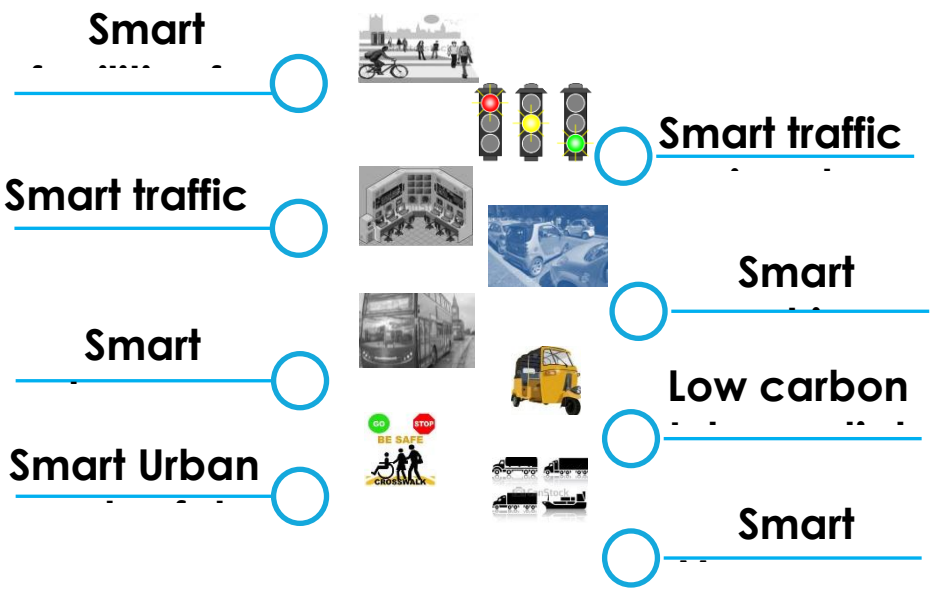

Figure 4 : Udaipur Smart City's Mobility Portfolio

Conclusion

Population growth, urban sprawl, rising incomes, economic prosperity, and growth of motor vehicles have compounded today's urban transport issues in Indian cities. Based on the facts and figures presented above and analysis of case study of Singapore integrated traffic management system it can be inferred that urban transport planning has to take into consideration land use, energy conservation, and last mile connectivity. The growing severity of environmental and social problems and chaotic mobility scenario of Indian cities today confirms that the way urban mobility is presently being managed is not working; the very direction of urban mobility planning needs to change. Urban transport determines what shape a city will finally take and what will be its carbon footprint. Planning in a way that cities retain a relatively mobility friendly, compact dwelling structure will affect how growth and people coexist in these cities in future. A new paradigm of urban mobility reflected in smart city portfolios of some of the cities which focus on walkable corridors, restriction of motor vehicles and preservation of heritage can be a path bearer to other cities for tackling the chaotic traffic situation on their rods. Models selected by these twenty cities will show other aspiring smart cities a sustainable, environment friendly path to develop a city with a reliable and affordable public transport and at the same time leaving enough space for people

rather than vehicles occupying most of the space. While the impact and extent of these initiatives in improving urban mobility is a subject of further study, successful implementation even in a few cases can be truly transformational for India's cities.

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Sustainable business model for the state-owned power distribution companies in India: Need of the hour

A Veluchamy, Dr. Raju Ganesh Sunder**, Dr. Rajesh Tripathi***, Dr. R. Mohamed Nafi*****

**Additional General Manager, Rural Electrification Corporation Ltd. (REC)*

***Professor & Head CCE, University of Petroleum and Energy Studies*

****Asst. Professor (Sr. Scale), CoMES, University of Petroleum and Energy Studies*

*****Chief Manager, REC, Central Institute for Rural Electrification, Hyderabad*

Abstract

The purpose of the study: India witnessed several reforms in power sector since 1956 and series of reforms after the enactment of the Electricity Act 2003. Although these reforms have significantly contributed to growth of the energy sector and socio-economic development, it has not achieved the primary objective of the reforms of improving the DISCOMs viability. The state-run DISCOMs are making the huge financial loss on the sustainable basis and the accumulated losses for the FY 2015 reached an alarming level of Rs.3.8 lakh crore. This has heavily impacted the development of power sector and overall economic development. This study was made to find out the reasons for the sustained losses of the DISCOMs and to find the solution to the above Perennial problem.

Design/Methodology/Approach

The paper provides a review of the relevant scholarly literature on power sector reforms, the performance of SEBs/DISCOMs and explored the reasons for the sustained losses of the state-run DISCOMs. It reviews the scholarly literature on business models and generating a sustainable business model. The two literature streams combined to form the basis for the suggested recipe.

Key findings and conclusions: The study explored the major reasons for the sustained financial losses of the DISCOMs. The study also finds that the power distribution business of the state-owned DISCOMs become financially and commercially unviable and unsustainable and its present business model failed to create value for self, its customers and the society at large. There exists a gap of availability of sustainable business model

for the state-owned DISCOMs. Developing a sustainable business model for the state-run DISCOMs is the need of the hour. It is suggested to use the tools and techniques as developed by Alexander Osterwalder & Yves Pigneur for generating a sustainable business model.

Contributions/Values

This paper highlighted the dire need to develop a sustainable business model for DISCOMs and to plug the huge leakage. This paper is of immense value to policy makers and stakeholders.

Keywords

Sustainable business model, designing of business model, sustainability, power sector reforms, power distribution companies, business model Innovation

Introduction

India witnessed several reforms in power sector since 1956 and major reforms after the enactment of the landmark legislation Electricity Act 2003, which has brought a sea change in the power sector. All the major reforms planned and being implemented is to achieve the prime objective to improve the performance of and the development of the power sector in general and to enhance the financial viability of the erstwhile SEBs and power distribution companies (DISCOMs) in specific. Although these reform measures have brought phenomenal changes and contributed to the growth of the energy sector and socio-economic development, it has not fully achieved the prime objective of the power sector reforms. The most critical challenge for the Indian power sector today lies in the distribution sector, the weakest link in the Generation--Transmission--Distribution value chain, as the distribution sector is reeling under deep trouble due to the mounting financial losses of the state-owned DISCOMs on sustainable basis even after unbundling, which has deteriorated the financial health of the DISCOMs and has heavily impacted the development of the power sector and is holding back the overall economic development of the nation, as the power is the prime mover of the other sectors of the economy. The power distribution business of the state-owned power distribution companies in India become financially and commercially unviable and unsustainable.

Objectives of the study

In order to find the solution to the above long-term problem being faced by the power sector in general and distribution sector in particular, an explorative study by detailed literature survey was made using secondary data collected from various sources research papers, books and

scholarly articles on power sector reforms in India, performance of state-owned DISCOMs in India, published data of Ministry of Power, CEA, REC, PFC, CERC, SERC, Planning Commission, various Rules, Laws & Acts enacted (please refer Reference as at Annexed) for the power sector reforms and various Govt. of India schemes viz., APDRP, R-APDRP, RGGVY, DDUGJY, DDG, NEF, research reports of World Bank, Asian Development Bank etc and literature and research papers on business model, Business model innovation, development of sustainable business model etc.

Literature Review

Power sector reforms in India

Various reforms in power sector carried out from the Pre-liberalisation era (1956-1991) to Post-liberalisation era (1991-2014) and reforms to date has been shown in Figure-1 [1]

Mounting losses of DISCOMs - Hindrance to economic development

The financially robust power sector is of paramount importance for economic growth and poverty alleviation.[5] GoI has implemented many reform programs in association with the State Governments for sustainable development of power sector across the country in general and to improve the financial viability of the state power utilities in specific through the enactment of various legislations [24]. Although these reform measures have contributed to the development of power sector, it has not achieved the prime objective of the reforms viz., the financial viability of the DISCOMs. The accumulated financial losses of DISCOMs in India has reached an alarming figure of Rs.3.8 lakh crore [1] for the FY 2015, which is 3.425 % of the India's GDP for the FY 2014-15. India could not afford such a huge loss, as the DISCOMs continue to incur such a huge financial losses year-on-year on a sustainable basis. Because of these mounting losses of the DISCOMs combined with its huge debts, barring few the financial health of almost all the state-run DISCOMs across the country have been heavily deteriorated and its net worth eroded, which has resulted in serious financial crisis. This has posed the highest risk of the very survival of the state-run DISCOMs and the power distribution business of the state-run DISCOMs become financially and commercially unviable and unsustainable.

World Bank has warned that the sustained losses of DISCOMs have reached a point that has been termed "India's subprime crisis"[2]. The accumulated financial losses of the power utilities in India for the six-year period from 2009-10 to 2014-15 is given in Figure -2 [1].

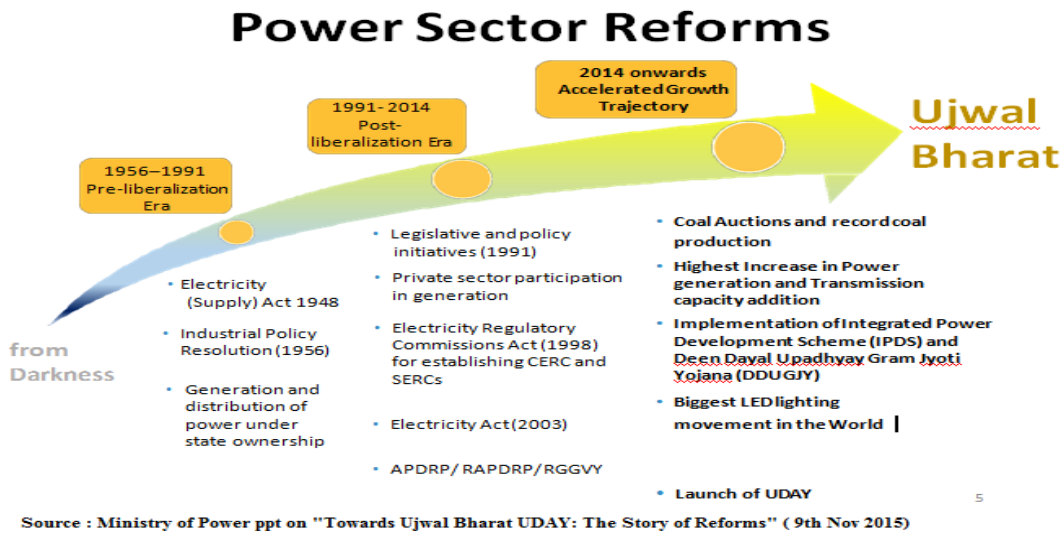


Figure 1

Accumulated financial losses of power utilities in India

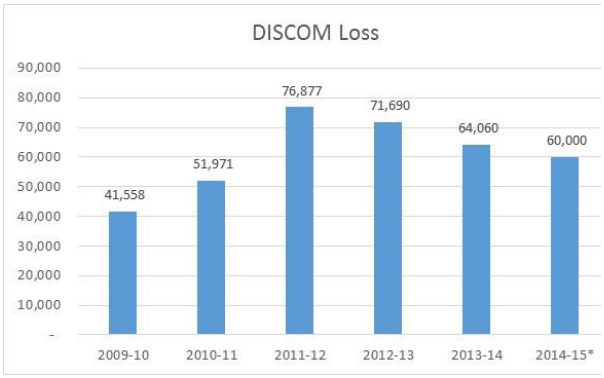


Figure 2

Source: Ministry of Power [1]

Deteriorating financial performance of state power utilities

Barring few state power utilities, almost all the state power utilities were making a huge financial loss on sustainable basis even after unbundling and implementation of a set of reforms. The sub-sector wise financial losses of bundled utilities, Generation, Transmission and Distribution businesses of the state power utilities in India for the period from 2003 to 2011 is shown in Figure-3[2].

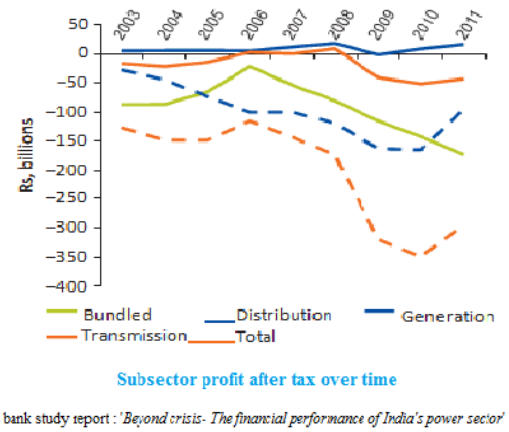


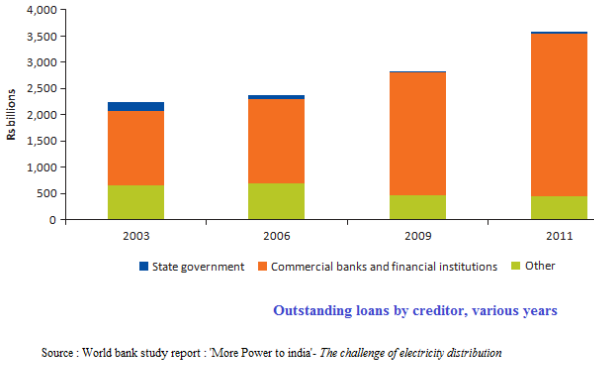
Figure-3

Because of the above, DISCOMs across the country are in serious trouble and are unable to generate sufficient revenue out of the sale of power, leading to huge losses and are unable to add the needed generation capacity to meet the growing demand-supply gap and DISCOMs are facing severe financial crunch finding very difficult even to meet out its operational requirement and debt repayment obligations to the Bankers, leading to

burgeoning Non-Performance Asset (NPA) in the book of Bank and Financial Institutions.

Mounting debts of DISCOMs & growing NPAs of Banks/FIs

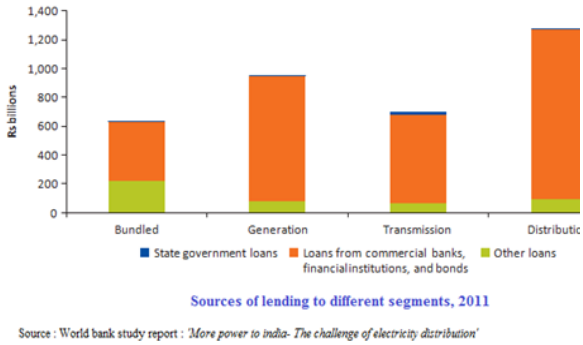
The total debts of the power sector are 3.5 lakh crore in 2011, out of which about 50% of the loan was given by the commercial Banks, followed by PFC (23%) and REC (20%)[3]. The outstanding loan of DISCOMs by various creditors showing the growing trend is shown in Figure-4.



Source : World bank study report : 'More Power to india'- *The challenge of electricity distribution*

Figure-4; Outstanding loans of DISCOMs by lenders/creditors

The debt owed by the DISCOMs is the highest as shown in Figure-5.

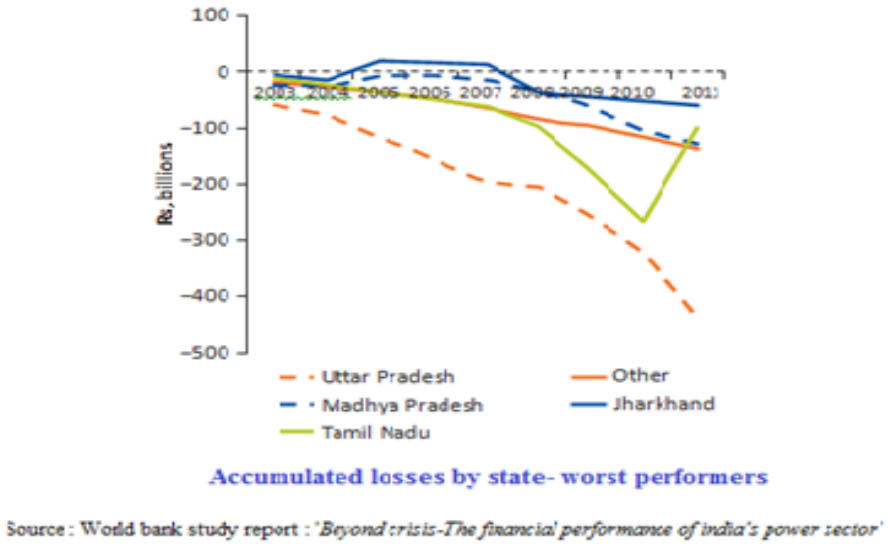


Source : World bank study report : *'More power to india- The challenge of electricity distribution'*

Figure-5

As per RBI Report (Feb' 2014), the DISCOMs losses stood at approximately Rs.70,000 crore (without subsidy). The accumulated losses of SEBs indirectly impacted the power producers since SEBs is the single largest buyer of electricity. Thus, the mounting NPAs in power sector could be primarily due to rise in losses and high debts owed by DISCOMs. Thus, the very high of losses has plunged the financial health of state electricity boards in a distressed state

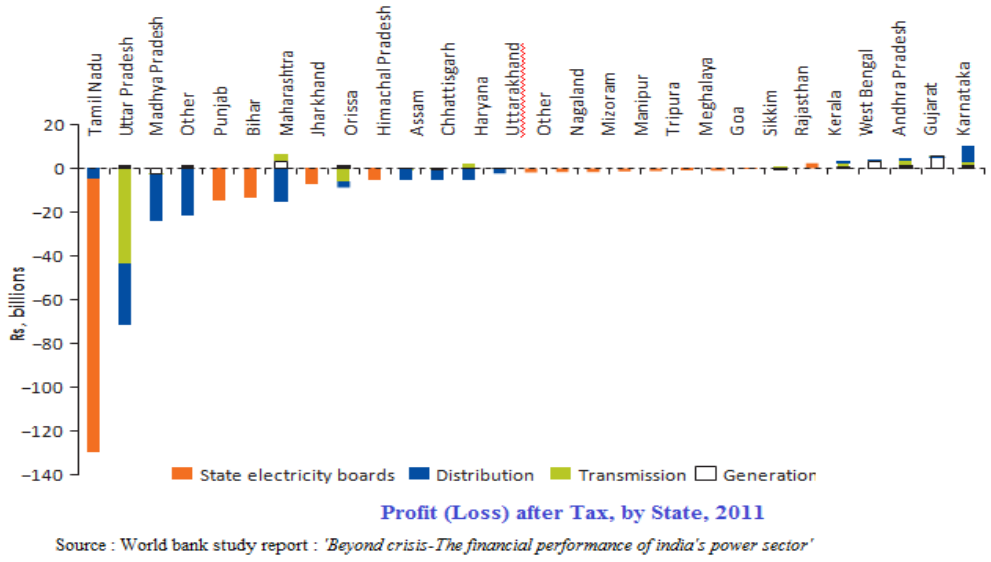
DISCOM's financial performance is worsening due to mounting losses, the GoI has pumped in money to DISCOMs for implementation of flagship reform programs viz., RGGVY, DDUGJY, DDG, IPDS, NEF to reduce the technical and commercial losses and to develop the power infrastructure in the states, which carries substantial GoI subsidy to the states[24]. DISCOMs were unable to service the interest and principal repayment of the loan availed by it from Banks and FIs, because of its poor financial performance.[6]. This has drastically affected the profits of the Banks due to the growing NPAs in its books besides, its capital adequacy ratio [7]. The credit rating of the DISCOMs has gone down drastically, due to which, DISCOMs ability to raise loans take a hit.



Source : World bank study report : *'Beyond crisis-The financial performance of india's power sector'*

Figure-6;

The state-wise Profit / Loss After Tax for the FY 2011 is shown in Figure-7.



Source : World bank study report : *'Beyond crisis-The financial performance of india's power sector'*

Figure 7

Worst performing DISCOMs

The accumulated losses of the DISCOMs are concentrated in four worst performing states Uttar Pradesh, Tamil Nadu, Madhya Pradesh and Jharkhand [2], as mentioned in Figure-6.

As per PFC report, the top six loss-making states for the FY 2013-14 [30] are mentioned in Table -1

Table-1; Financial losses of top 6 loss making states for the FY 2013-14

Worst performing states	(Rs. Crores)
Uttar Pradesh	17,678
Rajasthan	15,912
Tamil Nadu	12,677
Madhya Pradesh	6,941
Haryana	3,315
Jammu & Kashmir	2,219

Source: PFC report on the performance of state power utilities

Tamil Nadu stands third in the top loss-making utility during the FY 2013-14 by incurring a financial loss of Rs. 12,677 crore[29]. The world Bank has projected that in 2017, if the same trend continues, Rajasthan and Tamil Nadu will be making huge financial losses (without subsidy) in its distribution business to the tune of Rs.28,000 crore and Rs27,000 crore in respectively in one year. This is a serious alarming bell ringing up for its wake up.

Based on the detailed literature survey on performance of Tamil Nadu Generation and Distribution Company (TANGEDCO) of Tamil Nadu, an unbundled utility from the erstwhile Tamil Nadu Electricity Board (TNEB) in November, 2010 (wherein Generation and Distribution are bundled in a Company, which is a unique unbundling model in India), even after the unbundling is continued to make huge losses. TANGEDCO's financial losses were mounting and it has incurred a huge financial loss as Rs14,336 crore for the FY 2011-12. [20], [21]. The financial losses incurred by TNEB and TANGEDCO for the period from the FY 2004-05 to 2011-12 is given at Figure-8.

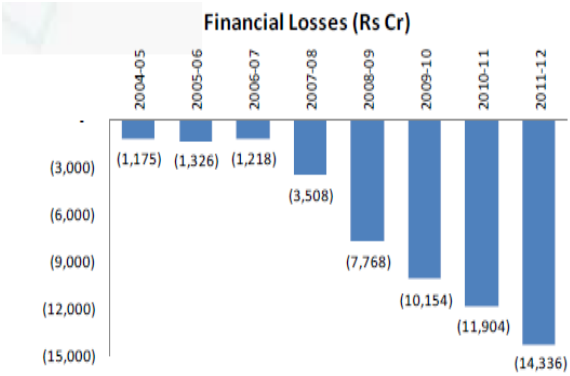


Figure-8; Financial Losses of TNEB & TANGEDCO over the years (Source: TANGEDCO)

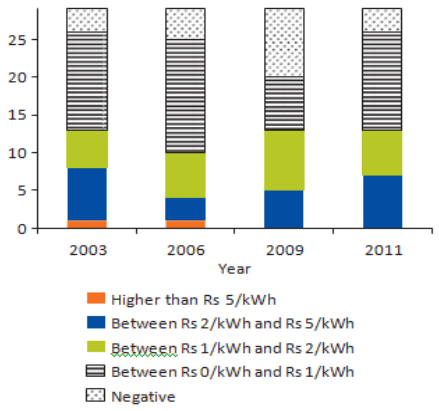
Major reasons for the sustained losses of DISCOMs

Many research studies carried out on Indian power sector have concluded that the primary reasons for the sustained financial losses of the SEBs and DISCOMs are due to high Aggregate Technical and Commercial losses (AT&C losses) [1],[3],[4],[5],[7] which comprises of the two major component viz., (i) Technical losses and (ii) Commercial losses.

The major Technical losses are the Transmission & Distribution (T&D) losses arising out of the energy losses in the Transmission and Distribution lines. The main reasons for the T&D and AT&C losses are irrational power tariff, power theft, non-billing, incorrect billing, inefficiency in bill collection, leakage in T&D system [30].

High AT&C losses & Gap between ACR and ACS- making DISCOMs business unviable

The sustained loss trend is continuing due to high AT&C losses and the gap between ACR and ACS as made the power distribution business commercially unviable and unsustainable[2],[6],[26]. The size of the gap between ACR and ACS (without subsidies) for DISCOMs for the period from 2003 to 2011 is very high (28%). The gap is in the range of Rs. 0 and Rs.1 per unit (Kw-H) is 12%, as mentioned in (Figure-9), [2]



Size of gap without subsidies (Real)

Source : World bank study report : *'Beyond crisis-The financial performance of i*

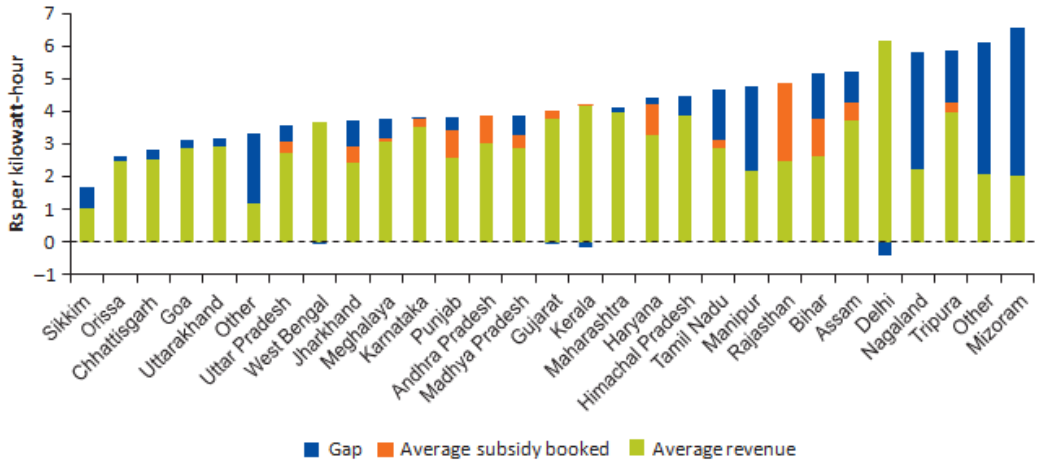
The state-wise gap between the ARR and ACS as per the World Bank study (2015) for the FY 2011 is mentioned in Figure-10.

Irrational Tariff:

As per Section 61 (g) of the Electricity Act 2003, the tariff should reflect the cost of supply of power and cross-subsidies to be eliminated progressively [24]. However, the tariff collected by DISCOMs are lower than the cost of power supply and the tariffs are not revised quite a long time, which is one of the main reasons for the mounting losses and erosion of the net worth of the state-run DISCOMs. It is seen from the Figure-11 that TANGEDCO of Tamil Nadu has incurred huge financial losses to the tune of about Rs.9,500 crore only in the year 2011, which is mainly due to the lower tariff, free power and the retail tariff has not been revised since 2003[3] .

Govt. distancing from tariff setting process - A hard reality

It is evident from the reports of the high-level committee appointed by the Govt. of India viz., Abraham Committee [7] and V.K. Shunglu committee [33] that the political intervention by the state Government in tariff setting process with SERC is one of the main reasons for the huge financial losses of the DISCOMs. The study further concluded that intervention of



Gap between Average cost and Average revenue, 2011

Source : World bank study report : *'The challenge of eletricity distribution'*

Figure 10

the state government in determining the tariff and the tariff setting process even though there is a clear-cut provision

in the Electricity Act 2003, and National Tariff Policy for distancing of the state Govt. from the SERC for distancing of the State Govt. from the SERC in tariff setting process.

Regulatory assets:

There is an inordinate delay in filing tariff petitions by DISCOMs, due to which 'truing up' process delayed as much as few years, which has resulted in piling up for huge regulatory assets, which is also one of the reasons for the financial losses.

Cross-subsidy:

Huge subsidy given by the DISCOMs to its domestic and agricultural consumers are the factors attributable to the worst performance of the DISCOMs. The subsidies passed on to agricultural and domestic customers are being cross-subsidized in the industrial and commercial consumers of power, who have to pay a higher price.[5],[6],[12]. The fact is that out of the 24% of power supplied to the agricultural sector only yields less than 6% of the total revenues. Tariff study on TANGEDCO finds that Tamil Nadu for the first time in 2015 has increased its agricultural tariff by 589%, to Rs 1.75 per unit.

Steps taken to reduce AT&C losses

Govt. of India has appointed high level special committees to have a detailed study the poor financial performance of DISCOMs and to improve its financial

viability. The Committee has emphasised the need to reduce the AT&C losses and to bridge the big gap between the ARR and ACS[7],[33]. Based on the Committee's recommendations, GoI has taken several further reform measures including implementation of APDRP, R-APDRP[24] to reduce the AT&C losses below 15%. The above schemes has helped state power utilities to reduce the AT&C losses by strengthening of the power system and improvement of system efficiency to some extent. However, the menace of mounting losses of DISCOMs continues.

Financial Restructuring Plan to rescue DISCOMs

The Govt. of India has given a major restructuring package of about Rs.1.90 Lakh Crore to the worst affected DISCOMs by Financial Restructuring Plan (FRP) in 2012. Under FRP, 50% of the short-term outstanding debts of DISCOMs would be taken over by the state governments. The debt will be first converted into state govt. guarantee backed bonds to be issued by DISCOMs to participating lenders. The balance 50% debts would be restructured with 3 year moratorium to pay the principal. While the FRP provided has yielded immediate relief to the DISCOMs [14], after the moratorium period was over in 2015, the DISCOMs were unable to repay their principal to DISCOMs due to its continued loss. The GoI again stepped in and sanctioned another debt restructuring package-II in 2015 to the worst affected DISCOMs.

Key findings on the performance of SEBs/DISCOMs

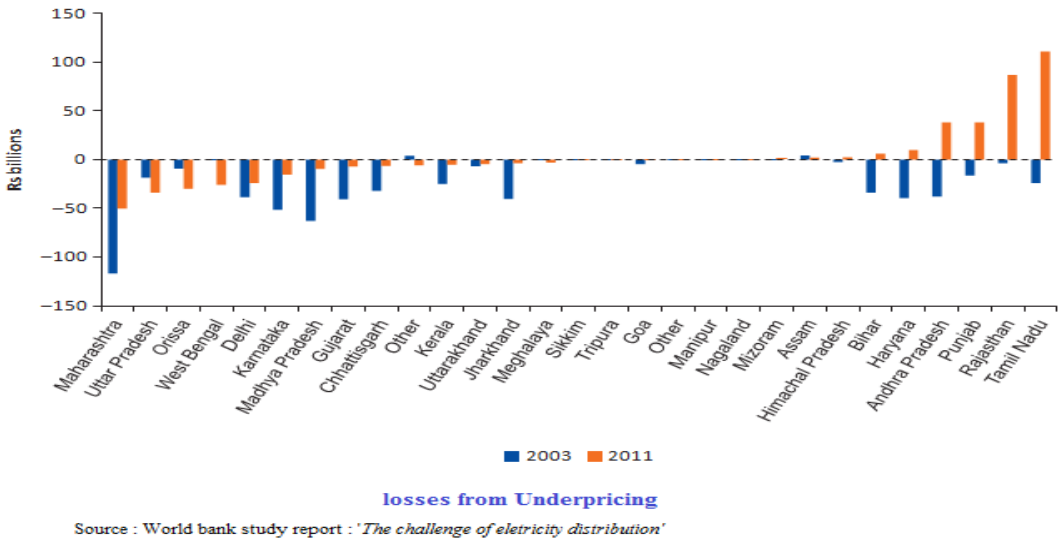


Figure-11

The study explored the major reasons for the sustained financial losses of the DISCOMs. The study also finds that the power distribution business of the state-owned DISCOMs become financially and commercially unviable and unsustainable and its present business model failed to create value for self, its customers and the society at large. There exists a gap of availability of sustainable business model for the state-owned DISCOMs.

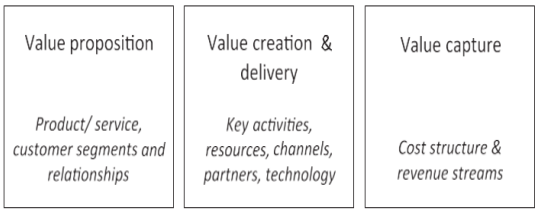
Business models for business sustainability

Business model:-Defined

A business model describes the rationale of how an organisation creates, delivers and captures value to customers and also to itself. It is a conceptual tool that contains a set of elements and their relationships and allows expressing a company's logic of earning money. It is a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams."[8].

Elements of business model

According to Bocken, S.W. Short, P. Rana and S. Evans "a business model is defined by three main elements viz., (i) value proposition, (ii) value creation and delivery and (iii) Value capture. Value proposition is concerned with the product and service offering to generate revenue. The value creation is the heart of any business model. Companies creates values through its new business, new market and new revenue streams. It captures values by earning revenues while providing services to its customers. The Conceptual business model framework is shown in Figure-12.



Conceptual business model framework
Adapted from Richardson (2008); Osterwalder and Pigneur (2005)

Figure-12

Sustainable business model

A business model to be sustainable, it must be (i) commercially successful (ii) future ready and (iii) a sustainable society. In order to get a competitive advantage, companies have to have sustainability as its goal and it has to change its business model [25].

Strategy, Business models, and Business model Innovation

An appropriate business model is a paramount importance for business sustainability and Organisations needs to pay more attention in designing its

business model for its commercial success. Strategy helps an organization to bring competitiveness and business success. A good business model alone will not be enough to achieve business sustainability, it requires a well-devised strategy too. Business Model Innovation is about creating value for Companies, Customer, and the Society. It is about replacing the outdated business model [26] It is changing 'the way we do business' as opposed to 'what we do' (Amit and Zott, 2012). Hence, for the business sustainability, companies have to change its business model, as it is a dynamic process.

Designing a Sustainable business model

It is suggested to re-design the business model for the state-run DISCOMs for the state-owned DISCOMs for its business sustainability, which could be done by conducting a scholarly research and by using the Business Model Canvas as designed by Alexander Osterwalder [26] having 9 components of the business model as depicted in Figure-13. Alexander Osterwalder & Yves Pigneur (2014) [8] have devised the tools and processes for generating business models viz., 'Business model canvas' tools which helps to create value for the business and ''Value Proposition Canvas' [9] helps to create value for the customers, which are being widely used for designing innovative business models.

Business Model Canvas developed by Alexander Osterwalder [8]

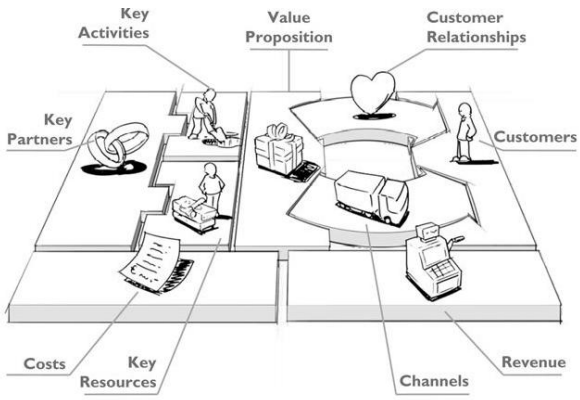


Figure-13

Evolving a conceptual framework for a sustainable business model

A business model can be best described through 9 basic building blocks that show the logic of how companies intend to make money. The nine blocks cover the four main areas of business: customers offer, infrastructure and financial viability. The business model is like a blueprint for a strategy to be implemented through organizational structures, processes, and systems.

The Customer Segments building block defines the different groups of people or organizations an enterprise aims to reach and serve. Without (profitable) customers, no company can survive for long. The Value Proposition building block describes

the bundle of products and services that create value for a specific customer segment. The Channels building block describes how a company communicates with and reaches its Customer Segments to deliver a Value Proposition. Customer Relationships building block describes the type of relationships a company establishes with specific Customer Segments. The Revenue Stream building block represents the cash a company generates from each customer segment. If customer comprises the heart of the business model, Revenue Streams are its arteries. The key Activities describes the important things a company must make its business model works. The Key Resource building block describes the most important assets required to make the business model work. The Key Partnership building block describes the network of suppliers and partners that makes the business model works. Partnerships are becoming a cornerstone of many business models. Companies create alliances to optimize their business models, to reduce the risk or acquire resources. The Cost Structure building block describes the most important costs incurred while operating under a particular business model. It is to mention that if there is any major change in any of the 9 components/building blocks of the business model, there will be changes in the other components of the business model.

Business Model Generation:

Business models are generated by innovative and out of box thinking. The business model design process has 5 phases [8] (i) Identify the interdisciplinary stakeholders (ii) understand (business) environment (iii) suspend reality (ideation) (iv) Prototyping (bring back reality) and (v) Implement the developed business model.

Evolving a new business model – a dynamic process:

Business Organisations needs to continuously innovate its business model to find new ways to create and capture value for its stakeholders and focuses primarily on finding new ways to generate revenues and define value propositions for customers, suppliers, and partners in order to keep its business viable and sustainable.

Major Findings

From the above-detailed literature review of power sector reforms in India, the performance of DISCOMs and the literature on the business model and the development of a business model, the following major findings emerges:

- The main reasons for the sustained losses of the state-owned DISCOMs in

India are mainly due to the huge AT&C losses, wide gap between the ARR and ACS, irrational tariff, the intervention of Govt in the tariff setting process, power subsidy, free power. The reason attributed for high AT&C losses are Transmission & Distribution losses, Lengthy LT lines, tariff not in consonance with the cost of supply, power theft, non-billing, incorrect billing, inefficiency in bill collection, leakage in transmission and distribution system, lack of investment etc.

- The power distribution business of the state-owned DISCOMs become financially and commercially unviable and unsustainable. The present business model being adopted by the state-owned DISCOMs have failed to create value for self, its customers and the society at large and its business model is unsustainable and become obsolete.
- There exists a gap of availability of sustainable business model for the state-owned DISCOMs.
- Hence, for the sustainability of the power distribution business of the state-owned DISCOMs in India, the present business model needs to be re-designed. An innovative business model, which is radically different needs to be developed to contain the burgeoning financial losses to DISCOMs and the exchequer.

Conclusion

There exists a gap of availability of sustainable business model for the state-owned DISCOMs. Developing a sustainable business model for the state-run DISCOMs is the need of the hour. It is suggested to use the tools and techniques as developed by Alexander Osterwalder & Yves Pigneur for generating a sustainable business model.

12. Contributions from the study:

This paper will set a tone to the policy makers and stakeholders, the dire need to develop a sustainable business model for the state-run DISCOMs to plug the huge leakage and to develop the ailing power sector. The paper would create an awareness of the serious problem being faced by the DISCOMs to all the stakeholders in particular and would help the researchers to carry out the research and for contributing to the knowledge and building management theories.

Abbreviations

ACS: Average Cost of Supply

APDRP: Accelerated Power Development and Reform Programme

ARR: Average Revenue Realized

AT&C loss: Aggregate Technical & Commercial loss

CEA: Central Electricity Authority

CERC: Central Electricity Regulatory Commission

DDG: Decentralized Distributed Generation

DISCOM: Power Distribution Company

DDUGJY: Deen Dayal Upadhyay Gram Joythi Yojana

SERC: State Electricity Regulatory Commission

EA Act: The Electricity Act, 2003

FI: Financial Institution

FRP: Financial Restructuring Plan

GDP: Gross Domestic Product

GoI: Government of India

MoP: Ministry of Power

MW: Mega Watt

NEF: National Electricity Fund

NPA: Non-Performing Asset

PFC: Power Finance Corporation Ltd

R-APDRP: Restructured Accelerated Power Development and Reform Programme

REC: Rural Electrification Corporation Ltd

RGGVY: Rajiv Gandhi Grameen Vidyutikaran Yojana

RBI: Reserve Bank of India

SEB: State Electricity Board

SERC: State Electricity Regulatory Commission

TANGEDCO: Tamil Nadu Generation and Distribution Company Ltd

TNEB: Tamil Nadu Electricity Board

T&D: Transmission and Distribution

UDAY: Ujwal DISCOM Assurance Yojana

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Tweaking of Low Cost Carriers (LCC) business model: Case of Major South East Asian Airliners

*Manish Yadav, **Prof. Tarun Dhingra

**Faculty Aviation Management, Modern College of Business & Sciences, Muscat (Oman)*

***Senior Associate Professor, CoMES, University of Petroleum and Energy Studies*

Abstract:

Low Cost Carrier (LCC) Business Model is very prominent in airline industry as a strategic move of airlines to sustain in dense marginal & dynamic market. There is plenty of research work on airline business model & low cost carrier yet there is dearth of research on systematic approaches & tools to compare the various business models of airlines especially low cost carriers. This paper addresses the gap & focus on systematic tool to compare the various business models of South East Asian airlines.

Design/methodology/approach

This research has been done by using Indexing method. The various business models of South East Asian airlines were ranked by denoting binary coding (0 for NO; 1 for YES) for each operating characteristics & then analyses the overall rating for the airlines. Highest rating shows the true low cost carrier business model while lowest denotes the true full service carrier. The concentration of the study was to determine the tweaking of the various airline business models features in order to race against the FSCs and their low cost subsidiaries.

Findings

Output of the study results in confirmation towards convergence of South East Asian airlines. The Low Cost Airlines of the region has strategically adopted "Hybrid Business Model" to sustain in highly regulated & dynamic airline industry.

Originality/value

The research work has potential for both theoretical & industrial contribution. By comparing the business models within the airline market, airlines can work on competitive strategy by adopting hybrid business model with appropriate features of both full service & low cost carriers. Theoretically, the study attempts to fill the knowledge gap in the field of research on comparison of various business models of

airlines i.e. Full Service Carriers, Hybrid Carriers, Low Cost Carriers & etc.

Key words: Low Cost Carrier (LCC); Hybrid Strategy; Business Model; Airline Industry

Introduction:

Airline industry has changed tremendously in last few years because of emergence of new business model so called "Low Cost Carrier" or "Low Cost Airline". In addition to this, airline industry has seen various growth aspects in terms of partnership ,mergers, takeovers, strategic alliances, code sharing across various business models of airlines resulting in various options for the passengers but with slight tweaking in core traditional airline low cost business models those having following features(R Doganis, 2010)(R. Sterzenbach, 2009)**:**

- Point to Point Traffic
- Usages of Secondary or feeder airports
- Homogeneous Fleet Type
- Direct Ticketing without travel agency mode
- Single fare each time per flight
- No FFPs & Complimentary services as frills

In industry sense, business model is blurring(Taneja, 2010)& thus various divergent strategies are in practice to achieve competitive advantage & sustainability in this airline business model. Thus, the dissimilarity amongst the different business models has altered and is no longer as clear and vibrant. These aspects motivated the researcher for pursuing research on the topic to compare and analyses the ranking of different airline business models across south east Asian region.

The methodology for the same is motivated through prior research work of Richard & Ronald(Richard Klophaus, 2012) who developed the methodology of assessing and comparison of various business models of European major airlines unlike the present research which focuses on major 15 south east asian airlines as per total passenger carried published by CAPA 2016 outlook report (CAPA, World Aviation Yearbook, April , 2016)

Through the study, researcher examines the tweaking range of business models & adoption of major intra business model characteristics amongst each other. This research has been done by using Indexing method. The various business models of South East Asian airlines were ranked by

denoting binary coding (0 for NO; 1 for analyses the overall rating for the airlines. Highest rating shows the true low cost carrier business model while lowest denotes the true full service carrier.

Previous study by Mason & Morrison(Mason, 2008)also highlights the Product & Organizational Architecture approach as effective tool to compare the business models. They(K J Mason, 2011)used cost and revenue data of major six European airlines that is being published by very few airlines. Present study use secondary data from different sources that YES) for each operating characteristics & th are publically available. The concentration of the study is to determine the tweaking of the various airline business models features in order to race against the FSCs and their low cost subsidiaries.

Airlines included in Survey

The following airliners (as shown in table 1.2) has been included in the survey for the purpose of this study. The airlines are selected on the basis of total number of passenger carried per annum as published in CAPA Outlook report.

Table 2.1 Source: Center for Asia Pacific Aviation (CAPA)

Airline	IATA Code	ICAO Code	Year Established	Country	Passengers Carried in 2015* (Millions)
Air Asia(AirAsia, 2016)	AK	AXM	1993	Malaysia	22.18 M
Indigo(IndiGo, 2016)	6E	IGO	2006	India	21.42 M
Air India(AirIndia, 2016)	AI	AIC	1932	India	12.42 M
Spicejet(Spicejet, 2016)	SG	SEJ	2005	India	11.74 M
Jet Airways	9W	JAI	1992	India	11.67 M
Mihin Lanka	MJ	MLR	2007	Sri Lanka	11.34 M

Lion Air	JT	LNI	2000	Indonesia	8.7 M
Nok Air	DD	NOK	2004	Thailand	7.62 M
Scoot	TZ	SCO	2012	Singapore	6.78 M
Go Air(GoAir, 2016)	G8	GOW	2005	India	6.2 M
Tiger Air	TR	TGW	2004	Singapore	5.8 M
Cebu Pacific Air	5J	CEB	1996	Philippines	1.53 M
Air Costa	LB	LLB	2013	India	0.58 M

LCC Business Model Criteria

Conventional LCCs model have less operating cost as compared to the full fledge carriers or flagship carriers. The mentioned Table 3.1 lists down the designated criteria to evaluatewhether the airline follow the low cost business model. These consist of fleet mix, point to point, ,fare class, cabin class, no code sharing , without frills, Flight Time, Frequent flyer program etc.

Table:3 LCC Business Model Criteria

Business Model Practice	**Criterion**	**Value**
Single Aircraft Type	Fleet Evenness Index (FEI)	1
Point-to-point	Airline has point-to-point connections only	Yes (1)
No Code sharing	Airline has no code sharing agreement with other carrier	Yes (1)
Only one one-way fare per flight available at each point in time	Airline operating each flight with single fare only	Yes (1)
	Airline operating each flight with only two fares	Yes (1)
Class cabin – Single	Airline operating with only one class cabin	Yes (1)

Flying Distance per flight	Short Haul (Less than 4 Hours only)	Yes (1)
	Long Haul (Greater than 4 Hours only)	Yes (1)
No meal & other frills	No free in-flight service – Lowest Fare	Yes (1)
	No free in-flight service - Highest Fare	Yes (1)
	No unrestricted checked baggage – Lowest Fare	Yes (1)
	No unrestricted checked baggage - Highest Fare	Yes (1)
	No FFPs - Frequent Flyer Programs	Yes (1)
Auxiliary Services	Meals Pre-booking, Excess Baggage choice, Prompt check-in	Yes (1)
No Primacy Check-In	No Primacy Check-In - Lowest Fare	Yes (1)
	No Primacy Check-In – Highest Fare category	Yes (1)

Total fleet size and type of aircraft plays very crucial role in operating cost of an airline hence are very crucial for the sustainability of an airline. Aircraft can contribute in respect of it's efficiency, less fuel cost, higher performance, higher utilization, block hours, operating performance, seating comfort, capacity breakups & distribution and so on. Airlines treat the homogeneity of fleet as a strategic move to achieve competitive advantage. Here, the Fleet Evenness Index (FEI) is calculated as the total number of air plane of the same maker to the total fleet size. If airlines have 50 airbus out of total 150 it means it has FEI is .33 (50 /150 = .33).

Point to Point connections means direct services to the city pairs. Code sharing implies the expansion strategy of the airline to cut the operating expenses on economy of scale basis. Single fare means the airline charge same ticket prices while more than one fare means charging more than one ticket price on the basis of third degree of price discrimination. If the airline offer more than one fare then the value for the particular criteria will be 0.5.

Single class cabin means if the seats are same i.e. economy class. If an airline has all the three classes Economy, first class and executive class then the criteria value is taken 0.33, if it has two

Class services then the value are taken 0.5. Distance covered or Flight time is considered as the criteria for short haul & long Haul flights. If airline serves short and long haul flights, its value is 0.5, if only short haul flights then its value is taken 1.*No Frills* and *No Priority Checks* define the additional ancillary services for the airline and taken as value 1 if yes.

Results *(Refer Appendices for reference):*

Table 4.1 shows the values for LCC indexing. For the determination of distinctive, airlines which have a value 16 are branded as Pure LCC Business Models, those with values between 8 to 10 are 'Hybrid Carrier with overlooking LCC characteristics', the ones with values between 5 to 7.5 are 'Hybrid Carrier with overlooking FSC characteristics' and the remaining airlines with value below 5 are branded as Full Service Carriers.

Table 4.1: LCC Indices

Type	**Airline**	**Value**
Pure LCC	Indigo	16.00
Hybrid Carrier with dominating LCC characteristics	Air Asia	10.00
	SpiceJet	9.33
	Tiger air	9.00
	Go Air	9.00
	Air India Express	9.00
	Air Blue	8.33
	Cebu Pacific Air	8.25
Hybrid Carrier with dominating FSC characteristics	Lion Air	7.50
	Scoot	7.50
	Nok Air	6.33
Full Service Carrier	Mihin Lanka	4.00
	Jet Airways	2.16
	Air India	2.14

From the results, one can depict that only IndiGo with an index value of 16 is a pure LCC as it is still following the traditional Southwest Business Model. As Air Costa does not have the domestic license, so we

can't consider Air Costa as an LCC as it is virtuously a regional carrier.

Results shows that 42 % (Total 6 Airlines) of airlines use one type of aircraft family hence Fleet Evenness Index (FEI) ranges from 0.14 (Air India) to 1 (Indigo).Average value of FEI is 0.64.The average value of point to point &no code sharing criteria is 0.5 that means half of the mentioned airlines are using point to point network and are not indulge in any code sharing agreement with any other airlines.

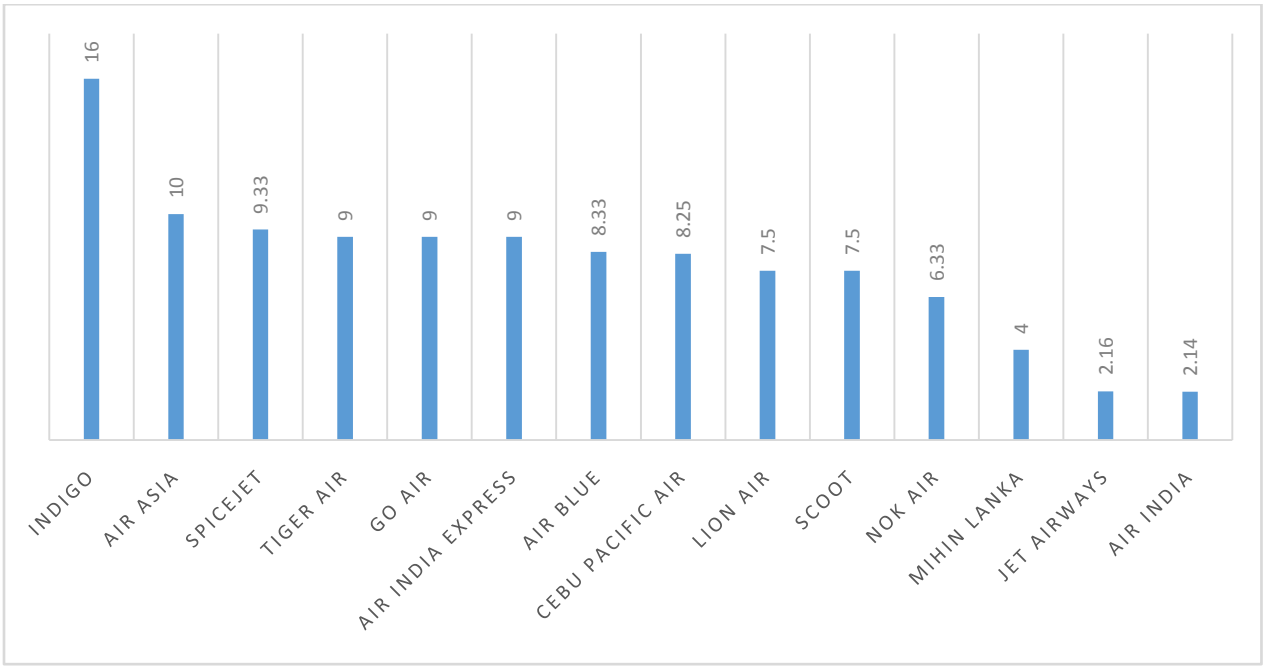

Figure: LCC Index Value

Based on the value zero or one w.r.t each criteria, the average value is calculated. For example if an airline is indulged in code sharing the average is given .5, if any airline has three types of aircraft family then the average is given 0.33.Given equal weight age to all the criteria, the consolidated LCC index is developed as shown in table 4.2 below.

Table 4.2 Consolidated LCC Index

Airline	***Value***
Indigo	1
Air Asia	0.63
SpiceJet	0.58
Tiger air	0.56
Go Air	0.56
Air India Express	0.56
Air Blue	0.52
Cebu Pacific Air	0.51
Lion Air	0.46
Scoot	0.46
Nok Air	0.39
Mihin Lanka	0.25
Jet Airways	0.13
Air India	0.13
Average Value	**0.48**

Table displays the airline ranking conferring to the consolidated LCC index. With value 1, Indigo Airlines shadow the textbook traditional LCC business model while on the other hand Air India, Mihin Airline and Jet Airways has value as low as 0.25 and 0.13 hence these airlines must not be in the list of Low Cost Carriers. The mean value of consolidated LCC Index is 0.48 indicating a high degree of hybridization amongst the mentioned airlines. Mainstream of the airlines counting Air Asia which once announced itself as a pure LCC, now are whirling hybrid though retaining dominating LCC features in order to race against the FSCs and their low cost subsidiaries.

Conclusion:

In South East Asia, the airlines are tweaking their business model and focusing on hybrid business models in order to infringe on markets that have so far been the reserve of legacy carriers. Our study confirm the hybridization of South East Asian airlines (Through mean value of consolidated LCC index i.e.0.48).Hence few of the low cost carriers are also tweaking their core traditional low cost business model to the hybrid one& vice versa; to get competitive advantage & sustainability in airline industry.

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APPENDICES:

Table 3.2: Analysis of South-East Asian Airlines – Tiger Air, Scoot and Air Asia

Business Model Technicalities	**Criterion for each Technicality**	**Tiger Air**(TigerAir, 2016)	**Scoot**(http://www.flyscoot.com/en/, 2015)	**Air Asia**(AirAsia, 2016)
Single Aircraft Type	Fleet Evenness Index (FEI)	1 type: A320 family	2 type: B777-200, B787-900	A320
Point-to-point	Airline has point-to-point connections only	No (0)	No (0) : Maximum of the flights are via Singapore only	Yes (1)
No Code sharing	Airline has no code sharing agreement with other carrier	No (0) : Code sharing agreement with Cebu Pacific	No (0) : Code Sharing Partnership with Tiger Air, Australia, Silk Air, Nok Air, Singapore Airlines, Virgin	Yes (1)
Only one one-way fare per flight available at each point in time	Airline operating each flight with single fare only	No (0)	No (0) : More than 3 fares per flight - Fly, FlyBag etc.	No (0) : Two different fares - Low Fare and Premium Flex
	Airline operating each flight with only two fares	Yes (1)	No (0) : More than 3 fares per flight - Fly, FlyBag etc.	Yes (1)
Class cabin – Single	Airline operating with only one class cabin	Yes (1)	Yes (1)	Yes (1)
Flying Distance per flight	Short Haul (Less than 4 Hours only)	Yes (1)	Yes (1)	Yes (1)
	Long Haul (Greater than 4 Hours only)	No (0)	No (0)	No (0)
No meal & other frills	No free in-flight service – Lowest Fare	Yes (1)	Yes (1)	Yes (1)
	No free in-flight service - Highest Fare	No (0)	No (0)	No (0)
	No unrestricted checked baggage – Lowest Fare	No (0)	Yes (1)	Yes (1)
	No unrestricted checked baggage - Highest Fare	No (0)	No (0)	No (0)
	No FFPs - Frequent Flyer Programs	Yes (1)	Yes (1)	No (0)

Auxiliary Services	Meals Pre-booking, Excess Baggage choice, Prompt check-in	Yes (1)	Yes (1)	Yes (1)
No Primacy Check-In	No Primacy Check-In - Lowest Fare	Yes (1)	Yes (1)	Yes (1)
	No Primacy Check-In – Highest Fare category	Yes (1)	No (0)	No (0)

Table 3.3: Analysis of South-East Asian Airlines – Cebu Pacific, Lion Air and Nok Air

Business Model Technicalities	**Criterion for each Technicality**	**Cebu Pacific**(CebuPacific, 2015)	**Lion Airhttp://www.lionair.co.id/lion-experience/about-us**	**Nok Air**(NokAir, 2016)
Single Aircraft Type	Fleet Evenness Index (FEI)	4 types: A320, A330, A319, ATR 72	2 types: B737 family, MD-90	3 types: B737 family, ATR 72
Point-to-point	Airline has point-to-point connections only	No (0)	No (0)	No (0) : via Bangkok
No Code sharing	Airline has no code sharing agreement with other carrier	No (0): Airline has code sharing agreement with Tiger Air	No (0): Airline has code sharing agreement with Wing Air	No (0): Airline has code sharing agreement with Scoot Airlines
Only one one-way fare per flight available at each point in time	Airline operating each flight with single fare only	No (0): Airline operating each flight with Three different fares - Fly, Fly Bag, Fly Bag Meal	No (0) : Airline operating each flight with Business, Economy, and Promo fares	No (0) : Airline operating each flight with NokEco, Nok Flexi
	Airline operating each flight with only two fares	No (0): Airline operating each flight with Three different fares - Fly, Fly Bag, Fly Bag Meal	No (0) : Airline operating each flight with Business, Economy, and Promo fares	No (0) : Airline operating each flight with NokEco, Nok Flexi also has Promotion fares at times
Class cabin - Single	Airline operating with only one class cabin	Yes (1)	No (0) : Airline operating with Economy and Business Class	Yes (1)
Flying Distance per flight	Short Haul (Less than 4 Hours only)	Yes (1)	Yes (1)	Yes (1)

	Long Haul (Greater than 4 Hours only)	No (0)	No (0)	Yes (1)
No meal & other frills	No free in-flight service – Lowest Fare	Yes (1)	Yes (1)	No (0)
	No free in-flight service - Highest Fare	No	Yes (1)	No (0)
	No unrestricted checked baggage – Lowest Fare	Yes (1)	Yes (1)	No (0)
	No unrestricted checked baggage - Highest Fare	No (0)	Yes (1)	No (0)
	No FFPs - Frequent Flyer Programs	Yes (1)	No (0)	Yes (1)
Auxiliary Services	Meals Pre-booking, Excess Baggage choice, Prompt check-in	Yes (1)	No (0)	No (0)
No Primacy Check-In	No Primacy Check-In - Lowest Fare	Yes (1)	Yes (1)	Yes (1)
	No Primacy Check-In – Highest Fare category	Yes (1)	Yes (1)	Yes (1)

Table 3.4: Analysis of South-East Asian Airlines – Indigo,SpiceJet,Go,and Air India Express

Business Model Technicalities	**Criterion for each Technicality**	**Indigo**	**Spicejet**	**Go Air**	**Air India Express**
Single Aircraft Type	Fleet Evenness Index (FEI)	1 type: A320-200	3 type : B737-900, B737-800, Q400	1 type: A320s	1 type: B737s
Point-to-point	Airline has point-to-point connections only	Yes (1)	Yes (1)	Yes (1)	Yes (1)
No Code sharing	Airline has no code sharing agreement with other carrier	Yes (1)	Yes (1)	Yes (1)	Yes (1)
Only one one-way fare per flight available at each point in time	Airline operating each flight with single fare only	Yes (1)	No (0) : Airline operating each flight with two fares i.e. Regular, Spice Flex	No (0) : Airline operating each flight with four types of fares	No (0) : Airline operating each flight with two fares

	Airline operating each flight with only two fares	Yes (1) - Airline operating each flight with only two fares	Yes (1) - Airline operating each flight with only two fares	No (0) : Airline operating each flight with four types of fares	No (0) : Airline operating each flight with more than two fares
Class cabin - Single	Airline operating with only one class cabin	Yes (1); Airline operating with only one class cabin	Yes (1); Airline operating with only one class cabin	No (0); Airline operating with only one class cabin	Yes (1); Airline operating with only one class cabin
Flying Distance per flight	Short Haul (Less than 4 Hours only)	Yes (1)	Yes (1)	Yes (1)	Yes (1)
	Long Haul (Greater than 4 Hours only)	Yes (1)	No (0)	Yes (1)	Yes (1)
No meal & other frills	No free in-flight service – Lowest Fare	Yes (1)	Yes (1)	Yes (1)	No (0)
	No free in-flight service - Highest Fare	Yes (1)	No (0)	No (0)	No (0)
	No unrestricted checked baggage – Lowest Fare	Yes (1)	No (0)	No (0)	No (0)
	No unrestricted checked baggage - Highest Fare	Yes (1)	No (0)	No (0)	No (0)
	No FFPs - Frequent Flyer Programs	Yes (1)	Yes (1)	Yes (1)	Yes (1)
Auxiliary Services	Meals Pre-booking, Excess Baggage choice, Prompt check-in	Yes (1)	Yes (1)	Yes (1)	Yes (1)
No Primacy Check-In	No Primacy Check-In - Lowest Fare	Yes (1)	Yes (1)	Yes (1)	Yes (1)
	No Primacy Check-In – Highest Fare category	Yes (1)	No (0)	No (0)	Yes (1)

Table 3.5: Analysis of Indian FSC & Regional carrier along with airlines from Pakistan and Sri Lanka

Business Model Technicalities	Criterion for each Technicality	Air India	Jet Airways	Air Costa	Air Blue	Mihin Lanka
Single Aircraft Type	Fleet Evenness Index (FEI)	7 types	6 types	2 types	3 types	A320, A321
Point-to-point	Airline has point-to-point connections only	No (0)	No (0)	Yes (1)	Yes	No (0)
No Code sharing	Airline has no code sharing agreement with other carrier	No (0)	No (0)	Yes (1)	Yes	No (0)
Only one one-way fare per flight available at each point in time	Airline operating each flight with single fare only	No (0)	No (0)	Yes (1)	No (0)	No (0)
	Airline operating each flight with only two fares	No (0)	No (0)	Yes (1)	No (0)	No (0)
Class cabin - Single	Airline operating with only one class cabin	No (0)	No (0)	No (0)	Yes (1)	No (0)
Flying Distance per flight	Short Haul (Less than 4 Hours only)	Yes (1)	Yes (1)	Yes (1)	Yes (1)	Yes (1)
	Long Haul (Greater than 4 Hours only)	No (0)	No (0)	Yes (1)	Yes (1)	No (0)
No meal & other frills	No free in-flight service – Lowest Fare	No (0)	No (0)	No (0)	Yes (1)	No (0)
	No free in-flight service - Highest Fare	No (0)	No (0)	Yes (1)	No (0)	No (0)
	No unrestricted checked baggage – Lowest Fare	No (0)	No (0)	No (0)	Yes	No (0)
	No unrestricted checked baggage - Highest Fare	No (0)	No (0)	No (0)	No (0)	No (0)

	No FFPs - Frequent Flyer Programs	No (0)	No (0)	Yes (1)	No (0)	No (0)
Auxiliary Services	Meals Pre-booking, Excess Baggage choice, Prompt check-in	No (0)	No (0)	Yes (1)	No (0)	No (0)
No Primacy Check-In	No Primacy Check-In - Lowest Fare	Yes (1)	Yes (1)	Yes (1)	Yes (1)	Yes (1)
	No Primacy Check-In – Highest Fare category	No (0)	No (0)	Yes (1)	No (0)	No (0)

Soft Infrastructure

Credit risk management: An analytical study of banks in India

Dr Sumeet Gupta*, Dr Vinay Kandpal**

**Associate Professor, CoMES, University of Petroleum and Energy Studies*

***Assistant Professor, CoMES, University of Petroleum and Energy Studies*

INTRODUCTION

The banking sector is the pillar of the monetary system in the Indian economy and its performance is praiseworthy. The Indian banking sector has changed over the last decade. Public and Private Sector Banks are trying to provide accessibility to the masses with the usage of technology to facilitate greater ease of communication and transactions. Banks have started mobile app for the ease of customers. Continuous efforts are being put to device new practices and modalities towards bringing in robustness in the Indian Banking System and at the same time catering to the needs of customers, both from industry and individual level. Saving money as a budgetary mediator division, confronts various risks as records changing over to Non-performing Assets (NPAs) furthermore the risks which are uncontrollable like foreign exchange risk, interest rate risk and so on. The travel towards risk administration rehearses in each circle has gotten to be basic in the present situation.

Indian Banks particularly open area banks have since quite a while ago utilized danger administration exercises. Notwithstanding, these exercises are most appropriate for transient arrangements, for long haul banks need to receive another danger administration movement where they can profit by more surprising danger structures. Risk management through derivative securities has been another avenue for banks to refine risk management practices. Like other International markets, cost and loan cost, instability in Indian money related

markets are additionally high; consequently the ramifications of not supporting the bank portfolio might turn out to be terrible. Derivatives give banks a chance to deal with their danger introduction and to produce income. The examination targets encircled to repeat the significance of danger administration rehearses through subsidiaries are to inspect the subordinate exposures in the banks and to decide the impact of the subsidiary introduction on bank's intimidation part.

Credit derivatives are financial instruments and can have the form includes forwards, swaps and options, which may be embedded in financial assets such as bonds and loans. Credit derivatives allow an investor to reduce or eliminate the credit risk or to assume credit risk, expecting to profit from it. Credit derivatives' value is derived from an underlying obligation which is either a bond or loan. A hedging is an investment to mitigate the risk of adverse price movements in an asset. Hedging in the currency market can be done through two positions, i.e. Short Hedge and Long Hedge.

LITERATURE REVIEW:

Smith, Robert 1984 focused on the benefits of hedging accounts in banking sector in the US impact of the volatility of interest rate; aim offsetting purchases of instrument denominated in dollars; Importance of information on developments and overall trends in future sales.

Jack Robinson 2009 analyzed that nowadays highly unstable farm prices have increased the farmers and his banker's interest in hedging their products. The farmers are also progressing faster than his bankers in perfecting skills. The main reason for the relatively low number of farmers who use future market is due to the lack of effective relationship with the knowledgeable banker.

David Miselman, 1974 analyzed that many economists blame the erratic inflation on recurring stop and go monetary and fiscal policies and see no evidence that we are likely to have a more steady and fiscal policies in the future than in the past. For the last several years, inflation has increased and has become even more erratic. More banks should perform well to examine their lending practice and rates to make them more conform more closely to the realities

of current inflation and high interest rates, and in order to avoid having rising interest expense and other cost outdistance revenue.

RESEARCH PROBLEM

Risk and uncertainty are intrinsic in all the phases through which banks are facing problem. Hedging framework is not developed by the Indian banking industry for hedging of risks. Central banks manage the amount of money and credit in an economy through their daily activities of buying and selling government debt, determining and maintaining core interest rates, setting reserve requirement levels, and issuing currency.

OBJECTIVE OF STUDY

The problem statement of the above business problem can be identifying the various kinds of risks which are faced by banks. Also, what they are required to prescribe procedures for risk identification, measurement and assessment, as well as procedure for risk management. The objectives of the study are:

- To identify various kinds of risk that banks are facing in their day to day transactions
- To analyze how can banks do hedging?
- To analyze the framework for hedging of risk

RESEARCH METHODOLOGY

The research is exploratory research. For this the experts and consultants from banking industry was targeted as respondent. The sample size is 80. In the study secondary data like books, RBI publications, Trend and Progress Reports of Banking in India, Articles and Research Papers relating to NPAs and Credit Risk Management published in journals and magazines.

DATA ANALYSIS AND INTERPRETATION

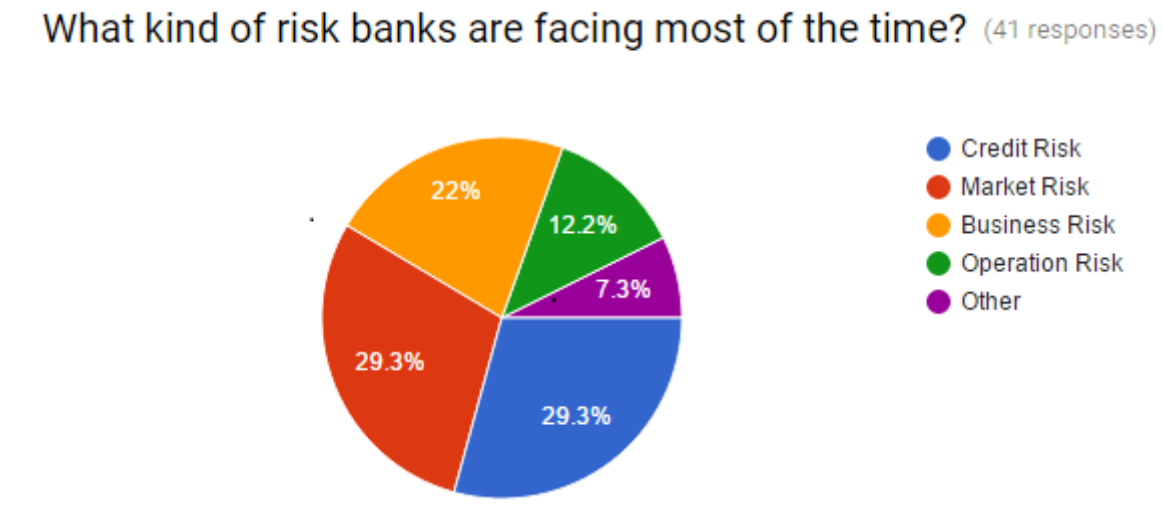


Figure A

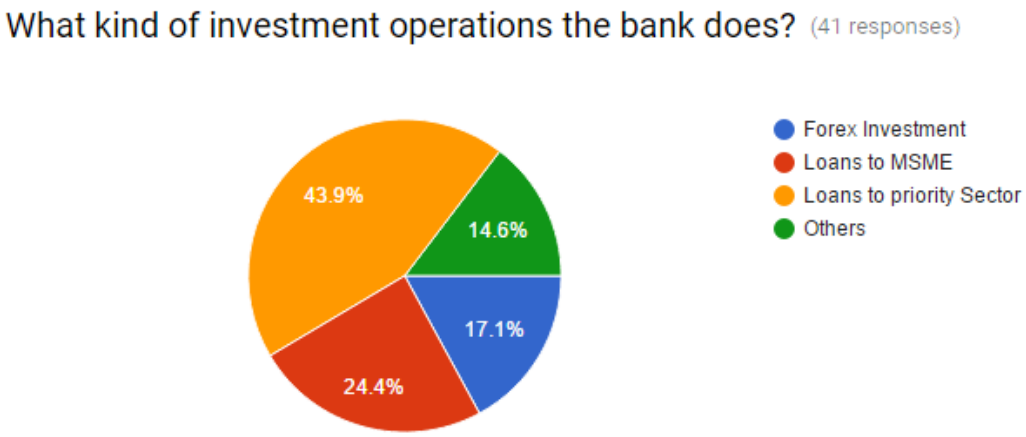


Figure B

From figure A, we come to know that banks are mostly facing credit risk as well as market risk equally i.e. 29.3%. The business risk faced by the bank is 22%. The operational risk faced by the bank is 12.2%. The other risks (7.3%) faced by banks are reputational risk, exposure risk, legal risk, strategic risk etc.

From figure B, we can see that the major investment operation the bank is giving

loans to priority sector i.e. 43.9%. It is followed by loans to Micro and Small Medium Enterprise (MSME) i.e. by 24.4%. The investment operation is done in Forex investment by 17.1%. 14.6% investment operation is done in other sectors like house old loan, personal segment etc.

The question deals with risk faced by banks in the scale of 1-5. There are 5 variables considered in this question like market risk, credit risk, operational risk, business risk, operational risk and others. The KMO value fluctuates between 0 and 1. The value 0 indicates that the factor analysis is inappropriate and if the values are 0.5 and above, then the factor analysis can be true and reliable. The result of KMO and Bartlett's test analyzes that the sampling adequacy is 0.530 so the question is valid for factor analysis.

Table C

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.530
Bartlett's Test of Sphericity	Approx. Chi-Square	39.452
	df	10
	Sig.	.000

Table D

Component Matrix[a]

	Component	
	1	2
Credit_Risk	.822	-.209
Business_Risk	.727	.307
Currency_Risk	.688	-.614
Market_Risk	-.528	-.199
Operational_Risk	.313	.847

Extraction Method: Principal Component Analysis.

a. 2 components extracted.

The output is component matrix before rotation. This has loadings for each variable where all loadings with less than 0.4 is suppressed displayed with blank spaces.

Oblique rotation is used as factors that are related to each other from the output of rotated component matrix variables, currency and credit risk are grouped into factor named as financial risk. Operational and business risks are grouped into a factor named as operational banking risk.

Table E

Rotated Component Matrix[a]

	Component	
	1	2
Currency_Risk	.918	
Credit_Risk	.783	.325
Operational_Risk	-.257	.866
Business_Risk	.398	.682
Market_Risk	-.304	-.476

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

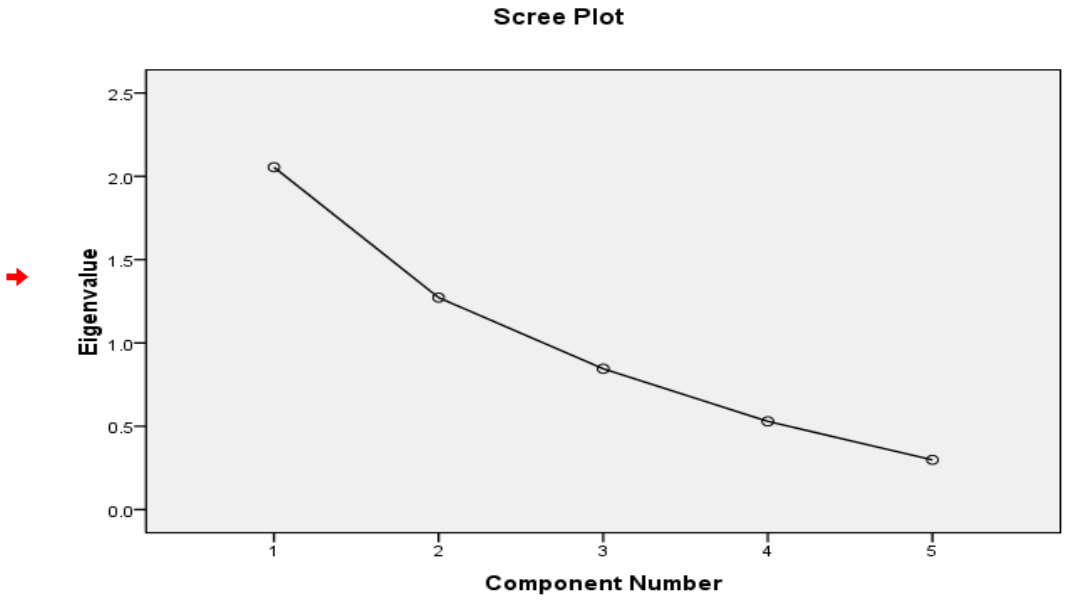


Figure F

Table G

Communalities

	Initial	Extraction
Credit_Risk	1.000	.719
Market_Risk	1.000	.319
Business_Risk	1.000	.623
Operational_Risk	1.000	.816
Currency_Risk	1.000	.850

Extraction Method: Principal Component Analysis.

A factor analysis test was conducted on 5 different kinds of risk faced by banks in the scale of 1-5. It is used when variables are less than 30 and commonalities after extraction are greater than 0.7.

This output shows the commonalities before and after extraction. The Principal component analysis is based on the assumption that all variance is common. Thus, before extraction commonalities are 1. The extraction column reflects the amount of variance among each variable.

The above below explains about the eigenvalues with relevant factors, before extraction, after extraction and after rotation. The table shows that response receivd are able to explain up to 66% of the total variance.

Table H

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.054	41.090	41.090	2.054	41.090	41.090	1.774	35.470	35.470
2	1.272	25.446	66.536	1.272	25.446	66.536	1.553	31.066	66.536
3	.845	16.903	83.439						
4	.530	10.590	94.030						
5	.299	5.970	100.000						

Extraction Method: Principal Component Analysis.

Table G

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.673
Bartlett's Test of Sphericity	Approx. Chi-Square	143.017
	df	45
	Sig.	.000

The question deals with the factor influencing the banks' risk. There are 10 variables considered such as:- Interest rate fluctuation, adverse change in market condition, political instability, mismanagement of loans, economic crisis, capital insufficiency, liquidity problem, hardware and software malfunction, capital control and credit control.

The result of KMO and Bartlett's test shows the sampling adequacy is 0.673 so the question is valid for Factor analysis.

Component Matrix[a]

	Component		
	1	2	3
Credit_control	.824	-.131	.236
Liquidity_problem	.780	-.140	-.187
Capita_Insufficiency	.749	-.127	-.182
Economic_crisis	.712		.209
Mismanagement_of_loans	.701	-.478	
Interest_rate_flactuation	.645	.564	
Hardware_and_software_malfunction	.586	-.194	-.489
Adverse_change_in_market_condition	.361	.690	
Political_Instability	.178	.643	-.347
Capital_Control	.330	.116	.756

Extraction Method: Principal Component Analysis.

a. 3 components extracted.

Table H

Rotated Component Matrix[a]

	Component		
	1	2	3
Mismanagement_of_loans	.798	-.205	.203
Liquidity_problem	.793	.174	
Capita_Insufficiency	.759	.174	
Hardware_and_software_malfunction	.725	.121	-.282
Credit_control	.711	.109	.483
Economic_crisis	.572	.191	.432
Adverse_change_in_market_condition		.753	.196
Interest_rate_flactuation	.341	.728	.298
Political_Instability		.722	-.209
Capital_Control			.830

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 4 iterations.

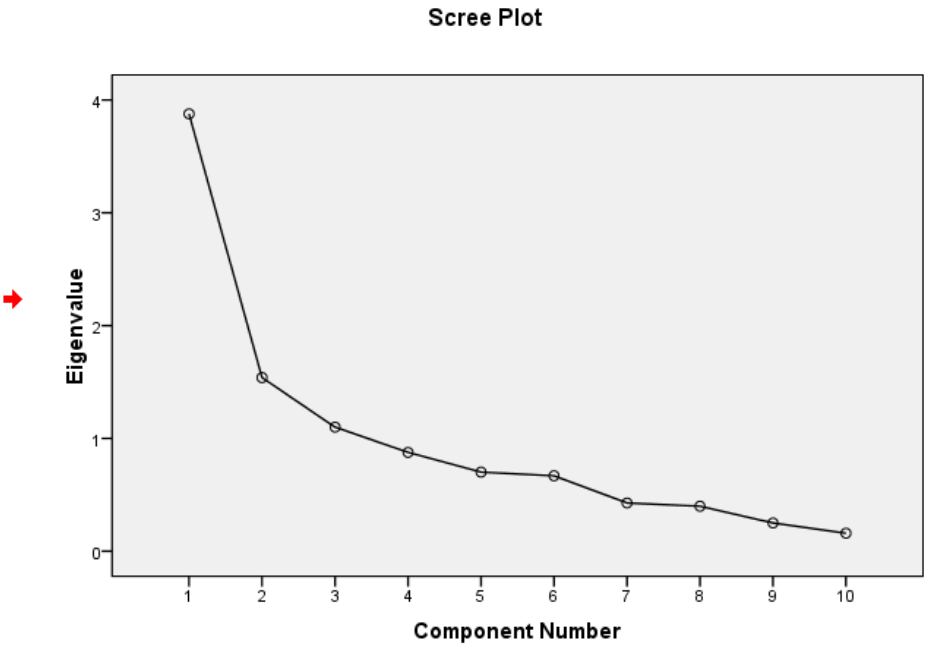
Table I

Oblique rotation is used as factors that are related to each other from the output of rotated component matrix variables, mismanagement of loans, liquidity problem, capital insufficiency, hardware and software malfunction and credit control are grouped into factor named as credit management. Whereas adverse change in market condition, interest rate fluctuation and political instability are grouped in a factor named as an economic issue. The other

factor which is considered is named as capital control.

For analyzing the data factor analysis test was done on 10 factors that has an impact the banks' risk. . It is used when variables are less than 30 and commonalities after extraction are greater than 0.7. The above diagram shows that the line starts to straighten after factor 6.

Figure J



Communalities

	Initial	Extraction
Interest_rate_flactuation	1.000	.735
Adverse_change_in_ market_condition	1.000	.607
Political_Instability	1.000	.565
Mismanagement_of_ loans	1.000	.720
Economic_crisis	1.000	.551
Capita_Insufficiency	1.000	.610
Liquidity_problem	1.000	.664
Hardware_and_ software_malfunction	1.000	.620
Capital_Control	1.000	.694
Credit_control	1.000	.751

Extraction Method: Principal Component Analysis.

Table K

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.877	38.772	38.772	3.877	38.772	38.772	3.320	33.197	33.197
2	1.539	15.391	54.162	1.539	15.391	54.162	1.787	17.867	51.063
3	1.100	11.001	65.164	1.100	11.001	65.164	1.410	14.100	65.164
4	.876	8.759	73.923						
5	.701	7.011	80.934						
6	.669	6.688	87.622						
7	.428	4.278	91.899						
8	.399	3.993	95.892						
9	.251	2.507	98.400						
10	.160	1.600	100.000						

Extraction Method: Principal Component Analysis.

Table L

The table K reflects the commonalities before and after extraction. Principal component analysis is based on the assumption that all variance is common. Thus, before extraction commonalities are 1. The extraction column shows the amount of variance in each variable.

The table L discuss about the eigenvalues with relevant factors, before extraction, after extraction and after rotation. From the table, it is analyzed that responses received are able to explain up to 65% of the total variance.

CONCLUSIONS

An effective credit management is essential for stability and continuing profitability of financial institution's, while deteriorating credit quality is the most frequent cause of poor financial performance and condition. Banks are increasingly facing credit risk in various instruments other than loans, as credit risk encompasses both default risk and market risk. Risk management underscores the way that the survival of an association depends vigorously on its capacities to anticipate and plan for the change instead of just waiting for the change and respond to it. The objective of risk management is not to disallow or forestall risk taking activity, but to guarantee that the risks are consciously taken with full knowledge, clear purpose and understanding so that it can be measured and mitigated.

Functions of risk management should actually be bank specifically dictated by the size and nature of the balance sheet. Risk

Management Committee, Credit Policy Committee, Asset Liability Committee, and so forth are formed committees mainly to handle the risk management aspects. The banks can take risk more precisely, anticipates adverse changes and hedges accordingly; it becomes a source of competitive advantage, as it can offer its products at a superior price than its competitors. Regarding the use of risk management tools, it is found that internal rating system and risk adjusted rate of return on capital are necessary. There has been a continuous decrease in the time period considered to declare a loan as non-performing. The continuous decrease in the time period is to bring the Indian banking norms at par with international norms. This move will certainly reduce the NPAs and in turn improve the asset quality of the banks.

SUGGESTIONS

- The bank should create different kinds of strategy for doing hedging it should be depended on following parameters like risk component, risk tolerance, to plan and execute the strategy.
- The bank should do proper document verification of customer as prescribed by RBI guidelines to avoid risk for non-payment.
- For practicing a hedging different kind of tools should be used like Statutory Liquidity Rate (SLR), Cash Reserve Ratio (CRR), Forwards, Futures, Swaps etc.
- For reducing the NPAs Banks should focus more on priority sector.
- Banks should ensure the credibility of the borrower is properly investigated before approving the loan.
- Banks should find out the original reasons/purposes of the loan required by the borrowers.
- Proper investigation regarding the guarantor should be checked by the banks.

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Constructs of process map for the "unified data platform" For operational intelligence and analysis of power sector

Pratik Ghosh *, Dr. Ratna Banerjee **, Dr. Vinay Kandpal***

Dr. Jacob T. Verghese****

**Power Sector Consultant at Plexus Infratech*

***Assistant Professor, CoMES, University of Petroleum & Energy Studies*

****Assistant Professor, CoMES, University of Petroleum & Energy Studies*

*****Chairman, Steag Energy Services India Private Limited*

Abstract

With today's modern and advanced technology, there are numerous infrastructure, technologies and systems available to control, operate and design the power sector network. The network spreads across the generation, transmission, distribution, trading and associated up-streams and down-streams. Globally this is managed by independent models and systems for each sub-sector of the value chain.

Each node and link in the network produces huge amount of data within the system and applications in the silos.

Purpose

The purpose of this paper is to suggest a process map for unification of this data across silos for analysis and use it for operational intelligence in the power sector. Due to modernization and the need to reduce downtime it has become inevitable to have integration between the various systems and manage the intricate process that is core for the sector.

This 'unified data framework' can bring better performance, reliability and analysis of the sector as a whole. The data thus unified can be analysed for fault diagnosis, financial implications, operational intelligence, risk minimization, delays avoidance, performance improvement, overall optimization of the sector etc.

Design methodology and approach

To have a robust and scalable "unified Data Framework" it is necessary to develop the constructs of the process map for addressing the gaps. The Software Requirement Specifications (SRS) of the Process Map was developed using tools like Microsoft-Visio and Unified Modelling Language and validated by experts regarding the use cases. This paper brings out the

necessary design aspects of a unified data framework at utility level which will represent the complex power sector model, the integration of technology and available systems for management, operation and maintenance.

Practical implications

Analysing performance among power plants is difficult, as each power plant works within a unique context of resource, physical plant settings, and organizational goals. However, benchmarking provides indicators that allow us to examine individual circumstances and performances within groups of similarly-sized power plants.
It must be suitable for storing and performing data analytics for the legacy as well as the future applications.

Findings

Today's modern technologies in information and communication systems provide computing power which can process this humongous wave of data to extract insights for efficient operation of the power sector. The power sector is a complex structure that encompasses numerous application and data elements. A robust, secured and scalable design of a unified data platform is therefore an important requirement.
Research has shown that process mapping methodologies can be useful for management of the complex problems and enable communication between data silos.

The paper wants to emphasize that a unified data platform would be a major tool for any power sector company. The platform will be capable to analyse and optimize the subsectors individually and the power sector as a whole. The application of the paper will allow management to design, analyse, optimize and implement advanced process map of complex system in the power sector.

Keywords

Process map, big data, data, analysis, unification, unified, framework, power, transmission, distribution, generation, trading, exchange, software, application, design, specifications

Introduction

Data management, storage and analysis is critical for any industry to be sustainable and develop in accordance to the external business environment and continuous changes.

Today smart power systems are generating huge volume of data which has changed the dynamics on how business process and analytics is done. Power sector is a massive producer of time-based or telemetry data which are

mission critical from generation, transmission, distribution, trading and other relevant data sources. There are various applications available in the silos of power sector which are generating data of various formats and nature.

As this data becomes huge and complex, the storage as well as the processing becomes crucial. More sensors are deployed across the power sector that produces heterogeneous data which are then collected at various levels.

The existing and legacy systems must be upgraded to handle the data storage and management. Add to that the new generation smart grids with automation system having numerous sensors embedded in the existing power system for controlling and monitoring.

The volume, the variety, the variability, the velocity of heterogeneous data collected from these sensors has all the characteristics to qualify as Big Data. With the availability of low cost storage and processing devices, it has now become possible to get data at small time buckets for further analysis.

We can capture time streaming data from devices for interpretation current system or to predict future events with higher accuracy. The grid can become more intelligent by processing and deriving information from the data.

Sources of data in power sector

In power sector, electricity is generated from different sources like coal, water, biomass, tides, wind, solar, nuclear etc. The generated power is then fed to transmission lines and transmitted to substations. Substations then distribute the power for real time consumption.

The power is then distributed to be consumed by Residential, Commercial, Industrial, Transportation, Emergency services and governmental services, etc. Smart and connected meters at customer end points broadcast utilization data to the service providers at regular interval of period.

IP-based smart meters and appliances enable the data flow in grid in more fast and efficient way. At each interconnect, there are controlling and monitoring tools which are generating real time data of the grid, substation and the power state.

The power sector data network

Power companies today cater to large regional or national networks with millions of customers having diverse requirements. Traditionally the power systems are sub divided into generation, transmission, distribution and trading networks.

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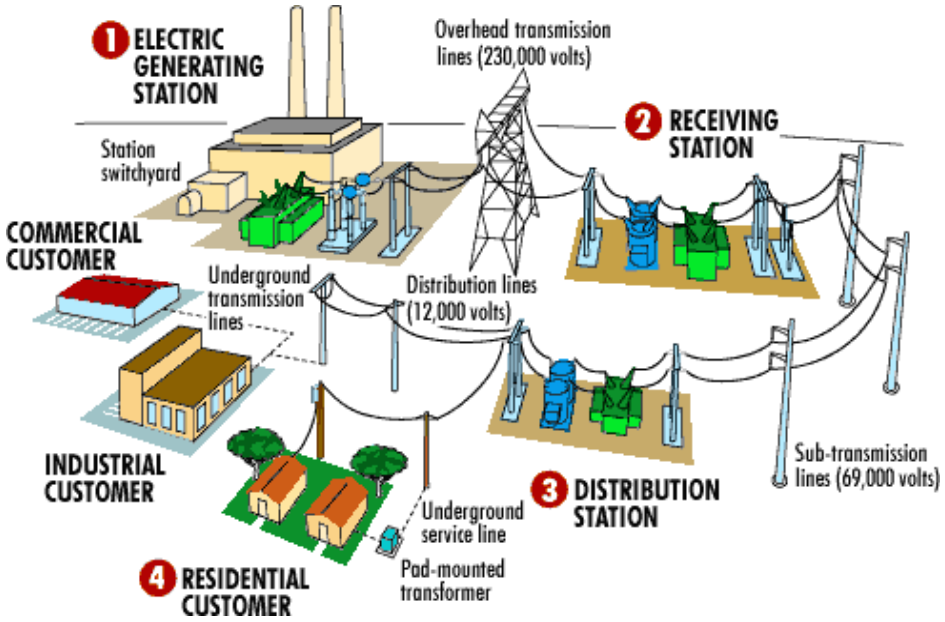


Fig. 1: A typical power sector structure.

A local power station serves one region and subdivided into numerous districts. The power station is then connected to the districts by the substations. Power supply spread in a tree like structure from the station to the customers and different types of sub stations. Large industries have dedicated lines from their industry to the power station. The above scenario brings out the sub sectors of the system as power Generation; Transmission; Distribution and Trading networks. We start with a little background of the Indian power sector as below.

Overview of Power Generation

Ministry of Power (MoP) has ambitious plan with multiple objectives, like sufficient energy, power reliability, quality, minimizing cost of energy and commercial viability of power industry.

India has a range of generation companies catering from regional to local level. Regional level has central owned plants like NTPC, NHPC and NPC etc. Private companies at regional level act as ultra-mega power plants (UMPP) and independent power producers (IPP). These inject their generation in the regional power pool through the central transmission utilities.

At state level the state owned gencos inject their generation into the state power pools via the state transmission utilities. And at local level all the sources of distributed generation, renewable energy sources are listed.

** On 31st March 2016, it was 302.08 GW as per data from Central Electricity Authority. As of 21st November 2016, the total installed power generation is 307.28 GW as per data from Ministry of Power. We can see that the growth is continuous and increasing month by month. Total capacity is the sum of utilities, captive power plants and non-utilities. We can very well understand the amount of data the power system is adding every month.

www.cea.nic.in/reports/monthly/installedcapacity/2016/installed_capacity-03.pdf

REVISED

ALL INDIA INSTALLED CAPACITY (IN MW) OF POWER STATIONS
(As on 31.03.2016)
(UTILITIES)

Region	Ownership/ Sector	Modewise breakup							Grand Total
		Thermal				Nuclear	Hydro	RES * (MNRE)	
		Coal	Gas	Diesel	Total				
Northern Region	State	17038.00	2879.20	0.00	19917.20	0.00	7502.55	661.56	28081.31
	Private	16606.00	108.00	0.00	16714.00	0.00	2478.00	7968.57	27160.57
	Central	12000.50	2344.06	0.00	14344.56	1620.00	8266.22	0.00	24230.78
	Sub Total	**45644.50**	**5331.26**	**0.00**	**50975.76**	**1620.00**	**18246.77**	**8630.13**	**79472.66**
Western Region	State	22800.00	2993.82	0.00	25793.82	0.00	5480.50	311.19	31585.51
	Private	36455.00	4288.00	0.00	40743.00	0.00	447.00	15003.73	56193.73
	Central	12898.01	3533.59	0.00	16431.60	1840.00	1520.00	0.00	19791.60
	Sub Total	**72153.01**	**10815.41**	**0.00**	**82968.42**	**1840.00**	**7447.50**	**15314.92**	**107570.84**
Southern Region	State	16882.50	556.58	362.52	17801.60	0.00	11558.03	506.45	29866.08
	Private	7670.00	5557.50	554.96	13782.46	0.00	0.00	17647.67	31430.13
	Central	11890.00	359.58	0.00	12249.58	2320.00	0.00	0.00	14569.58
	Sub Total	**36442.50**	**6473.66**	**917.48**	**43833.64**	**2320.00**	**11558.03**	**18154.12**	**75865.79**
Eastern Region	State	7540.00	100.00	0.00	7640.00	0.00	3168.92	225.11	11034.03
	Private	8731.38	0.00	0.00	8731.38	0.00	195.00	250.28	9176.66
	Central	14351.49	90.00	0.00	14441.49	0.00	925.20	0.00	15366.69
	Sub Total	**30622.87**	**190.00**	**0.00**	**30812.87**	**0.00**	**4289.12**	**475.39**	**35577.38**
North Eastern Region	State	60.00	445.70	36.00	541.70	0.00	382.00	254.25	1177.95
	Private	0.00	24.50	0.00	24.50	0.00	0.00	9.47	33.97
	Central	250.00	1228.10	0.00	1478.10	0.00	860.00	0.00	2338.10
	Sub Total	**310.00**	**1698.30**	**36.00**	**2044.30**	**0.00**	**1242.00**	**263.72**	**3550.02**
Islands	State	0.00	0.00	40.05	40.05	0.00	0.00	5.25	45.30
	Private	0.00	0.00	0.00	0.00	0.00	0.00	5.85	5.85
	Central	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Sub Total	**0.00**	**0.00**	**40.05**	**40.05**	**0.00**	**0.00**	**11.10**	**51.15**
ALL INDIA	State	64320.50	6975.30	438.57	71734.37	0.00	28092.00	1963.81	101790.18
	Private	69462.38	9978.00	554.96	79995.34	0.00	3120.00	40885.57	124000.91
	Central	51390.00	7555.33	0.00	58945.33	5780.00	11571.42	0.00	76296.75
	Total	**185172.88**	**24508.63**	**993.53**	**210675.04**	**5780.00**	**42783.42**	**42849.38**	**302087.84**

powermin.nic.in/en/content/power-sector-glance-all-india

MINISTRY OF POWER

सत्यमेव जयते

Generation | Transmission | Distribution | Rural Electrification | Energy Efficiency | Research & Training | Power for All

GARV DASHBOARD | Vidyut PRAVAH | NATIONAL UJALA DASHBOARD | DEEP e-Bidding Portal | Tarang

Power Sector at a Glance ALL INDIA

As on 21-11-2016
Source: OM SECTION

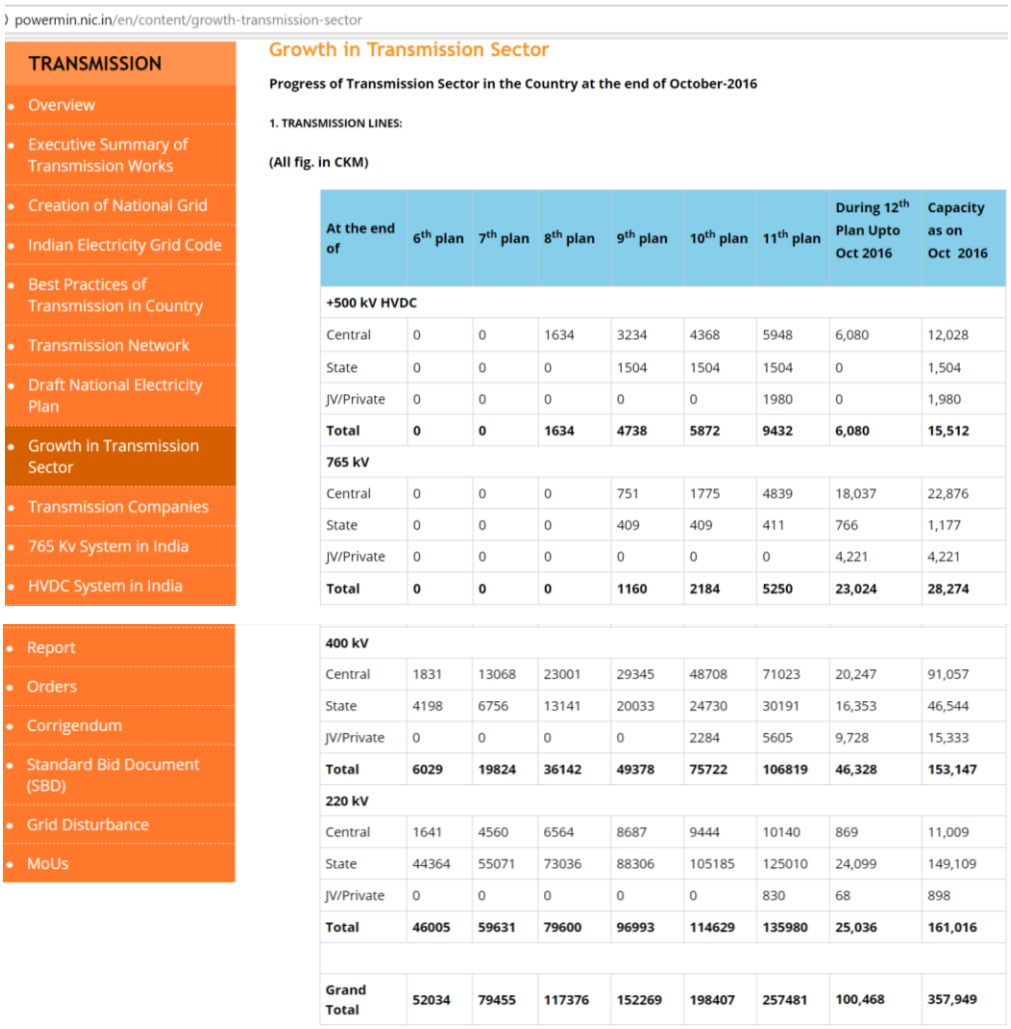
1.Total Installed Capacity:(As on 31.10.2016)

Sector	MW	% of Total
State Sector	101,472	33.02%
Central Sector	76,182	24.79%
Private Sector	129,624	42.18%
Total	307,278	

Overview of Power Transmission

India has a hierarchical transmission system where Powergrid Corporation of India Limited (PGCIL) is the central transmission utility (CTU) and at the regional and national level, independent state transmission utilities (STUs) are there for each state.

** Installed transmission (circuit km) and distribution capacity (MVA) up to end March 2015 was 313,437 circuit kilometers (CKM) of high voltage HVAC and HVDC transmission network. The same transmission sector has expanded to 357,949 CKM as on October 2016. Again, the growth is visible and India needs to work towards achieving a national grid which can supply power throughout the nation.



powermin.nic.in/en/content/growth-transmission-sector

TRANSMISSION

- Overview
- Executive Summary of Transmission Works
- Creation of National Grid
- Indian Electricity Grid Code
- Best Practices of Transmission in Country
- Transmission Network
- Draft National Electricity Plan
- Growth in Transmission Sector
- Transmission Companies
- 765 Kv System in India
- HVDC System in India

- Report
- Orders
- Corrigendum
- Standard Bid Document (SBD)
- Grid Disturbance
- MoUs

Growth in Transmission Sector

Progress of Transmission Sector in the Country at the end of October-2016

1. TRANSMISSION LINES:

(All fig. in CKM)

At the end of	6th plan	7th plan	8th plan	9th plan	10th plan	11th plan	During 12th Plan Upto Oct 2016	Capacity as on Oct 2016
+500 kV HVDC								
Central	0	0	1634	3234	4368	5948	6,080	12,028
State	0	0	0	1504	1504	1504	0	1,504
JV/Private	0	0	0	0	0	1980	0	1,980
Total	**0**	**0**	**1634**	**4738**	**5872**	**9432**	**6,080**	**15,512**
765 kV								
Central	0	0	0	751	1775	4839	18,037	22,876
State	0	0	0	409	409	411	766	1,177
JV/Private	0	0	0	0	0	0	4,221	4,221
Total	**0**	**0**	**0**	**1160**	**2184**	**5250**	**23,024**	**28,274**
400 kV								
Central	1831	13068	23001	29345	48708	71023	20,247	91,057
State	4198	6756	13141	20033	24730	30191	16,353	46,544
JV/Private	0	0	0	0	2284	5605	9,728	15,333
Total	**6029**	**19824**	**36142**	**49378**	**75722**	**106819**	**46,328**	**153,147**
220 kV								
Central	1641	4560	6564	8687	9444	10140	869	11,009
State	44364	55071	73036	88306	105185	125010	24,099	149,109
JV/Private	0	0	0	0	0	830	68	898
Total	**46005**	**59631**	**79600**	**96993**	**114629**	**135980**	**25,036**	**161,016**
Grand Total	**52034**	**79455**	**117376**	**152269**	**198407**	**257481**	**100,468**	**357,949**

Overview of Power Distribution

The restructuring of Indian state electricity boards has brought into picture numerous public and private distribution utilities. These distribution utilities (discoms) are at the fore front of power distribution to end consumers. Lot of focus and new policies have been implemented like:

- Integrated Power Development Scheme (IPDS)
- Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY)
- National Electricity Fund (NEF)
- Financial Restructuring Scheme

The objectives of the various schemes are:

- Strengthening of sub-transmission and distribution networks in the urban areas;
- Metering of distribution transformers / feeders / consumers in the urban area.
- IT enablement of distribution sector and strengthening of distribution network
- Separation of agriculture and non-agriculture feeders
- Strengthening of sub-transmission and distribution networks in the rural areas;
- Metering of distribution transformers / feeders / consumers in the rural area.
- Rural Electrification

The bottlenecks and challenges

The systems in silos today perform tasks like performance analysis, energy management systems, remote monitoring, maintenance management, fault diagnostics, network and protection management etc.

- All these systems are data dependent and require communication of data between the independent systems. The analysis of data becomes very complex if carried out in the silos.
- The challenge that the smart-grid and modern power plant management systems or energy management systems (EMS) face today are the complexity of numerous disconnected network and their management on numerous platform which act in silos whereas the activities in a power system depend upon information relating to the state of the power network and their interconnection.
- Individual tools, software and models record existing network elements in power sector and it's infrastructure layers. Records are kept for generation, transmission and distribution equipment in their respective silos.
- This distributed data approach has disadvantages when it comes to real network integration as independent system use diverse models and standards which make the overall network management difficult.
- Energy management is not accurate due to disconnected models and data. This also increases the data inconsistencies which result from the disconnected or duplication of information in different silos.

These disadvantages may be attributed to the fact that the data is in silos and different system and is difficult to combine for unified management. The advanced networking and communication protocols and systems allow complex systems to be integrated for operation, controlling, management and monitoring.

The solution

The easy availability of high speed and less expensive computers today which present the new possibilities for the power utilities to use advanced computer based performance analysis, optimisation strategies, thermodynamic and electrical model designing and development of robust energy management systems. The modern system use methodologies ranging from artificial intelligence to neural networks to expert systems.

The problem demands a data framework which can handle both data and the processing capabilities required for data analysis across various stakeholders of the power sector. A data framework designed to store, manage and analyze the humongous data to reveal the knowledge of unseen patterns which are hidden in these datasets and utilize them for making strategic, tactical and operational decisions.

The proposal

Methodology

The process map for the Unified Data Framework is the base on which the system can be developed using models. The process map is based upon the real-life scenarios and organisation principles. The data must be designed and defined so that it can be used for classification, abstraction, association and aggregation as a whole or part of the larger structure.

These guidelines are applied to create the process map. To define the process map, the sector and its sub sectors need to be analysed to identify objectives and define the relationships or association between them.

The Process Map

Individual systems available in silos record huge data in layers. Independent data records are available for generation, transmission, distribution and trading sub sector. The data in silos have disadvantages though data management system is available within the sub sector. The diverse systems and network management is difficult as they are not coordinated due to disconnected systems and data management.

These also can lead to inconsistencies in records like duplication of information etc. It does not allow the analysis and diagnosis of the diverse activities to evaluate the sector as a whole. These disadvantages are primarily due to separate systems and data management which cannot be unified for management decisions.

A unified platform would not only increase the operation of the individual network but will provide an integrated and

unified system to manage the technologies and infrastructure layers.

The available systems are 'customized' for specific process management and therefore have specialised data abstractions. However, each of the application available in silos is based on the real-world network. This makes it possible to design a unified platform which supports the individual applications based on the sector specific structure. The baseline analysis need not take into account the functionality of individual applications. This design philosophy will have the basis on overall sector functionality rather than the underlying sub sector domain. A process built around the sector structure is more stable than based upon individual functionality. The process map is designed based upon the principles of thought process of the domain experts. The domain experts will provide insight for the design of the process map. As a result, the process map will be modular and resemble the real-world power sector scenario.

Detailed analysis of the sector as a whole and its sub sectors will be carried out during the initial stages. Using latest modelling techniques, the process map will be designed which closely represents the power sector as a whole.

Utilization of the Process Map

The unified framework integrates the various elements of the power sector and its activities. The process map is the base of the overall systems architecture. It defines the methods of data storage and data usage for different applications available in silos. This integrated system will have different and distributed databases. Therefore, the process map will address the design of data layers, application layers and protocols for data usage.

Constructs of the Unified Data Framework

- The basic structure of the power sector can be represented as a set of nodes and links. The nodes are individual or a group of component of the entire system. A link connects and binds these nodes together for specific relationship.
- Cross-Platform Access to Data and Analytic - To seamlessly migrate from the legacy and existing applications and have cross-platform data and analytical engines to operate as a cohesive analytic environment. This transition should be transparent and the framework should combine the power of multiple analytic engines to address a business scenario.
- Include & distribute fast moving data through the ecosystems - The framework should provide an intelligent, self-reliant solution for inclusion and distribution of legacy and future data.

- Integrated hardware and application layer for speed and scale - For a powerful and ready to-run enterprise framework the system should be easy to configure and optimize. An integrated hardware and application layer will have additional benefits like ease of manageability and reliability. The framework should design keeping the existing infrastructure in mind and leverage current investments in technology and resources.

- A Unified Data Framework is proposed for the unification of the platforms which will address the activities in the power sector defined by the individual elements and their interconnection.
- The effectiveness and accuracy of the management system should have closeness to the real-world network.
- The framework should be scalable to handle the increasing customer base and numerous technologies which has increased the complexity of the energy management networks.
- A unified data framework should improve the management of the independent applications as well as integrating the numerous technologies and infrastructure available in silos.
- Current systems are customised for specific power application management and represent much specialised design and modelling. However, each of these applications in silos is based on the real-world network. It is therefore possible to build a unified data framework which supports all data, protocols and systems to replicate the power domain structure.

- The unified platform should consider the increasing customer base on one side and installation of new and independent technologies which makes the system a large and complex model. In the yester years administrators and designers had an overview of the technical requirement for the design, scalability and management of the models. But today it is much difficult a task to manage the complex systems available even in silos and add to that the problem of the increasing data that needs to be processed.
- The framework also needs to define interface for various data mining or data analysis methods like Pattern Matching, Classifications, Training and testing sets, Decision trees, Support Vector Machine (SVM), Clustering, Regression Analysis to name a few. The framework must be defined so that the legacy systems and modern systems can co-exist.
- The framework should be scalable and flexible to adapt and interface the future protocols and systems. The framework should broadly classify data into generation data, transmission data,

distribution data, consumer data and other relevant data.

- The framework should define methodology for data centre to define intelligent data networks from all aspects of the system, be it technical, commercial, operational, maintenance, collection and other stake points to make the grid more intelligent, robust and smart.
- The framework should allow users to define mechanism for filtering and cleaning the raw data to evaluate the data in necessary time buckets. These datasets will grow to hundreds of gigabytes the framework needs to be designed with power and flexibility to meet all such requirements.
- The framework should support numerous processing techniques like batch, stream, iterative processing. Thus, we require such a framework to store this vast distributed data and to perform all these types of analysis.

Data Analysis and Usage

The data can be used to extract the dynamic state of the power plant and processed for fault analysis and diagnostic system. Load forecasting for huge economic and industrial consumers can be performed as a vital part in optimizing electricity consumption. The data history and pattern analysis can be used for forecasting and prediction system. The network can be used for the demand side management and plan for future generation based on forecasts. This will help utilities save millions in revenue. The application range of intelligent output can be numerous if we design the framework adaptable and flexible for current and future requirement.

To achieve this, we not only need to upgrade or modify our existing systems in power sector but also need policy level changes to ease the flow of data across the sector. Let us all move towards a unified data framework which will support the efficient management of the power sector in India.

Conclusion

This paper brings out the necessary design aspects of a unified data framework at utility level which will represent the complex power sector model, the integration of technology and available systems for management, operation and maintenance.

The authors conclude that a unified platform would be a major tool for the power sector. The platform will be capable to analyse and optimize the subsectors individually and the power sector as a whole. The application of the unified platform will allow management to design, analyse, optimize and implement advanced process map of complex systems.

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4. *Mr. Santosh Saraf – ED Powergrid Corporation of India*
5. *Mr. Ajoy Rajoni – VP Operations Reliance Energy*
6. *Mr. Avinash Surve – IT Expert Reliance Energy Power Distribution*
7. *Mr. Sanjeev Kumar – Power Plant Simulator Expert Steag Energy Services*
8. *Mr. Debasish Patra – Power Plant Performance and Optimization Expert Steag Energy Services*
9. *Mr. Sunil Sharma – Operations Management Solar Energy Corporation of India*
10. *Mr. H Mukherjee – C&I Expert L&T Controls and Instrumentaton*
11. *Mr. Boben Anto – Thermal Power Expert and Consultant*
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Convergence of energy consumption across selected countries

Hiranmoy Roy*; Narendra N. Dalei**

**Associate Professor, CoMES, University of Petroleum and Energy Studies*

***Assistant Professor(SS), CoMES, University of Petroleum and Energy Studies*

Abstract:

This paper examines the issue of convergence of energy consumption among major selected countries as there is high degree of inequality in human development across countries. We intend (attempt) to answer an important question that whether low energy consumption countries will be able to catch up the high-energy consumption countries, using convergence analysis. Country wise energy consumption data from 2005 to2013 are used (Source: British Petroleum). From the perspective of evaluating welfare implications and redistributive policies of the policy makers and to achieve social equality, a question that arises is: Will the poor energy consuming states will be able to catch up the high energy consuming states? It is of importance to know whether distribution of income and output across states are increasingly becoming equal over time resulting in equality in energy consumption or the low energy consuming countries will remain lower for many generations and those countries are having high energy consumption will be higher forever. We propose to answer this question by using the convergence analysis which is well known in macro-economic analysis. Economists employed convergence analysis to find answer of similar question of growth convergence, human development convergence, and income convergence between nations. Though economists were interested for these issues many decades, during 1980's only the convergence question attracted the attention of economists and econometrician. However, for energy consumption, convergence analysis one has to consider the countries as the relevant units of analysis. Our results of convergence analysis cast doubt on the hypothesis that low energy consumption countries are actually growing at a faster rate than high energy consumption countries leading to convergence in terms of energy consumption.

JEL Classification Code: O40, C50

Keywords: Energy consumption, Convergence, Economic growth

1. Introduction

The degrees of inequality in energy consumption across countries are in sharp contrast to each other. "Regional disparity in energy consumption is often a source of economic and political tension and dissatisfaction. Although theory and measurement of such disparities never received adequate attention globally. What is disturbing is very often the choices are made without proper validation and verification of inequality in energy consumption theories (Qiaosheng Wu Svetlana Maslyuk and Valerie Clulow, 2016) in global context.

Of late, the theory finding favour among policy makers is that energy consumption is one of the prime determinant of economic growth and disparity, the distribution of 2007 energy consumption under energy consumption-based equity criterion was studied by the authors. Based on these criteria, the Gini coefficient was 0.50. Top 10 countries in terms of energy consumption include: Qatar, Iceland, United Arab Emirates, Bahrain, Trinidad and Tobago, Kuwait, Luxembourg, Canada, United States and Brunei Darussalam. These countries harbour 5.52 % of the world's population, and use 24.06 % of the world's energy. The distribution of energy resources may result in significant social, environmental and economic inequalities (Jacobson et al., 2005). A critical issue faced by policy makers across the world is how to distribute the costs and benefits through policies designed to address such problems. This study argues that energy consumption has a distinct and critical social dimension.

The authors (Mishra, Binod and Russel Smith, 2014) test for convergence in energy consumption per capita among ASEAN countries over the period 1971 to 2011 using the panel KPSS stationarity test and panel Lagrange multiplier (LM) unit root test. The results for the panel stationarity and unit root tests with structural breaks find support for energy convergence in ASEAN.

One study on energy consumption convergence (Anoruo, Emmanuel and William R. DiPietro, 2014) applies a battery of panel unit root procedures to test for convergence in per capita energy

consumption among 22 African countries. Specifically, the study implements both the conventional panel unit root testing procedures and the Sequential Panel Selection Method (SPSM). The results from the standard panel unit root tests provide evidence of convergence in per capita energy consumption for the 22 countries as a group.

A question that naturally arises is: Will the low energy consuming countries be able to catch up the high energy consuming countries? It is of importance to know whether distribution of income and output across states are increasingly becoming equal over time resulting in equality in energy consumption or the low energy consuming countries will remain lower for many generations and those countries are having high energy consumption will be higher forever.

We propose to answer this question by using the convergence analysis which is well known in macro-economic analysis. Economists employed convergence analysis to find answer of similar question of growth convergence, human development convergence, and GDP convergence between nations or regions within a country (Martin, Xavier Sala-i 1995, Roy, H and Kaushik Bhattacharjee 2009). Though economists were interested for these issues many decades, during 1980's only the convergence question attracted the attention of economists and econometrician. It is imperative to discuss first the classical approach to convergence analysis. This methodology is classical in its approach because it uses the traditional techniques of classical econometrics, a characteristics shared by almost all the alternative approaches. Like other classical theories it is the basis of reference and target of criticism of other methodologies. It is also like classical theories has survived and will keep surviving the challenges of modern age.

In line with this the paper seek to explore convergence of energy consumption for major selected countries. The remaining part of the paper is as follows. Section 2 describes methodology used in the paper. Descriptive data analysis is presented in section 3 followed by result and discussion on convergence analysis in section 4. At last section 5 concludes the study.

Methodology of Convergence Analysis of Energy Consumption

We estimate the following regression equations for testing the convergence of energy consumption as mentioned in the convergence literature:

$$ECGR_{2012-13} = \beta_1 - \beta_2 \ln EC_{2009} - \beta_3 \ln EC_{2010} - \beta_4 \ln EC_{2011} - \beta_5 \ln EC_{2012} + \varepsilon_{i1} \quad (1)$$

$$ECGR_{2011-13} = \beta_1 - \beta_2 \ln EC_{2009} - \beta_3 \ln EC_{2010} - \beta_4 \ln EC_{2011} - \beta_5 \ln EC_{2012} + \varepsilon_{i2} \quad (2)$$

$$ECGR_{2010-13} = \beta_1 - \beta_2 \ln EC_{2009} - \beta_3 \ln EC_{2010} - \beta_4 \ln EC_{2011} - \beta_5 \ln EC_{2012} + \varepsilon_{i3} \quad (3)$$

$$ECGR_{2009-13} = \beta_1 - \beta_2 \ln EC_{2009} - \beta_3 \ln EC_{2010} - \beta_4 \ln EC_{2011} - \beta_5 \ln EC_{2012} + \varepsilon_{i4} \quad (4)$$

Where, $\ln EC$ is the natural logarithm of energy consumption of given countries.

$ECGR_{2009-13} = (\ln EC_{2013} / \ln EC_{2009}) / 4$, is the growth rate of energy consumption of any country between 2009 and 2013 and so on.

Going by the classical convergence analysis, if we find $\beta > 0$, we say that the data set exhibit absolute beta convergence. The second condition for convergence is that $\sigma_{t+T} < \sigma_t$ where σt is the standard deviation of energy consumption.

Descriptive Data Analysis

A cluster analysis of our sample based on energy consumption supports our claim of methodology. We found three clusters of countries as per existing notion and belief as we can classify them as low energy consumption countries, medium energy consumption countries and high energy consumption countries. This is shown in Table- A, B and C below respectively.

Table-A Cluster of States-I

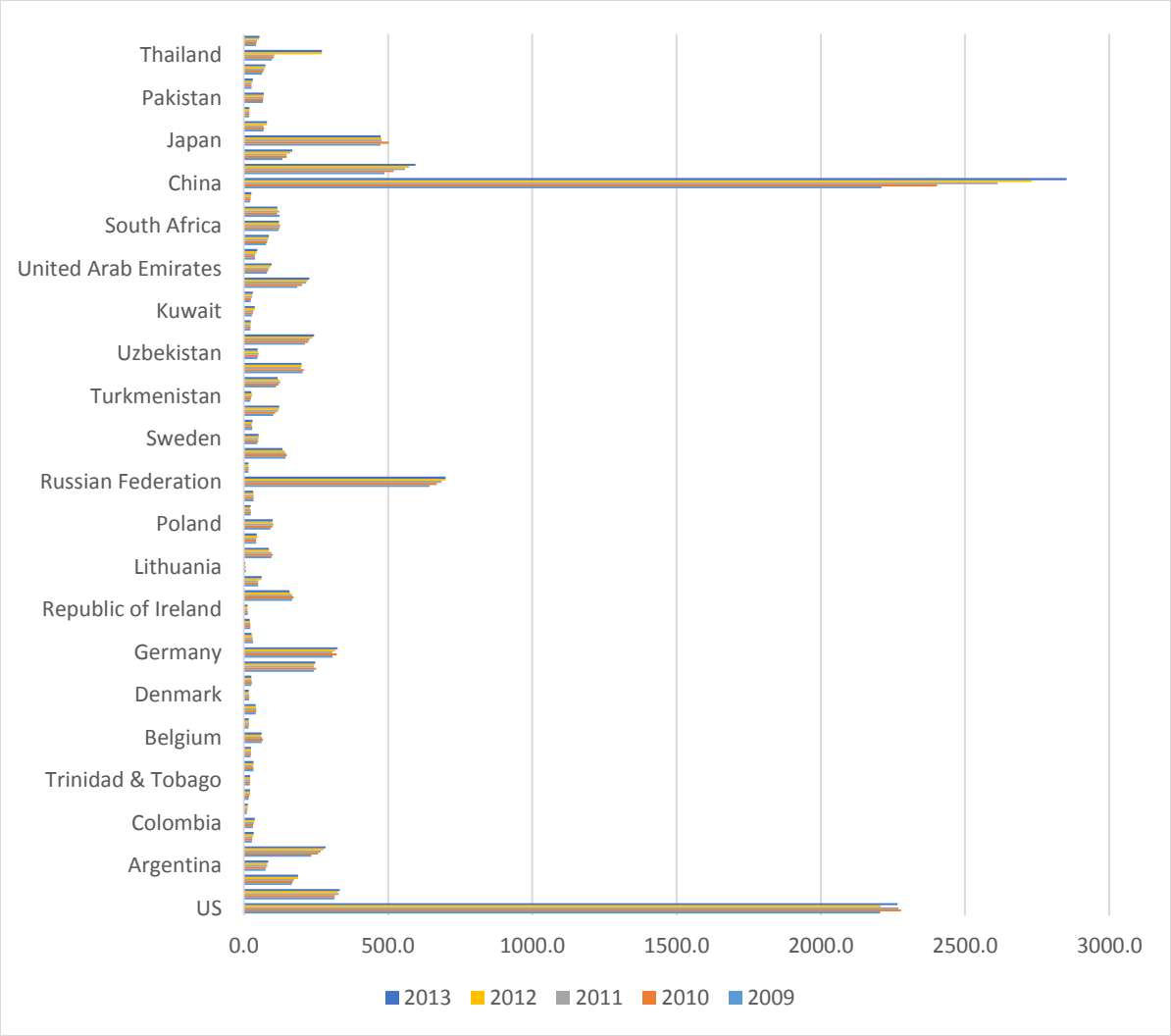
Sl. No.	Country	Energy Consumption Growth rate of last 4 year (2009-2013)	% Growth
1.	Thailand	-0.25383	-25.38
2.	Kuwait	-0.07141	-7.14
3.	Peru	-0.06758	-6.76
4.	Qatar	-0.06749	-6.75
5.	Vietnam	-0.0641	-6.41
6.	China	-0.06376	-6.38
7.	Ecuador	-0.06186	-6.19
8.	Indonesia	-0.05836	-5.84
9.	Kazakhstan	-0.05308	-5.31
10.	Saudi Arabia	-0.0505	-5.05
11.	India	-0.04975	-4.98
12.	Brazil	-0.0481	-4.81
13.	Colombia	-0.04801	-4.80
14.	Chile	-0.04642	-4.64
15.	United Arab Emirates	-0.04641	-4.64
16.	Singapore	-0.04435	-4.44
17.	Turkey	-0.04433	-4.43
18.	Bangladesh	-0.04292	-4.29
19.	Algeria	-0.0405	-4.05
20.	Malaysia	-0.04031	-4.03
21.	Turkmenistan	-0.03863	-3.86
22.	Philippines	-0.03809	-3.81
23.	Iran	-0.0343	-3.43
24.	Mexico	-0.03012	-3.01
25.	Egypt	-0.02989	-2.99
26.	Argentina	-0.0295	-2.95
27.	Russian Federation	-0.02033	-2.03

Table B: Cluster of States-II

Sl. No.	Country	EC Growth rate of last 4 year (2009-2013)	% Growth
1.	Poland	-0.01985	-1.98
2.	Sweden	-0.01966	-1.97
3.	Trinidad & Tobago	-0.01798	-1.80
4.	Canada	-0.01462	-1.46
5.	Germany	-0.01389	-1.39
6.	Belarus	-0.01284	-1.28
7.	Ukraine	-0.0114	-1.14
8.	Israel	-0.0103	-1.03
9.	Pakistan	-0.00988	-0.99
10.	New Zealand	-0.00952	-0.95
11.	Slovakia	-0.00794	-0.79
12.	US	-0.0067	-0.67
13.	Norway	-0.00612	-0.61
14.	Uzbekistan	-0.00479	-0.48
15.	France	-0.00443	-0.44
16.	Switzerland	-0.00391	-0.39
17.	South Africa	-0.00283	-0.28
18.	Bulgaria	-0.00267	-0.27
19.	Austria	-0.00175	-0.17
20.	Czech Republic	-0.00096	-0.10

Table C: Cluster of States-III

Sl. No.	Country	EC Growth rate of last 4 year	% Growth
1.	Japan	-1.7E-06	0.00
2.	Belgium	0.003967	0.40
3.	United Kingdom	0.004529	0.45
4.	Finland	0.005981	0.60
5.	Romania	0.006963	0.70
6.	Portugal	0.008978	0.90
7.	Denmark	0.010046	1.00
8.	Italy	0.014257	1.43
9.	Australia	0.016036	1.60
10.	Republic of Ireland	0.01958	1.96
11.	Spain	0.020587	2.06
12.	Netherlands	0.024441	2.44
13.	Hungary	0.027374	2.74
14.	Greece	0.049067	4.91
15.	Lithuania	0.086158	8.62



In Table D we provide some of the descriptive statistics for the data of energy consumption of selected countries.

Table D: Descriptive Statics:

Countries	Mean	St.Dev.	Min.	Max.
US	2245.4	35.37	2205.9	2277.9
Canada	324	8.61	314	332.9
Mexico	177.4	10.17	166.6	188.5
Argentina	80.2	3.91	75.1	84.5
Brazil	263.8	19.17	234.3	284
Chile	31.5	2.72	28.8	34.6
Colombia	34.8	2.74	31.3	38
Ecuador	13.3	1.3	11.5	14.7

Countries	Mean	St.Dev.	Min.	Max.
Slovakia	16.5	0.51	16	17.1
Spain	143	5.96	133.7	149.2
Sweden	50.7	2.42	47.2	54
Switzerland	29.1	0.96	27.6	30.2
Turkey	115.2	8.95	102.8	122.8
Turkmenistan	26.3	2.72	22.6	29.9
Ukraine	120	5.39	112.2	126.4
United Kingdom	202.5	4.16	198.2	209

Peru	19.9	2.19	16.6	21.8	Uzbekistan	49	2.03	46.9	52.2
Trinidad & Tobago	21.6	0.64	20.5	22.1	Iran	229.4	12.46	212.6	243.9
Austria	33.8	1.22	32	35.4	Israel	23.9	0.6	23.3	24.8
Belarus	25	0.59	24	25.5	Kuwait	34	4.04	28.4	38
Belgium	62.8	2.25	60.3	66.3	Qatar	28	3.02	24.2	31.8
Bulgaria	17.8	0.91	16.9	19.2	Saudi Arabia	210.7	16.66	186	227.7
Czech Republic	42.7	0.97	41.8	44	United Arab Emirates	88.4	6.78	80.6	97.1
Denmark	18.5	0.88	17.2	19.6	Algeria	42.1	3.44	38.6	46.6
Finland	27.2	1.12	26.1	28.9	Egypt	83	4.34	77	87.6
France	246.5	3.61	242.9	251.8	South Africa	123.3	2.03	121	126.3
Germany	315.7	8.49	306.4	325	Australia	119.2	4.07	115	123.7
Greece	30.4	2.26	27.2	33.1	Bangladesh	24.7	1.66	22.5	26.7
Hungary	22.2	1.13	20.4	23.4	China	2562	257.17	2210.3	2852.4
Republic of Ireland	13.8	0.61	13.2	14.4	India	547.1	42.92	487.6	595
Italy	166.3	5.5	158.8	173.1	Indonesia	152	13.45	133.6	168.7
Kazakhstan	54.7	6.12	50.2	62	Japan	481.3	12.25	474	503
Lithuania	6.4	0.9	5.7	8	Malaysia	74.1	6.07	69	81.1
Netherlands	93.5	5.7	86.8	100.5	New Zealand	19.5	0.29	19.1	19.8
Norway	44.5	2.2	42.1	47.9	Pakistan	68.2	1.1	66.9	69.6
Poland	98.6	3.88	92.3	102.8	Philippines	28.8	2.2	26.7	31.8
Portugal	24.1	1.23	22.2	25.5	Singapore	70.3	4.91	63.4	75.7
Romania	34.1	0.66	33	34.8	Thailand	170.2	92.2	98.3	271.3
Russian Federation	679.4	23.23	644.4	699.3	Vietnam	47.7	5.43	42.1	54.4

We observe that Lithuania, Ecuador and Republic of Ireland are having lowest energy consumption while U.S. and China are having highest energy consumption. Minimum. Also the standard deviation of energy consumption is highest in China, U.S. and lowest in Belarus and Republic of Ireland. Similarly the mean value of energy consumption is highest in U.S. and Chile while lowest in Lithuania and Ecuador.

Results of Convergence Analysis of Energy Consumption

We have estimated four growth model considered energy consumption growth rate (ECGR) for four-time periods viz. 2012-13, 2011-13, 2010-13 and 2009-13 as dependent variables. In each model, natural log of energy consumption is taken as explanatory variables, results of which are shown in Table E.

Table E: Result of Beta Convergence

	Model-I	Model-II	Model-III	Model-IV
	$ECGR_{2012-13}$	$ECGR_{2011-13}$	$ECGR_{2010-13}$	$ECGR_{2009-13}$
lnEC_12	-0.00444 (0.037605)	-0.50222*** (0.018803)	0.334814*** (0.012535)	-0.25111*** (0.009401)
lnEC_11	-0.04544 (0.115946)	0.47728*** (0.057973)	0.015147 (0.038649)	-0.01136 (0.028987)
lnEC_10	-0.10874 (0.145549)	-0.05437 (0.072775)	-0.29709*** (0.048516)	-0.02718 (0.036387)
lnEC_9	0.154219* (0.090666)	0.077109* (0.045333)	-0.05141* (0.030222)	0.288555*** (0.022667)
_CONS	0.023022 (0.017796)	0.011511 (0.008898)	-0.00767 (0.005932)	0.005756 (0.004449)
Number of obs	62	62	62	62
F(4, 57)	1.42	186.49	0.000	289.94
Prob > F	0.2383	0.000	0.000	0.000
R-squared	0.0907	0.929	0.9404	0.9532
Adj R-squared	0.0269	0.924	0.9362	0.9499
Root MSE	0.03837	0.01918	0.01279	0.00959

Model-I in Table E shows that there is beta convergence for energy consumption for the year 2009 because the coefficient of lnEC_9 is positive and significant at 10% level. Considering Model II in Table 4 we find that coefficient of lnEC_11 and lnEC_9 are positive and significant which indicate beta convergence. If we consider Model III of Table E, we find that there is beta convergence as coefficient of lnEC_12 is positive and significantly affecting energy consumption growth rate at 1% level of significance. Similarly, Model IV in Table E also exhibits beta convergence because coefficient of lnEC_9 is positively and statistically significantly affecting energy consumption growth rate at 1% level of significance other things remaining constant. Since in majority of the models except Model III, coefficient of lnEC_9 is positive and statistically and significantly affecting respective energy consumption growth rates so the necessary condition for beta convergence is fulfilled.

Table F: Result of Sigma Convergence

	EC_2013	EC_2009
Nubmer of obs	62	62
Mean	191.282	168.856
Std. Deviation	460.1134	395.2454
Variance	211704.318	156218.959
Skewness	4.843	4.674
Std. Error of Skewness	.304	.304
Minimum	5.7	8.0
Maximum	2852.4	2210.3
$\sigma_{EC\_2013} > \sigma_{EC\_2009}$		

Results of Sigma Convergence in Table F reveal that $\sigma_{EC\_2013} > \sigma_{EC\_2009}$. Thus, sufficient condition for convergence hypothesis does not fulfill. Thus, it has been concluded that energy consumption growth rate for major selected countries may take some more time to converge. This may be due to geo-politics of energy, political instability of countries, divergence in economic growth and economic slowdown and unsuccessful implementation of global greenhouse gas emission mitigation policy by global communities.

Conclusion:

We have estimated four growth model considered energy consumption growth rate (ECGR) for four-time periods viz. 2012-13, 2011-13, 2010-13 and 2009-13 as dependent variables.

In Model-I we observe beta convergence for energy consumption for the year 2009. Considering Model II we find beta convergence of energy consumption coefficient for the year 2011 and 2009. If we consider Model III we find that there is beta convergence of energy consumption for the year 2012. Model IV also exhibits beta convergence because coefficient for the year 2009. Since in majority of the models except Model III, we observed beta convergence of energy consumption for the year 2009, so the necessary condition for beta convergence is fulfilled.

However, results of Sigma Convergence reveal that $\sigma_{EC\_2013} > \sigma_{EC\_2009}$. Thus, sufficient condition for convergence hypothesis does not fulfill. Thus, it has been concluded that energy consumption growth rate for major selected countries may take some more time to converge, which may be due to geo-politics of energy, political instability of countries, divergence in economic growth and economic slowdown and unsuccessful implementation of global greenhouse gas emission mitigation policy by global communities.

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Designing an Optimal Portfolio Post Implementation of 7th Pay Commission

Mr. Hitesh Punjabi*

**Finance, Chetana's Institute of Management & Research, India*

Abstract:

The Indian stock markets have surged over last 3 years; NSE Nifty has given returns of over 46.0%. The recent reforms on passage and Implementation of 7th pay commission will have positive impact on certain sectors. The implementation of 7th Pay Commission will restructured the salaries of existing central government employees. This means more disposable money in the hands of a huge number of employees serving in government and government-run units. This will result in improved demand and thus sectors like Automobile, Consumer Durables, Media, Real Estate and FMCG are likely to do well.

Portfolio construction is an important process of the investors for investment in the equity market. The focus of this research is to construct an optimal portfolio in Indian stock market in current environment with the help of the Sharpe single index model. The optimal portfolio stocks are selected from Nifty Auto Index, Nifty FMCG Index, Nifty India Consumption Index, Nifty Media and Nifty Reality Index. A good combination of portfolio will give maximum return for a level of risk. The results of the present study and such micro level studies have more utility value to the investors and fund managers.

Keywords: 7th Pay Commission, Single Index Model, Optimal Portfolio.JEL: G02, G11, G15.

Introduction:

On September 25th 2013, Finance minister had announced 7th Pay commission which was be implemented in January 2016. The Govt employees would get higher salaries, researcher believes that this

would drive demand for discretionary items such as white goods, two wheelers, FMCG etc. Researcher believes that consumer discretionary theme such as automobiles, travel & tourism, education, lifestyle, leisure & recreation, medical services and consumer banking/ financial services sectors will show good growth going ahead. Researcher is of opinion investors should focus on these sectors to build their equity portfolio going ahead. Researcher has covered the sectors based on the back of past experience of sectors impacted by implementation of pay commissions.

Problem statement

Every investor usually is confused while selecting securities for his portfolio. He is also faces problems while deciding the proportion of investment to be made in each security. To help investors to decide in deciding optimal portfolio, researcher has used the Sharpe's Single Index model may to construct optimal portfolio. So, keeping in mind 7^{th} pay implementation the consumption driven sectors like FMCG, AUTO, Reality, Media and Consumer durables sector had been considered. Therefore, the present study is entitled as "Designing an Optimal Portfolio post implementation of 7th Pay Commission"

Objectives of the study

- To construct an optimal portfolio for investors using Sharpe's single index model by using the selected sectors (consumption sectors)
- To help investors in selecting a portfolio which would provide higher returns after considering risk?

Scope of the Study

Scope of the study is to construct the optimum portfolio across consumption driven sectors to reduce itsrisk and maximise the profits. Based on the historical performance, risk and return of those companies have been analysed and top companies have been selected for construction of portfolio.

Limitation of the Study

1. The portfolio is constructed on the basis Sharpe's model considering the stock price movements and fundamental factors of company are not taken into consideration for this study.
2. The study is limited to Consumption driven company's (Stocks and sectors) listed on NSE

Theory:

Single Index Model:

Stock prices over a period reveal that most stock prices move with the market index. When the Sensex or nifty increases, stock prices also tend to increase and vice-versa. This indicates that stock prices are linked to the market index and this relationship can be used to determine the return on stock. The following equation can be used towards this purpose:

$Ri= \alpha+\beta R_m+e_i$

Where, R_i is the expected return on security i

α is the intercept of the straight line or alpha co-efficient

β is the slope of the straight line or beta co-efficient

$R_m$is therate of return on the market index

e_i is the error term

Source: (Punithavathi, Pandian, (2001). "Security Analysis and Portfolio Management", Vikas Publishing House, pp. 355-376).

According to this equation, the return of a stock can be divided into two components, the return due to the market and the return independent of the market. βi indicates the sensitiveness of the stock return to changes in the market return.

The single index model is based on assumption that stocks vary together because of the common movement in the stock market. The expected return, standard deviation and co-variance of the single index model represent the joint movement of securities. The mean return is

$Ri= \alpha+\beta R_m+e_i$

The variance of security's return $\sigma_i = \beta_i \sigma^2_m + \sigma^2_{ei}$

The variance of the security has wo components namely, systematic risk or market risk and unsystematic risk or unique risk. The

variance explained by the index is referred to as systematic risk. The unexplained variance is called residual variance or unsystematic risk.

Systematic risk = β^2_i* variance of market index

Unsystematic risk = Total variance – systematic risk

e^2_i = σ^2_i – Systematic risk

Source: (Punithavathi, Pandian, (2001). "Security Analysis and Portfolio Management", Vikas Publishing House, pp. 355-376).

Research methodology

The study is based on secondary source and the data required for this study was obtained from the website www.nseindia.com.Quantitative research techniques are used by choosing data for the 50 companies which are part of the CNX Nifty Index. The sample size being sectors which will be impacted with implementation of 7th Pay commission, the all the stock which are part of NSE Reality Index, NSE FMCG Index, NSE Auto Index, NSE Consumption Index, NSE Media Index have been used in the research to design optimal portfolio. The stock price movement (closing price daily) from 1st April, 2013 to 9th Nov, 2016 is taken and the risk-free rate of return (Rf) is taken as 6.68% which is 10-year Government Bond as on 9th Nov 2016. The financial parameters like β for each stock, the stock return, systematic & unsystematic risk and the Sharpe's Single Index are calculated. To determine the stocks which are to be included in the optimum equity portfolio, the cut-off point was found out to determine the inclusion of a stock in the optimal equity portfolio.

Finally, the proportion of each stock in the equity portfolio was calculated to get the values of the portfolio return, portfolio β and the portfolio variance (portfolio risk).The steps involved in finding out the stocks to be included in the optimal portfolio are as follows:

1. Find out the excess return to beta ratio for each stock under consideration

   $\frac{R_i - R_f}{\beta}$

   Where R_i = the expected return on stock i

   R_f = the return on risk-free asset

   β= the expected change in the rate of return on stock I associated with one unit change in the market return

2. Rank them from the highest to the lowest.

3. Calculate Ci for all the stocks according to the ranked order using the following formula

$$Ci=\sigma^2_m \sum_{i=1} \frac{(Ri-R_f)\,\beta}{\sigma^2_{ei}}$$

$$1+\sigma^2_m \sum \beta^2_i/\sigma^2_{ei}$$

where,

σ^2_m = variance of the market index

σ^2_{ei} = variance of a sock's movement that is no associated with the movement of market index i.e. a stock's unsystematic risk.

4. The cumulated values of Ci Start declining after a Ci and that point is taken as the cut-off point, also that stock ratio is the cut-off ratio C.

5. Construction of the Optimal Portfolio

The portfolio manager has to find out how much will be invested in each security, once the securities are selected. The percentage of funds to be invested in each security can be estimated as follows:

$$X_i = \frac{Z_i}{\sum_{i=1}^{n} Z_i}$$

$$Zi = \frac{\beta_i}{\sigma^2_{ei}} (R_i-R_f/\ \beta i) - C_i$$

Source: (Punithavathi, Pandian, (2001). "Security Analysis and Portfolio Management", Vikas Publishing House, pp. 355-376).

The first expression indicates the weights on each security and they add up to one. The second shows the relative investment in each security.

Calculation:

Fifteen companies listed under each of NSE Auto index, NSE FMCG Index and NSE Media Index have been selected for the study. Thirty companies from Nifty India Consumption Index and 10 companies from NSE Reality Index have been selected for analysis. The chosen companies belong to various consumer related sectors.

NSE Auto Index

Table 1.1 represents the list of sample companies selected for this study. The historical stock prices pertaining to the above companies from 1st April 2013 to 9th Nov 2016 were collected from www.nseindia.com. NSE Nifty50 index selected as benchmark index for the present study. Fifteen companies listed under Nifty Auto index was selected for constructing an optimal portfolio using Sharpe's Single Index Model. As a first step, the mean returns of these companies' stocks were computed.

The returns of the individual securities and market index are calculated using the following formulae:

Security Return =Current Year Security Price –Previous Year Security Price

Previous Year Security Price

To know the market risk face by each security, the beta values of company's stock returns were computed using regression method in excel and their unsystematic risk as measured by σ^2_{ei} is also computed and tabulated in the Table 1.1.

Table 1.1 depicts the excess return and excess return to beta ratio. Excess return is the difference between expected return on the stock and the risk-free rate of interest. The risk-free rate of interest is assumed to be 6.68% in this study.

Table No 1.1: Nifty Auto Index

Security	Mean Return	Excess Return (Ri-Rf)	Beta	Unsystematic Risk	Excess return to beta ratio	Ranking

APOLLOTYRE	31.14	24.46	1.08	6.10	22.70	11.00
MRF	52.29	45.61	0.92	2.92	49.63	8.00
AMARAJABAT	54.33	47.65	0.72	3.98	66.02	5.00
BOSCHLTD	46.12	39.44	0.66	2.47	59.45	6.00
BHARATFORG	96.35	89.67	1.03	4.03	86.84	3.00
EICHERMOT	106.37	99.69	0.79	3.83	126.17	2.00
EXIDEIND	5.98	-0.70	0.84	2.92	-0.83	15.00
ASHOKLEY	94.33	87.65	1.19	4.94	73.91	4.00
TATAMOTORS	19.38	12.70	1.35	3.25	9.42	12.00
BAJAJ-AUTO	11.38	4.70	0.79	1.75	5.93	13.00
M&M	11.55	4.87	0.90	2.19	5.39	14.00
TVSMOTOR	132.07	125.39	0.84	6.03	148.49	1.00
MOTHERSUMI	60.39	53.71	0.98	5.32	54.99	7.00
MARUTI	48.17	41.49	0.94	2.03	44.08	9.00
HEROMOTOCO	25.74	19.06	0.81	1.98	23.42	10.00

Source: Nseindia,

Result and Discussion:

The above table (Table 1.1) shows that the TVS Motors stock has the highest excess return to beta ratio of 148.49 while that of Exide Ind stock has the lowest of -0.83. This ratio provides the relationship between potential risk and reward from a company's stock. The ranking of stocks done based on excess return to beta ratio reveals that TVSMOTOR stock ranks first, the Exide Ind stock ranks the last.

Table 1.2: Optimal Portfolio Calculation

Security	(Ri-Rf)*β/σ^2	Σ(Ri-Rf)*β/σ2	β^2/σ^2	Σβ2/σ2	Ci	Zi	Xi
TVSMOTOR	17.57	17.57	0.12	0.12	143.60	0.69	1.0
EICHERMOT	20.54	38.11	0.16	0.28	133.65		
BHARATFORG	22.97	61.08	0.26	0.55	111.12		
ASHOKLEY	21.06	82.14	0.28	0.83	98.42		
AMARAJABAT	8.64	90.78	0.13	0.96	94.03		
BOSCHLTD	10.59	101.37	0.18	1.14	88.64		
MOTHERSUMI	9.86	111.23	0.18	1.32	84.08		
MRF	14.33	125.56	0.29	1.61	77.91		
MARUTI	19.26	144.82	0.44	2.04	70.69		
HEROMOTOCO	7.85	152.67	0.34	2.38	64.05		
APOLLOTYRE	4.32	156.99	0.19	2.57	60.99		
TATAMOTORS	5.26	162.25	0.56	3.13	51.80		
BAJAJ-AUTO	2.13	164.38	0.36	3.49	47.09		
M&M	2.01	166.39	0.37	3.86	43.07		
EXIDEIND	-0.20	166.19	0.24	4.10	40.51		

Source: Nseindia,

The companies are listed in above table(Table1.2) are based on their ranks. The excess return is divided by the unsystematic risk $\sigma^2_{ei}$and multiplied by the beta in order to calculate the 'Ci' values. The Unsystematic risk is calculated using the following formula:

Unsystematic risk = Total variance – systematic risk

e^2_i $= \sigma^2_i$ – Systematic risk

Source: (Punithavathi, Pandian, (2001). "Security Analysis and Portfolio Management", Vikas Publishing House, pp. 355-376). Table 1.2 represents the Ci of all companies. The β2/ $\sigma^2_{ei}$and its cumulative are necessary for the calculation of Ci. The Ci value goes on increasing from 143.6and starts declining from 133.65. Therefore, the value of 143.6 is considered as the *'cut-off point'*. The securities which come after the cut-off point will not be considered

for the optimal portfolio construction. The Ci is calculated using the formula mentioned above.

Out of fifteen companies only one company has been selected for the optimal portfolio construction after applying single index model. Once the companies on which investment is to be made are known it is essential to know the proportion of investment to be made in each company's security. The proportion of weights to be assigned to each security in a portfolio is calculated using the above-mentioned formula:

Table 1.2 represents the proportion of investment to be made by the investor to earn maximum returns. The figure shows that 100% of investment may be made in the TVS Motor stock % in NSE Auto Index.

Nifty FMCG Index

Table 2.1 represents the list of sample companies selected for this study. The historical stock prices pertaining to the above companies from 1st April 2013 to 9th Nov 2016 were collected from www.nseindia.com. NSE Nifty50 index selected as benchmark index for the present study. Fifteen companies listed under Nifty FMCG index was selected for constructing an optimal portfolio using Sharpe's Single Index Model.

Result and Discussion:

The above table (Table 2.1) shows that the Britannia stock has the highest excess return to beta ratio of 134.22 while that of TATAGLOBAL stock has the lowest of -9.29. The ranking of stocks done based on excess return to beta ratio reveals that Britannia stock ranks first, the TATAGLOBAL stock ranks the last.

Table No 2.1: Nifty FMCG Index

Security	Mean Return	Excess Return	Beta	Unsystematic Risk	Excess return to beta ratio	Ranking
TATAGLOBAL	-2.33	-9.01	0.97	2.60	-9.29	15.00
BRITANNIA	80.33	73.65	0.55	3.24	134.22	1.00
GODREJIND	6.02	-0.66	1.08	2.82	-0.61	12.00
JUBLFOOD	4.65	-2.03	0.86	4.70	-2.36	13.00
GODREJCP	19.44	12.76	0.75	4.05	17.00	8.00
MARICO	35.82	29.14	0.42	2.56	69.51	4.00
MCDOWELL-N	14.85	8.17	0.69	4.49	11.86	10.00
DABUR	20.93	14.25	0.50	2.30	28.47	6.00
HINDUNILVR	24.37	17.69	0.53	2.26	33.37	5.00
EMAMILTD	43.64	36.96	0.49	3.78	74.86	3.00
COLPAL	12.85	6.17	0.46	1.83	13.41	9.00
UBL	6.31	-0.37	0.77	4.53	-0.49	11.00
GSKCONS	14.48	7.80	0.46	3.19	17.03	7.00
ITC	3.53	-3.15	0.79	1.97	-3.96	14.00
PGHH	46.23	39.55	0.30	1.96	132.39	2.00

Source: Nseindia,

Table No 2.2: Optimal Portfolio Calculation

Security	(Ri-Rf)*β/σ^2	Σ(Ri-Rf)*β/σ2	β^2/σ^2	Σβ2/σ2	Ci	Zi	Xi
BRITANNIA	12.47	12.47	0.09	0.09	128.64	0.74	0.66
PGHH	6.03	18.50	0.05	0.14	129.84	0.39	0.34
EMAMILTD	4.83	23.33	0.06	0.20	112.70		
MARICO	4.76	28.09	0.07	0.27	101.96		
HINDUNILVR	4.14	32.23	0.12	0.40	80.67		
DABUR	3.10	35.33	0.11	0.50	69.49		
GSKCONS	1.12	36.45	0.07	0.57	63.48		
GODREJCP	2.36	38.82	0.14	0.71	54.42		
COLPAL	1.55	40.37	0.12	0.82	48.70		
MCDOWELL-N	1.25	41.62	0.11	0.93	44.54		
UBL	-0.06	41.56	0.13	1.06	39.05		
GODREJIND	-0.25	41.31	0.42	1.48	27.91		
JUBLFOOD	-0.37	40.94	0.16	1.63	25.01		
ITC	-1.27	39.67	0.32	1.95	20.26		
TATAGLOBAL	-3.37	36.30	0.36	2.32	15.64		

Source: Nseindia,

The companies are listed in above table (Table 2.2) are based on their ranks. The excess return is divided by the unsystematic risk σ^2_{ei} and multiplied by the beta in order to calculate the 'Ci' values. The Unsystematic risk is calculated using the above-mentioned formula:

Table 2.2 represents the Ci of all companies. The β2/ σ^2_{ei} and its cumulative are necessary for the calculation of Ci. The Ci value goes on increasing from 128.64 and starts declining from 129.84. Therefore, the value of 129.84 is considered as the *'cut-off point'*.

Out of fifteen companies two companies has been selected for the optimal portfolio construction after applying single index model. Table 2.2 represents the proportion of investment to be made by the investor to earn maximum returns. The figure shows that 66% of investment may be made in the Britannia and 34% in PGHH stock in NSE FMCG Index.

Nifty Media Index

Table 3.1 represents the list of sample companies selected for this study. The historical stock prices pertaining to the above companies from 1st April 2013 to 9th Nov 2016 were collected from www.nseindia.com. NSE Nifty50 index selected as benchmark index for the present study. Fifteen companies listed under Nifty Media index was selected for constructing an optimal portfolio using Sharpe's Single Index Model.

Table No 3.1: Nifty Media Index

Security	Mean Return	Excess Return	Beta	Unsystematic Risk	Excess return to beta ratio	Ranking
EROSMEDIA	29.75	23.07	0.96	9.81	24.11	5.00
SUNTV	-0.53	-7.21	0.99	6.75	-7.25	12.00
DISHTV	12.78	6.10	1.10	4.66	5.54	9.00
TV18BRDCST	12.78	6.10	1.27	6.55	4.81	10.00
DEN	-19.50	-26.18	0.92	8.59	-28.38	14.00
NETWORK18	11.06	4.38	1.28	7.16	3.43	11.00
PVR	32.63	25.95	0.62	4.41	42.10	3.00
HTMEDIA	-4.85	-11.53	0.40	16.00	-29.07	15.00
TVTODAY	66.44	59.76	1.03	9.90	58.10	1.00
ZEEL	21.53	14.85	0.84	3.05	17.60	6.00
INOXLEISUR	44.65	37.97	0.86	5.97	44.23	2.00
DBCORP	11.80	5.12	0.47	2.30	10.92	8.00

SITINET	19.00	12.32	0.81	4.56	15.23	7.00
JAGRAN	20.30	13.62	0.48	2.88	28.45	4.00
HATHWAY	-11.86	-18.54	0.74	5.89	-24.90	13.00

Source: Nseindia,

Result and Discussion:

The above table (Table 3.1) shows that the TVTODAY stock has the highest excess return to beta ratio of 58.10 while that of HTMEDIA stock has the lowest of -29.07. The ranking of stocks done based on excess return to beta ratio reveals that TVTODAY stock ranks first, the HTMEDIA stock ranks the last.

Table No 3.2: Optimal Portfolio Calculation

Security	**(Ri-Rf)*β/σ^2**	**Σ(Ri-Rf)*β/σ2**	**β^2/σ^2**	**Σβ2/σ2**	**Ci**	**Zi**	**Xi**
TVTODAY	6.21	6.21	0.11	0.11	55.98	0.22	1.0
INOXLEISUR	5.46	11.67	0.12	0.23	49.79		
PVR	3.62	15.29	0.09	0.32	47.72		
JAGRAN	2.27	17.56	0.08	0.40	43.88		
EROSMEDIA	2.25	19.81	0.09	0.49	40.15		
ZEEL	4.10	23.91	0.23	0.72	32.92		
SITINET	2.19	26.10	0.14	0.87	29.99		
DBCORP	1.04	27.14	0.10	0.96	28.11		
DISHTV	1.44	28.58	0.26	1.22	23.32		
TV18BRDCST	1.18	29.76	0.25	1.47	20.23		
NETWORK18	0.78	30.55	0.23	1.70	17.98		
SUNTV	-1.06	29.48	0.15	1.84	15.98		
HATHWAY	-2.34	27.14	0.09	1.94	13.99		

DEN	-2.81	24.33	0.10	2.03	11.93		
HTMEDIA	-0.29	24.04	0.01	2.04	11.74		

Source: Nseindia,

The companies are listed in above table (Table 3.2) are based on their ranks. The excess return is divided by the unsystematic risk σ^2_{ei} and multiplied by the beta in order to calculate the 'Ci' values. The Unsystematic risk is calculated using the above-mentioned formula:

Table 3.2 represents the Ci of all companies. The $\beta 2/ \sigma^2_{ei}$ and its cumulative are necessary for the calculation of Ci. The Ci value goes on increasing from 55.98 and starts declining from 55.98. Therefore, the value of 55.98 is considered as the *'cut-off point'*.

Out of fifteen companies only one company has been selected for the optimal portfolio construction after applying single index model. Table 3.2 represents the proportion of investment to be made by the investor to earn maximum returns. The figure shows that 100% of investment may be made in the TVTODAY stock % in NSE Media Index.

Nifty India Consumption Index

Table 4.1 represents the list of sample companies selected for this study. The historical stock prices pertaining to the above companies from 1st April 2013 to 9th Nov 2016 were collected from www.nseindia.com. NSE Nifty50 index selected as benchmark index for the present study. Fifteen companies listed under Nifty India Consumption index was selected for constructing an optimal portfolio using Sharpe's Single Index Model.

Table No 4.1: Nifty India Consumption Index

Security	Mean Return	Excess Return	Beta	Unsystematic Risk	Excess return to beta ratio	Ranking
SUNTV	-0.53	-7.21	0.99	6.75	-7.25	30.00
RELINFRA	18.67	11.99	1.76	4.57	6.81	20.00
BHARTIARTL	6.52	-0.16	0.86	2.82	-0.18	24.00
HAVELLS	39.11	32.43	0.83	3.66	39.17	7.00
RCOM	18.69	12.01	1.56	6.61	7.68	19.00
IDEA	4.73	-1.95	0.75	4.76	-2.59	27.00
BRITANNIA	80.33	73.65	0.55	3.24	134.22	3.00
M&M	11.55	4.87	0.90	2.19	5.39	23.00
JUBLFOOD	4.65	-2.03	0.86	4.70	-2.36	26.00
ZEEL	21.53	14.85	0.84	3.05	17.60	14.00
BAJAJ-AUTO	11.38	4.70	0.79	1.75	5.93	22.00
TVSMOTOR	132.07	125.39	0.84	6.03	148.49	1.00
TATAPOWER	-10.66	-17.34	1.13	3.03	-15.40	29.00
GODREJCP	19.44	12.76	0.75	4.05	17.00	16.00
APOLLOHOSP	20.11	13.43	0.67	3.40	20.07	12.00
MARUTI	48.17	41.49	0.94	2.03	44.08	6.00
HEROMOTOCO	25.74	19.06	0.81	1.98	23.42	11.00
MCDOWELL-N	14.85	8.17	0.69	4.49	11.86	18.00
MARICO	35.82	29.14	0.42	2.56	69.51	5.00
DABUR	20.93	14.25	0.50	2.30	28.47	10.00
EMAMILTD	43.64	36.96	0.49	3.78	74.86	4.00

PAGEIND	68.20	61.52	0.42	3.76	144.86	2.00
HINDUNILVR	24.37	17.69	0.53	2.26	33.37	9.00
COLPAL	12.85	6.17	0.46	1.83	13.41	17.00
UBL	6.31	-0.37	0.77	4.53	-0.49	25.00
INDHOTEL	25.99	19.31	0.57	4.22	33.70	8.00
GSKCONS	14.48	7.80	0.46	3.19	17.03	15.00
TITAN	12.38	5.70	0.86	3.61	6.61	21.00
ITC	3.53	-3.15	0.79	1.97	-3.96	28.00
ASIANPAINT	23.15	16.47	0.85	2.23	19.46	13.00

Source: Nseindia,

Result and Discussion:

The above table (Table 4.1) shows that the TVSMOTOR stock has the highest excess return to beta ratio of 148.49 while that of SUNTVstock has the lowest of -7.25. The ranking of stocks done based on excess return to beta ratio reveals that TVSMOTORstock ranks first; the SUNTV stock ranks the last.

Table No 4.2: Optimal Portfolio Calculation

Security	$(Ri-Rf)*\beta/\sigma^2$	$\Sigma(Ri-Rf)*\beta/\sigma 2$	β^2/σ^2	$\Sigma\beta 2/\sigma 2$	Ci	Zi	Xi
TVSMOTOR	17.57	17.57	0.12	0.12	143.60	0.64	0.86
PAGEIND	6.94	24.51	0.05	0.17	143.95	0.10	0.14
BRITANNIA	12.47	36.98	0.09	0.26	140.52		
EMAMILTD	4.83	41.81	0.06	0.32	127.59		
MARICO	4.76	46.57	0.07	0.39	117.55		
MARUTI	19.26	65.84	0.44	0.83	79.01		
HAVELLS	7.35	73.18	0.19	1.02	71.69		
INDHOTEL	2.62	75.80	0.08	1.09	69.00		
HINDUNILVR	4.14	79.94	0.12	1.22	65.39		
DABUR	3.10	83.04	0.11	1.33	62.37		
HEROMOTOCO	7.85	90.89	0.34	1.66	54.54		
APOLLOHOSP	2.64	93.53	0.13	1.79	52.02		
ASIANPAINT	6.24	99.77	0.32	2.11	47.09		
ZEEL	4.10	103.87	0.23	2.35	44.17		
GSKCONS	1.12	104.99	0.07	2.41	43.43		
GODREJCP	2.36	107.36	0.14	2.55	41.99		
COLPAL	1.55	108.91	0.12	2.67	40.75		
MCDOWELL-N	1.25	110.16	0.11	2.77	39.66		
RCOM	2.84	113.00	0.37	3.14	35.90		
RELINFRA	4.62	117.62	0.68	3.82	30.74		
TITAN	1.36	118.98	0.21	4.03	29.51		
BAJAJ-AUTO	2.13	121.11	0.36	4.39	27.59		
M&M	2.01	123.11	0.37	4.76	25.85		
BHARTIARTL	-0.05	123.07	0.26	5.02	24.50		

UBL	-0.06	123.00	0.13	5.15	23.87		
JUBLFOOD	-0.37	122.63	0.16	5.30	23.10		
IDEA	-0.31	122.32	0.12	5.42	22.53		
ITC	-1.27	121.05	0.32	5.74	21.06		
TATAPOWER	-6.44	114.61	0.42	6.16	18.58		
SUNTV	-1.06	113.55	0.15	6.31	17.98		

Source: Nseindia,

The companies are listed in above table (Table 4.2) are based on their ranks. The excess return is divided by the unsystematic risk σ^2_{ei} and multiplied by the beta in order to calculate the 'Ci' values. The Unsystematic risk is calculated using the above-mentioned formula.

Table 4.2 represents the Ci of all companies. The $\beta 2/ \sigma^2_{ei}$ and its cumulative are necessary for the calculation of Ci. The Ci value goes on increasing from 143.6 and starts declining from 143.95. Therefore, the value of 143.95 is considered as the *'cut-off point'*.

Out of thirty companies two companies have been selected for the optimal portfolio construction after applying single index model.Table 4.2 represents the proportion of investment to be made by the investor to earn maximum returns. The figure shows that 86% of investment may be made in the TVS Motorstock and 14% in PAGEIND stock in NSE India Consumption Index.

Nifty Reality Index

Table 5.1 represents the list of sample companies selected for this study. The historical stock prices pertaining to the above companies from 1st April 2013 to 9th Nov 2016 were collected from www.nseindia.com. NSE Nifty50 index selected as benchmark index for the present study. Ten companies listed under Nifty Reality index was selected for constructing an optimal portfolio using Sharpe's Single Index Model.

Table No 5.1: Nifty Reality Index

Security	Mean Return	Excess Return	Beta	Unsystematic Risk	Excess return to beta ratio	Ranking
DLF	-21.10	-27.78	1.94	7.72	-14.29	8.00
IBREALEST	0.56	-6.12	2.12	9.65	-2.89	6.00
HDIL	24.73	18.05	2.30	9.62	7.83	2.00
UNITECH	-30.54	-37.22	2.09	13.48	-17.78	10.00
OBEROIRLTY	-0.34	-7.02	0.96	5.43	-7.35	7.00
PHOENIXLTD	8.51	1.83	0.50	3.79	3.68	3.00
SOBHA	-6.27	-12.95	0.80	5.47	-16.28	9.00
PRESTIGE	10.57	3.89	1.07	6.74	3.65	4.00
GODREJPROP	5.55	-1.13	0.80	3.27	-1.41	5.00
DELTACORP	30.58	23.90	1.39	9.91	17.17	1.00

Source: Nseindia,

Result and Discussion:

The above table (Table 5.1) shows that the DELTACORP stock has the highest excess return to beta ratio of 17.17 while that of UNITECH stock has the lowest of -17.78. The ranking of stocks done based on excess return to beta ratio reveals that DELTACORP stock ranks first, the UNITECH stock ranks the last.

Table No 5.2: Optimal Portfolio Calculation

Security	(Ri-Rf)*β/σ^2	Σ(Ri-Rf)*β/σ2	β^2/σ^2	Σβ2/σ2	Ci	Zi	Xi
DELTACORP	3.36	3.36	0.20	0.20	16.82	0.05	1.0
HDIL	4.32	7.68	0.55	0.75	10.22		
PHOENIXLTD	0.24	7.92	0.07	0.81	9.70		
PRESTIGE	0.62	8.54	0.17	0.98	8.66		
GODREJPROP	-0.28	8.26	0.20	1.18	6.98		
IBREALEST	-1.35	6.92	0.47	1.65	4.19		
OBEROIRLTY	-1.23	5.68	0.17	1.81	3.13		
DLF	-7.00	-1.32	0.49	2.30	-0.57		
SOBHA	-1.88	-3.20	0.12	2.42	-1.32		
UNITECH	-5.78	-8.98	0.33	2.74	-3.27		

Source: Nseindia,

The companies are listed in above table (Table 5.2) are based on their ranks. The excess return is divided by the unsystematic risk σ^2_{ei} and multiplied by the beta in order to calculate the 'Ci' values. The Unsystematic risk is calculated using the above-mentioned formula. Table 5.2 represents the Ci of all companies. The β2/ σ^2_{ei} and its cumulative are necessary for the calculation of Ci. The Ci value goes on increasing from 16.82 and starts declining from 16.82. Therefore, the value of 16.82 is considered as the *'cut-off point'*

Out of ten companies only one company has been selected for the optimal portfolio construction after applying single index model. Table 5.2 represents the proportion of investment to be made by the investor to earn maximum returns. The figure shows that 100% of investment may be made in the DELTACORP stock % in NSE Reality Index.

Final Portfolio

Table 6.1 represents the list of stocks in the final portfolio after short listing of stock from NSE AUTO Index, NSE FMCG Index, NSE Reality Index, NSE India Consumption Index and NSE Media Index for this study. The historical stock prices pertaining to the above companies from 1st April 2013 to 9th Nov 2016 were collected from www.nseindia.com. NSE Nifty50 index selected as benchmark index for the present study. Six companies were shortlisted for final portfolio and then these were selected for constructing an optimal portfolio using Sharpe's Single Index Model.

Result and Discussion:

The below table (Table 6.1) shows that the TVSMOTOR stock has the highest excess return to beta ratio of 148.49 while that of TV TODAY stock has the lowest of 58.10. The ranking of stocks done based on excess return to beta ratio reveals that TVSMOTOR stock ranks first; the TVTODAY stock ranks the last.

Table No 6.1: Final Portfolio

Security	Mean Return	Excess Return	Beta	Unsystematic Risk	Excess return to beta ratio	Ranking
TVSMOTOR	132.07	125.39	0.84	6.03	148.49	1.00
BRITANNIA	80.33	73.65	0.55	3.24	134.22	3.00
PGHH	46.23	39.55	0.30	1.96	132.39	4.00
TVTODAY	66.44	59.76	1.03	9.90	58.10	5.00
PAGEIND	68.20	61.52	0.42	3.76	144.86	2.00
DELTACORP	30.58	23.90	1.39	9.91	17.17	6.00

Source: Nseindia,

Table No 6.2: Optimal Portfolio Calculation

Security	$(Ri-Rf)*\beta/\sigma^2$	$\Sigma(Ri-Rf)*\beta/\sigma 2$	β^2/σ^2	$\Sigma\beta 2/\sigma 2$	Ci	Zi	Xi
TVSMOTOR	17.57	17.57	0.12	0.12	143.60	0.64	0.86
PAGEIND	6.94	24.51	0.05	0.17	143.95	0.10	0.14
BRITANNIA	12.47	36.98	0.09	0.26	140.52		
PGHH	6.03	43.01	0.05	0.30	139.32		
TVTODAY	6.21	49.22	0.11	0.41	118.44		
DELTACORP	3.36	52.58	0.20	0.61	86.04		

Source: Nseindia,

The companies are listed in above table (Table 6.2) are based on their ranks. The excess return is divided by the unsystematic risk σ^2_{ei} and multiplied by the beta in order to calculate the 'Ci' values. The Unsystematic risk is calculated using the above-mentioned formula.

Table 6.2 represents the Ci of all companies. The $\beta 2/ \sigma^2_{ei}$ and its cumulative is necessary for the calculation of Ci. The Ci value goes on increasing from 143.6 and starts declining from 143.95 Therefore, the value of 143.95 is considered as the *'cut-off point'*

Out of six companies two companies have been selected for the optimal portfolio construction after applying single index model. Table 6.2 represents the proportion of investment to be made by the investor to earn maximum returns. The figure shows that 86% of investment may be made in the TVSMOTOR stock and 14% in PAGEIND in Final Portfolio which is based on consumption story on back of 7th pay implementation in India.

Findings &Recommendations for Investors

1) Researcher has found out the stocks which will give good return on back of implementation of 7th Pay commission and risk and reward ratio. Researcher has found the Stocks to be included in a portfolio from each of the sectorial index and then final

portfolio in which best stocks are selected from the individual sectors and final portfolio is designed for the investors.

a) TVS Motor from NSE Auto Index. The proportion of allocation of funds an investor should make in TVS Motor should be 100%.
b) Britannia and Procter &Gamble Hygiene and Health Care Ltd (PGHH) from NSE FMCG Index. The proportion of allocation of funds an investor should make in Britannia should be 66% and 34% in PGHH.
c) TV Today from NSE Media Index. The proportion of allocation of funds an investor should make in TV Today should be 100%.
d) Delta Corp from NSE Reality Index. The proportion of allocation of funds an investor should make in Delta Corp should be 100%.
e) TVS Motor and Page Ind from NSE India Consumption Index. The proportion of allocation of funds an investor should make in TVS Motor should be 86% and 14% in Page Ind.
f) TVS Motor and Page Ind are stocks which an investor should hold in his portfolio in current scenario. The proportion of allocation of funds an investor should make in TVS Motor should be 86% and 14% in Page Ind. This is the portfolio researcher recommends investor to hold currently.

Conclusion

Researcher has tried to construct an optimum portfolio keeping in mind implementation of 7th pay commission, sectors which would should good growth going forward. Researcher has designed portfolio for FMCG, Auto, Media, Reality and India Consumption sectors and a final portfolio which comprises of best stocks selected from those individual sectors. Researcher has found out through this study two stocks TVS Motor and Page Ind investors should hold in a portfolio and allocate funds in both the stocks. Researcher expects these two stocks to deliver good returns for investors going ahead.

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Digital Trends in Major Capital Projects (MCP)

*Sundararaman Chintamani**

**Practice Head Oil and Gas, Tech Mahindra*

Introduction

International Energy Agency (IEA) predicts an energy supply investment *of 1 trillion US$* per year through to *2030*. With the expanding global energy demand, more and more major capital projects in the Energy and Utility sector are in the offing. Today the energy sector is characterized by increasingly complex and large-scale capital projects. While the projects are becoming complex, the global engineering and project management companies are also increasingly focussing on geographical expansion and diversification. In addition, they are also contending with greater volatility impact the environments in which they are working. Successful execution of the capital projects would be a major source of competitive advantage.

The development of increasingly large and complex major capital projects in the Oil and Gas (O&G) industry take years and involve complex technologies, large scale supply chains and changing local conditions. They also face other challenges of strategic, monetary and regulatory compliances that may challenge conventional way of doing project management.

Oil and Gas capital projects not only need to manage costs, mitigate risk, deliver projects on time and on budget, but also need to ensure safe and reliable operations throughout the project lifecycle. An important aspect of this is the capturing, management and dissemination of information. With today's innovative and intelligent Engineering Information Management (EIM) solutions, Oil and gas companies accelerate project development, reduce risk and deliver safe and sustainable projects throughout the asset's lifecycle.

Engineering Information Management (EIM) are the strategies, methods and tools used to capture, manage, store, preserve, and deliver engineering content and technical documents related to all engineering-related organizational processes. But today major capital projects cannot be contended with the typical Engineering Information Management tools alone. They need a smart approach taking into account of constraints and risks impacting them. The approach to smart project management shall comprise of a foundation built of new age technologies, agile processes, positioning of the right

skills and leveraging information technology etc. This is to continuously evolve the way the projects are executed, A range of new age technologies, Mobility, Analytics, Sensors, Social media, Cloud computing and allied technologies such as drones, 3D printing are disrupting the traditional way of doing business. They are being supported by the

Challenges of Major Capital Projects

Every industry sector such as Energy, Utilities, Manufacturing and Transportation are increasing their investments in capital projects. Most of the sectors spend nearly **1/3rd**of their annual revenues to capital projects. But the energy sector spends nearly **80%.**The companies are at great risk, if these projects are not properly managed. Beyond the project specific risks, the financial health of the corporation would be in danger, if the capital projects had the issues of schedule variance and budget variance, they would fail to bring in the expected returns. Companies are also concerned about the impact of inflation and shortages of skilled resources on their ability to deliver projects on time and on budget.A study conducted by Booz & Co in **2012**of large scale oil and gas projects revealed that almost **50%**were under-performed; **30%**had cost over-run and **12%**had

given the added dimensions of volatility, risks and competition.

explosion of connected, intelligent devices. The connected devices, better known as the Internet of Things (IoT) are creating incomparable real time visibility to track and monitor projects and assets end-to-end from design to commissioning.

schedule variance and over 30 %showed substantial operational issues.

Engineering Information Management (EIM)

Information Technology (IT) has been a critical component of major capital projects, but much of the IT focus so far was on enabling the project work via document control and integration of remote offices. Due to dynamic complex nature of the capital projects, the IT system evolved into *Engineering Information Management (EIM)* over the years. EIM can be technically defined as the strategies and systems used for capturing, managing, storing, preserving and delivering engineering content and technical documents associated with all engineering-related organizational processes. EIM tools and strategies also allowed the management of an organization's unstructured information, wherever that information exists.

Engineering Information Management solutions manage all of the data handled in engineering activities such as engineering reports. EIM solution is a system that manages documents and drawings along their metadata. Critically, an EIM solution must also help document version control during the design processes, so that accurate data is always available to the In the Oil & Gas construction project, Engineering Information Management (EIM) has a crucial role to play in the effective and safe management of assets in the project lifecycle. EIM is concerned with the management of all data and documents pertaining to the asset's design and its physical assets. EIM covers all stages of capital project lifecycle starting from Planning, Conceptualization, Front End Engineering Design (FEED), Detailed Design, Procurement, Construction/Building, Commissioning, Handing over, Operations, Maintenance, Modifications and Decommissioning.

The Document Management work shall concentrate on the early collection and organization of key Project documents. These key documents shall be high graded from the many thousands of available project documents. These may consist of:

- CAD drawings
- Contracts
- Graphic files

drawings, technical documents, data and project

right person at the right time. This guarantees data quality, enhances efficiency, improves operational excellence and assures compliance with regulations.

- Design Basis Document
- Design Summaries
- Photo sets
- Regulatory submittals
- Reports/Studies/Plans
- Risk Assessments
- Specifications
- Vendor Documents
    - Equipment Manuals
    - Parts Lists
    - Data sheets
- Assorted Hardcopies

Typically these documents exist in the following formats:

- MS Word
- Excel Spread Sheets
- PowerPoint Presentations
- Project Files
    - MS Project
    - MS Access
    - Primavera
- AutoCAD Drawings
    - Photos in JPG format

    - Scanned files in TIF format
- MS NetShow video clips (ASF format)
- Hardcopy documents
    - Photographs
    - Vendor Data
    - Correspondence
    - Reports

A high-end electronic Document Management System (DMS) is primarily to organize, manage and provide desktop access to key Project documents.

All documents entered into the DMS shall be indexed to record important document properties such as:

- Title
- Document type
- Document sub-type
- Original document number
- Original document supplier

Challenges in Engineering Information Management

Engineering information is not only complex, but is also very dynamic. The trend towards outsourcing leads to dependence on exhaustive contractor and supplier systems. The stakeholders of a project need to seamlessly access the data from the systems. In this context master data integrity, standardization of naming

- Facility category

Some of the key project documents exist only in hardcopy format and hence there is need to include them in the document management system. This shall be addressed by scanning and converting them into PDF files so that they can be viewed using the free Adobe Acrobat Reader Viewer. The files can also be processed using Optical Character Recognition (OCR) technology to transform the scanned images into computer recognizable text. This OCR step would permit the system to retrieve documents based not only on their index properties, but also the actual content of the document text. The library of hardcopy documents along with numerous other project files can be catalogued and indexed so that the documents can be searched or retrieval anytime.

and numbering conventions, management of metadata are vital. Owner operators need a tracking mechanism that can track when documents were sent and received, who sent them and what the data quality was. A solution is needed to manage the complete lifecycle of document management in projects, ensuring that the asset information is maintained as-built through multiple plant changes and is always available for consumption. In

MCPs many a times, problems come from poor information management and handover. It is well established that these can be costly to all parties involved in the asset lifecycle. Many studies have recognized poor EIM and data interoperability as the reason for many asset performance problems. The prime challenge in EIM is the integration of multiple databases and systems together. Maintaining consistent processes and enabling role-based access with strong version control would be the additional challenges.

Trends of Digital Solutions in MCP

Recently, there has been a shift in strategic priorities with more firms opting to become digital innovation leaders. The new wave of innovators has caught sight of the impact that digital technologies are having on business performance, such as increasing the ultimate recovery rate of hydrocarbons. They also have seen how digital technologies are accelerating the completion of major capital projects. In addition, they are seeing digital technologies increase the operational efficiency, reliability and safety of all types of operations. Digital solutions are solutions comprising of convergence of new age technologies such as Networks, Mobility, Analytics, Cloud, Sensors, Social Media, Security, Drones, 3D Printers, and Robots etc. Let us see how these technologies are going to turnaround the MCP industry, especially for the Oil and Gas sector.

Networks & Communication Systems

In a major capital project, if the company wants to go either for a traditional EIM system or for a digital solution, the first challenge would be to set up the project data network. It may just start with the setting up of the Email system, Printers and the Servers. As part of the Communications strategy, effective Email would be a key concern. Email has become a prime communication tool in any business today. In many major capital projects, the initial proposals for network connection would not be accepted. But, once a series of Emails are lost and there is a delay of activities due to communication gap, people may realize the potential value of the service and approve the proposal.

At the outset of the project, before the communications strategy is implemented, users may access personal emails. This would be undesirable one from

inefficiencies in Email handling such as forwarding mail, attachments, address books and the other being the confidentiality part of the project. As infrastructure is increased with dedicated networks, the entire owner team shall be brought onto one Email system.

Further steps would include bringing up of the Design Office into the company's Wide Area Network (WAN).Based on the corporate's IT standardization strategy, new PCs to be brought in, software to be standardized and servers and printers to be installed.

In offshore platforms, during the actual platform installation, a high (128K) bandwidth dedicated satellite link for voice, fax and data may be installed on the installation contractor's derrick barge. During the hook-up phase, the satellite link shall be transferred to a semi-submersible accommodation vessel. As the Living Quarters are commissioned, a T1 Operations microwave link shall be established.

The Communications strategy would also to try new video technologies in video conferencing. Video Conferencing would work effectively between the design office and the management office. Cost effective solutions like MS NetMeeting can be more effective by not requiring custom hardware boards and by concentrating primarily on "application sharing" rather than on video. Video conferencing may be required during the upending of spar hulls in an offshore project. During this activity, huge spar hull is flooded, so that it is up-righted in the water from the horizontal to vertical orientation. The actual upending sequence may last few minutes, but it requires lot of coordination between offshore and onshore. While upending of the spar hull is planned, the live video feed of the upending shall be transmitted from offshore to the shore, so that all the stakeholders give their inputs as well make observations.

Alcatel-Lucent, Huawei Technologies, Harris Cap Rock, Inmarsat, and ERF Wireless are some of the prominent players which are providing reliable oilfield communication solutions and services. Markets and Markets predicts the market for global oilfield communications to grow from **USD 2.6 Billion in 2015 to USD 3.7 Billion in 2020**, at a Compound Annual Growth Rate (CAGR) of **7.4%** during the forecast period of 2015-2020. Over the next 5 years, this market is expected to experience high traction in North America (NA), and the Middle East and Africa (MEA) regions.

Mobility

Today, mobile devices are no longer just a mode of communication. They are much more than that. Because of the versatile features of mobile phone technology, today they can enable many activities and tasks in every walk of life and business. With the advent of industry approved mobile devices, Oil and Gas industry can leverage the technology to a great extent especially while executing major capital projects. Generally during the execution of major capital projects, multiple resources work on assorted activities, sometimes under tough weather conditions, remote locations, or both. The success of a project is typically governed by efficient execution, which essentially depends on effective collaboration.

In a traditional MCP many tasks are accomplished manually, which often leads to project schedule variance. But with the cutting edge features of mobile technologies, such as GPS (Global Positioning System)and video, enable a number of surplus capabilities beyond communication. For example, advanced mobility features enable social project collaboration. This helps managing work tasks such as registering, scheduling, locating, and even visualizing construction designs.

Construction plans can be efficiently shared with various people at different locations on the construction site, accessed at the same time, by sharing the mobile screens. This helps companies to complete projects within budget and schedule. The quality of decision making can be improvised.

To remotely accomplish complex tasks such as tool and equipment tracking, Project Managers can use GPS technology. Many engineers start using mobile devices in their field data collection function to remotely track equipment location. The Engineering & Construction (E&C) companies are also deliberate in the usage of barcodes or radiofrequency identification (RFID) tags for all building material and GPS technology to monitor the assets. In the oil field, theft of assets is becoming a challenge nowadays. When Oil Field Theft is making a dent in the profitability of the companies, it is high time the E&C companies consider using geo-fencing concepts with the help of advanced GPS mechanisms so as to define geographical boundaries for movement of materials. More accurate information about the inventory can be made available, which would reduce the pilferage and allow effective usage of the assets.

In a recent poll (**2015**) conducted by Deloitte with the executives at leading E&C companies revealed that **96%** of respondents accepted productivity benefits due to mobility. At every company, use of mobile devices for work-related activities was common. Another online survey conducted by Conject with over **300** architects, engineers and contractors found **91%** of respondents identified better collaboration as one of the top three benefits of mobility, followed by reduced dependence on paper **(60%)** and a reduction of unforeseen problems **(54%)**.

Analytics

In any typical major capital project, terra bytes of data are generated every week. But many a times, project management practitioners are unable to use existing tools such as spread sheets to analyze these data to identify the best practices, trends and patterns. But today there are tools and techniques available that enable the project managers to sift through huge volume of project data so as to provide accurate, objective and dependent analytical output, in a user-friendly dashboard format.

The other positive advantage of the dashboards of the analytics tools is the ability to slice and dice them. The typical way of managing project issues such as cost deviation, schedule variation, loading of resources, and a whole lot of factors influencing the project is very difficult task, in major capital projects. Today they are easily addressed with the advances in Big-data processing and Predictive Analytics that help project managers to take informed decisions.

Growing number of contractors are finding ways to use the data − Comparisons of profitability (by customer, region, etc.), Estimating quantities and costs based on past history, Improving performance, compliance and win rate, Monitoring unstructured data like emails for key words and phrases, Linking payroll data, including subcontractors, to schedule performance, labour rate compliance and future estimating.

Tools such as Predictive Project Analytics (PPA) from Deloitte help to avert challenges by leveraging an unique algorithm to determine the likelihood of project success. No matter where one is in the project lifecycle, predictive analytics can improve capital efficiency, contain project costs and provide insights into organization's level of manageable project complexity and risk given current capabilities.

Cloud

At every stage of the execution of major capital projects, huge amounts of data, i.e. hundreds of thousands of documents are generated. At different stages different stakeholders, own the documents and handover to others. At this juncture, it is very critical that managing and controlling of the information to keep the projects on track and within the scope.

Today cloud-based Engineering Information Management (EIM) solutions are making significant strides in managing the life cycle of major capital projects from the start till the project hand over. They differ from standard EIM solutions in that they enable real-time collaboration and more-efficient workflows between various stakeholders in a project. The potential improvements in efficiency can help companies contain costs and reduce risk, with potentially significant competitive advantage for early adopters.

When the diverse virtual teams need to work around the clock, inefficient handovers from projects to operations are bound to happen. Cloud based solutions address this resulting in improved project efficiency, reduced delays, fewer scope changes, and optimized materials and inventory management, all of which help contain rework or redundant labour efforts.

Today many software vendors are developing and offering cloud-based solutions to industrial clients because these solutions offer such key benefits as:

- Cloud based solutions help condense the time during construction, so that the companies can easily handover information to operations. Geographically scattered people can collaborate quickly.
- Faster system deployment time with off-site disaster recovery, which allows organizations to be more agile in the adoption of solutions.

- Since cloud based solution can be reached anywhere it essentially removes geographic boundaries. Features such as Conferencing, Voice, Video and Drawings can be made available to any part of the globe at any time. Today with the help of 3D printing technology the designs can be accessed from the system any near shore location and be sent to the required place in the shortest time.
    - Better collaboration support for virtual project teams with diverse roles.
    - Increased flexibility in usage and pricing via pay-per-usage licensing models.

In-spite of having several benefits envisaged from the cloud based solution, end-user organizations have been slow in the adoption of these solutions over concerns about security and accessibility. However, new vendor offerings, increasingly ubiquitous connectivity and changing economics are shifting the market dynamic. People also contemplate if the new solution would really offer the cost benefit, as they have to lock in with the vendor for specific years under the pay as you use model. Hence Gartner is recommending that the CIOs should initially try a Proof of Concept (POC) model and take a decision later based on the benefits.

Sensors / IOT Devices

Internet of Things (IOT) based sensors for the MCP sector typically involves using the smart sensors in the field to offer more intelligent information, instead of just plain data. Instead of just equipment data or material location, they can provide real-time information such as equipment condition such as vibration or temperature. They can also monitor moisture levels in concrete, so that curing of concrete structures can be continuously monitored. When the raw date is consolidated along with relevant factors over a period of time, valuable insights can be generated such as expected time for equipment overhaul using predictive rather than reactive measures or relative strength levels of the built structure.

RFID tags can find potential application in the "Just in Time" (JIT) concept in the supply chain of major capital projects. By tagging equipment and spare parts, one can track them during the complete asset lifecycle. Using RFID tags, one can set a specific number certain supply item needed. When the actual supplies fall below that number an alert can be triggered for a supply request. This way, one can ensure a particular item is never run out of stock and also never order more than what is needed.

When it comes to mechanical maintenance of certain equipment, such as drills the self-detecting sensors can send maintenance alerts when the tool is in need of repairs, heading off the necessity for last-minute work or costly breakdowns.

Today considerable money is spent on maintaining temperature in buildings through air conditioners. IoT based sensors can monitor the temperature of buildings, in terms of how much power is being used

and how often the air conditioning machinery is left idling.

Wearable devices find an upward trend in capital projects and their benefits are abundant. Hands-free devices, such as Google Glass, can permit workers to transmit images and follow critical guidelines without taking a hand off their machines, while working. Such devices also help regulatory compliance by allowing automatic time stamping, which prevents records distortion. Also these wearable devices can even provide continuous health monitoring of the workers.

Social Media

Major capital projects are often complicated, fast-paced and can cause potential damage in the Health, Safety and Environment (HSE) front. They are also carried out in an environment prone to fraud, uncertainty, waste and abuse. Major Capital Projects often face the challenge of being criticised from all directions. Activist groups, NGOs (Non-Governmental Organization) or media outlets may just pick up an issue, which may quickly turn into a major crisis and become a threat to a company and its reputation. Hence the companies need to be prepared for critical discussions and crisis communication at all times. Public and environment groups may protest against new projects, or catastrophic events like oil spills or other disasters. There is a wide range of topics that can affect the business and reputation. It is critical for the Public Relations and Communications teams at the Major Capital Projects to monitor the overall discussions about them and be cognizant of the sentiment towards them. With conventional tools, it may be difficult to keep track of the external discussions and do the crisis management in right time. For any successful crisis communications, short response time is essential. Any delay in response would build up negative reporting. During the Macondo blow-out, BP realised this. If the company had proper social media monitoring mechanism in place, it would have helped significantly cutting down on the response time.

Social Media tools typically enable enhanced collaboration and information sharing for users such as Employees, Partners, Candidates, Customers, Local Population and Industry Experts. They may include Internal Blogs, Communities, Discussion Forums, Idea Junction, Micro-Blogs, and Internal Wikis. The primary

objective of the enterprise social media is to improve collaboration, help knowledge transfer and be a single sign-on knowledge repository. Today's MCP business is becoming increasingly complex with the development of Offshore and unconventional resources, Complex drilling process and Digital Oil Fields (DOF). These reasons call for improved collaboration tools to facilitate exchange of information and also to enable more frequent and detailed reporting. Companies can use these tools to improve client experience—enhance communication and provide sophisticated status reporting, visual progress reports, and more timely change orders. This would enable the customers to remotely track the project status and be able to swiftly respond to issues as and when they happen.

Typically, many social collaboration tools also act as a one-stop shop for all project related documents and discussions, and can be accessed through mobile app or the mobile web. Such tools can also facilitate employees to be cognizant of industry leading best practices as they can access insights from external experts and address technical queries through crowd sourcing. With these tools, companies can determine information access levels, view the status of both an overall project and individual tasks, as well as share and create a repository of all project files, documents, directories, and more. It integrates a company's intranet with real-time messaging, team collaboration tools, and social networking.

With social-media tools, project understandings can be shared with stakeholders throughout the project lifecycle and used to create better outcomes. Many vital details such as contact details, areas of expertise, and contribution to a project can be uploaded and pooled as with social-media tools. A project specific social-media application, however, permits continuous updating of expertise based on current work challenges. Any member of the project can rate others to see who has the most current experience on a particular issue. Again a project specific tool can connect all applicable players, such as the owner, the lead contractor, and the subcontractors. Informal workspaces can be created to complete the corporate information management systems, which are in place to manage documents, data, and information.

Augmented Reality

Augmented reality (AR) is a live direct or indirect view of a physical, real-world environment whose elements are augmented (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data. Various technologies are used in Augmented Reality rendering including optical projection systems, monitors, hand held devices, display systems worn on the human body, head mounted display Smart glasses etc. Today all these have become part of the digital solutions and find a place in major capital projects. AR technology facilitates architects, engineers, owners, and contractors at various locations to visualize a virtual, but a realistic building based on interactive 3D models using the latest in Building Information Modelling (BIM) technology.

Beyond visualization, AR capabilities on mobile devices can also be used for construction design analysis. Any possible design changes that may be required between design and construction can happen by enabling the collaboration and discussion between contractors and architects on modularized components. This would result in effective and efficient processing of change requests during construction. Further, field information can also be collected and shared with stakeholders in real time with stakeholders when combined with associated technologies such as drones or smart glass. This obviously results in enhanced follow-up on project status progress and informed decision making through improved accuracy, early identification of issues, faster inspections etc.

cycle from *12 weeks* to just *12 hours* by using 3D printers.

3D Printers

3D Printing is the process of making physical objects from a digital model using a printer. Today all industry sectors start using 3D printing technology and oil and gas industry is no exception. Companies in the energy sector have been using 3D printing technology to assist with prototyping and seen some significant benefits. While prototyping some parts, GE Oil and Gas, have cut down the design

Prototyping through 3D Printer delivers major benefits to capital projects by shortening the development and retooling process. Design changes can be made preciously and in fewer steps, by simply fine-tuning the CAD (Computer-Aided Design) file. For industries that operate on a large scale, 3D printing reduced prototyping lead times and cost. Hence 3D printing is becoming popular by the Oil

and Gas (O&G) industries, especially during the major capital projects.

Gartner predicts that by **2019, 10%** of all O&G, as well as oilfield service companies will be using 3D printers for the production of parts and equipment used within operations. 3D printing capability would generate a massive range of intricate designs that can drastically reduce the supply chain lifecycle and enable modular assembly at sites.

Drones

A drones also known as Unmanned Aerial Vehicle (UAV), commonly is an aircraft without a human pilot aboard. Drones would make an enormous impact during the execution of major capital projects in the coming years.

Earlier surveying of the land would require areal footage from a plane or helicopter. But today this job is easily possible with the help of drones.

Drones can hover around project sites to capture in depth images, which can in turn be transmitted in real time to intelligent, automated computer systems that may be able to react without human intervention.

Unlike humans, drones can easily access remote or dangerous areas and can work 24/7. For instance, when the workers work on tall towers and distillation columns, this can save time and reduce the risk of accidents. Drones have the ability to hover literally inches away from a superstructure, inspecting important areas such as joints, welds and seams that can be examined in greater detail than ever would have thought possible with traditional methods.

A major concern during the execution of major capital projects is the surveillance monitoring so that theft of high value items is avoided. Drones can now monitor a project site location continuously. Since drones effectively supplement the existing security scheme, their contribution to maintaining site integrity is very useful...

One major benefit of using drones is their ability to transport materials to the project site. However they do not have the capacity to handle heavy payloads. They can be easily used for the delivery of schematics, contracts and other important documents.

Robots

The engineering construction industry has not traditionally been a favourable field for the application of robotic technologies. However, several stimuli such as the dwindling labor population, retirement of the skilled workers and the safety issues of labourers have promoted the development of robotic construction systems. Engineering construction involves many dangerous and chaotic environmental factors which cause poor working conditions for construction workers. Replacing workers with robotic systems has many advantages such as increased quality, productivity and safety. Robots can be used for repetitive and predictable activities, such as tiling, bricklaying, welding and spool fabrication, demolition, and concrete recycling.

With the help of robots enabled with sensors and controls, digging and placing of soil can be done automatically. Task-specific, dedicated robots can perform specific well defined tasks. They can be robots for structural work, used for concrete placing, steelwork lifting and positioning, robots for finishing or completion work such as exterior wall spraying, wall or ceiling panel handling and positioning, robots for inspection works doing external wall inspection and robot for maintenance work such as window and floor cleaning.

The most significant benefits of robotics and automation systems in engineering construction industry would be:-

- Increased productivity and work efficiency
- Reduced costs
- Better quality work with enhanced accuracy
- Enhancement of occupational safety for worker

Conclusions:

Today major capital projects are becoming really large and complex, connecting numerous stakeholders. The volume of information managed and transferred has exponentially increased. To meet the contract obligations, crucial stakeholders spend more time in Engineering Information Management, rather than spending time core engineering activities. At this stage, the new age digital solutions such as Networks, Sensors, Mobility, Analytics, Robotics, 3D Printing come handy to help the companies address the key elements of standardizing and automating Engineering Information

Management (EIM) processes, revamp technology landscape, and reduce cost and time of information processing.

The digital solutions in major capital projects help with:

- Better engineering data quality
- Quicker access to engineering data
- Improved asset and equipment data integrity
- Right engineering decisions at right time
- Better collaboration among stakeholders
- Rapid turnaround of projects
- Lesser penalties and fines due to fulfilment of regulatory compliance

Glossary

- AR - Augmented reality
- BIM - Building Information Modelling
- CAD - Computer Aided Design
- DMS - Document Management System
- DOF - Digital Oil Field
- E&C - Engineering & Construction
- EIM - Engineering Information Management
- FEED - Front End Engineering Design
- GPS - Global Positioning System
- HSE - Health, Safety and Environment
- IEA - International Energy Agency
- IOT - Internet of Things
- JIT - Just in Time
- LAN - Local Area Network
- MCP - Major Capital project
- NGO - Non-Governmental Organization
- O&G - Oil and Gas
- OCR - Optical Character Recognition
- PPA - Predictive Project Analytics
- RFID - Radio Frequency Identification
- UAV - Unmanned Aerial Vehicle
- WAN - Wide Area Network

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Expectations of Indian Higher Education Institutions from NAAC Accreditation

Anusuiya Prasad Semwal*

**Assistant registrar University of Petroleum and Energy Studies*

Abstract

With increase in enrollments for higher education in India the issue of quality becomes a challenge both for the academic institutions and the students seeking admission in them. In order to regulate quality, several accreditation bodies have been formed. One such agency that operates in India is the National Assessment and Accreditation Council (NAAC). The mandate set by the Government of India makes accreditation compulsory for Higher Education Institutes (HEIs). NAAC through a rigorous accreditation process is entrusted to accord accreditation to HEIs. In NAAC's opinion there are nine thrust areas that they expect the HEI to benefit from. The issue around NAAC's opinion requires an understanding of the gaps that may arise between the intension of NAAC and expectations of HEIs from the entire exercise of accreditation. Unless the gaps are understood and bridged, the accreditation process will remain a mere exercise in futility. This study addresses the issue of accreditation from the HEIs perspective and not from the accreditation agencies viewpoint. The study breaks the nine thrust areas as set by NAAC into a hierarchical structure of sub-factors. The hierarchical structure helps in identifying the relative importance of sub-factors and the nine thrust areas through a pair-wise comparison aggregating to HEI expectations. Data collected from 130 public and private HEIs forms the sample for the study. The study concludes that the HEIs expect that the accreditation will help them identify their strengths, weaknesses and opportunities; create an environment of collegiality and build an image that will facilitate seeking external funds.

Keywords: Accreditation, NAAC, Higher-education, Analytic Hierarchy Process

Introduction

With phenomenal increase in demand for higher education, the Indian higher education system is witnessing several

changes and challenges. There is an increase in enrollment of students made possible with the growth in the number of institutions of higher learning both in the public as well as private sector.

The general expectation of stakeholders in society from Higher Education Institutions (HEIs) is that they operate with high efficiency. In simple terms, efficiency defines a relationship between quantities of inputs toward achieving quantity of outputs. For the practice of managing higher education this does not answer the crucial questions of which inputs and which outputs to measure, and how to ensure the quality aspect of such management approaches (Klumpp , 2015). Therefore, how to ensure that the quality of higher education meets the stakeholder expectations has become a great challenge. Hence, there are growing global discussions about developing the capacity for reliable quality assurance and accreditation of higher education (Hou 2012). As Eaton 2016 suggest that accreditation of higher education is the dominant means to assure and improve the quality of higher education.

With this objective of quality assurance the National Assessment and Accreditation Council (NAAC) was established in 1994 to give constructive push in the direction of quality improvement of the Indian Higher Education Institutions (HEIs) (NAAC, 2015)). Also, to cater to the quality challenges, in year 2013, through government notification the UGC made accreditation compulsory for all HEIs in India. The purpose of making accreditation mandatory was to give importance and recognition to the excellence and quality of education imparted by Indian higher educational institutions. It was to facilitate additional funding and other incentives to deserved Higher Educational Institutions. Encouraging internationalization of teaching-learning, research and collaborations was also the purposes to introducing it. This mandatory requirement of accreditation has made the promoters of such HEIs to be more involved in imparting higher education and be accountable to stakeholder expectations.

To initiate the quality assurance process, the NAAC accreditation process includes a set of standards, institutional self-review and peer review, determination of achievement of accreditation, and award of accredited status. NAAC with its checklist of expectations perform a peer-review through a panel of experts of a HEI to evaluate award of accreditation status. The

accreditation assessment process is rigorous, objective in some areas, but largely subjective.

Universities and private higher education providers are usually at loggerheads about the quality of the qualifications, the impact that the scope of regulatory compliance has on institutional autonomy, and the cost of doing business (Padró&Nair , 2016).

This article discusses the expectations of higher education institutions from the accreditation process based on the benefits claimed by the accrediting agencies.

Review of Literature

Accreditation: The Felt Need

In today's world where competition exists between organizations, to sustain in business and to progress further these organizations have to produce product and services of a quality that is aligned with the expectation of their stakeholders. To build confidence in the stakeholders, organizations' require a validation and further certification from a third party of their internal process& systems (Mark Staples, 2012). Accreditation is expected to deliver the confidence in stakeholders. The accreditation acts as an assurance of safety and conformance of the product or the service that they consume(Ukas, 2016).

Accreditation is a process of certification of organization's competency in the specified area. It is a validation of the ability of an organization against predefined sets of criteria. It is a process where an organization certifies another organization for its excellence. This certifying organization goes through the product, services and processes of the organization seeking for accreditation, thereafter validates and certifies accordingly (amta, 2016).

Accreditation is considered as the external independent assessment of an organization (large, small, or individual) to affirm that what it says it does in documentation it does in practice, to an agreed standard. As Rankin&Welsh (2013) suggest that accreditation enables an independent confirmation of organizational competence (having policies in place, a quality management system and audit systems to support self-regulation).

Initially accreditation has been to the manufacturing units but later spread into service like healthcare and education. There has been an emergent need to build up national standards for quality education.

The process of peer review between accrediting agencies and institutions were developed and adopted(Morse, 2008). With the concern for quality assurance in HEIs and to lift the quality of Higher Education in the country the Indian government set up a National Policy in Education advocating the existence of independent national accreditation body. Accreditation bodies like the National Assessment and Accreditation Council (NAAC) has been contributing in quality enhancement of HEIs in India.

Accreditation in Education

Universities and colleges are the institutions of Higher Education (BIS, 2012). Universities, in general consist of collection of schools, colleges and faculties but by large both are established to serve more or less the similar purposes and represent higher education institution only. The significance of education in the development of any country cannot be underestimated. It is the education which develops knowledge, expertise and excellence that escorts the development of any nation and its economy (Chaudhary & Malik, 2013). Moreover, the Higher Education sector influences the economic planning of the nation and is the key mover of the society. Therefore, the quality of education has vital role in development of any country (Simon McGrath, 2015).

The issue of quality education has always been a concern of stakeholders (EYF, 2013). In India the higher education system is facing challenges on three fronts i.e. expansion, excellence and equity (UGC, 2003). The Higher Education Institutions have grown to multiple folds in last two decades and has turn into one of the largest education systems in the world (Everitt, 2014). Certainly it has grown in an outstanding way. In this aspiration of growth India could succeed in addressing the issue of equity and expansion but quality issues has missed somehow. Indian Higher Education could only uphold a very small base of institutions with quality (Agarwal, Higher Education in India: Need for Change, 2006). The Indian Higher Education Institutions (HEI) has been facing some important and considerable challenges nationally and globally.

In India, accreditation is mandatory since it gives importance and recognition to the excellence and quality of education imparted by Indian higher educational institutions. It facilitates additional funding and other incentives to deserving Higher Educational Institutions.

Encouraging internationalization of teaching-learning, research and collaborations were also the purposes to introducing it. Such systems of course have given opportunity to all stakeholders to understand Indian HEIs more closely. This also made the HEIs involved in imparting Higher Education accountable to stakeholders by some extent. Therefore, it is very essential that HEI take quality very seriously if they want to continue to provide sustainable value proposition to all their stakeholders (UNESCO, 1998).

There is lot many studies conducted on customer's satisfaction specially covering the marketing perspective. The studies on expectations with respect to product & service industry and perceived benefits were also noticed. Service quality and study of gap between exceptions and perceived satisfaction are also there. These studies have also addressed the perspective of various stakeholder involved in respective industry. There are studies available on the above with respect to Higher Education Institutions.

(Abdullah, 2006) Introduced the new methodology to measure service quality for the higher education sector, this new model was named as HEdPERF (Higher Education PERFormance). This new model had covered Academic, non-academic, reputation, access, programme issue and understanding dimensions of higher education sector.(Ho & K.Wearn, 1996) Developed Higher Education TQM Model of Excellence (HETQMEX). According to them quality is always in demand in Higher Education Institutions and there Total Quality Management is always required to assess and sustain quality and the satisfaction level of various stakeholders can be achieved by implementing such systems. (Kebriaei & Roudbari, 2005) Conducted a study in Zanjan University of Medical Sciences to find out gaps between the expectation and perception of students with respect to Educational Service Quality received. A modified SERVQUAL questionnaire was distributed to 386 students and in the study it was found that there a high gap between the expectation and perception in almost all aspect of quality dimensions of educational services. The study also recommended the strategy should be followed to reduce these quality gaps.

(Razi-Ur-Rahim, 2012) Has made an attempt to establish a method to forecast the service quality perceptions in a NAAC accredited B-School, measure the gap

between students' expectations and perceptions. In his study he tried to measure the result of service quality on students' satisfaction and reputation of the institution.(Prasad & Jha, 2013) Have made an attempt to review the models being used in measuring quality in Higher Education. He put various models all together and elaborates different quality dimensions taken care by these models. By integrating all the previous models they also try to conceptualize the new models with six dimensions which include Physical Aspects, Reliability, Competence, Personal Interaction, Course Structure and Policy.

An attempt was also made by (Annamdevula & Bellamkonda, 2014) to moderate the SERVQUAL model as per the requirements of education sector which is named as HiEdQUAL. This model covers various quality dimensions focusing the students as a primary stakeholder. The study describes the method to develop a new measuring instrument of SQ (service quality) which explores other dimensions of service quality within the higher education sector.

The studies on the impact of accreditation on service quality of Higher Education Institutions have also been seen. (B.S.Sahay & Thakur, 2007) in their study had tried to analyze the quality aspects of Indian management education. Further, they analyzed that what makes difference between the two institutions. The researchers had also tried to explore the national and international accreditation process, and how these accreditations can contribute in achieving excellence in these business schools.(Reichgelt & Yaverbaum, 2007) has also tried to understand the interrelation between the accountability with accreditation. They tried to explore that how the accreditation made HEIs accountable to provide value for money. Further, the study was focused on accreditation and its role in ensuring quality in Higher education.(Julian & Ofori-Dankwa, 2006) in their study had tried to find out the accreditation role in strategic decision making of traditional business school. They argued that the core process of accreditation are not well fitted for the new competitive environment and therefore the existing business schools sometimes find sore while adapting it. They also gave some suggestions to accrediting agencies to implement it in their processes.(Robinson, 2004) in his article advocated the need of accreditation in Distance Learning Programs. He had discussed about accreditation, types of accreditation, best practices and the issues

related to quality of distance education and its relation with accreditation. (Pearson, 1979) argued that the accreditation of accounting programs benefits all facet of the profession. He further mentioned that the accreditation process is also similar to an audit of financial statement because both encompass information gathering, investigating and reporting. (Harvey, 2004) have the different view about accreditation and concluded it as a shift of power from Higher Education professionals to managers and bureaucrats. He mentioned that accreditation is putting education in control rather giving flexibility. He further added that the accreditation process needed to be "acceptable" to the regulatory bodies and professional engaged in Higher Education profession.

(Boraiko, N.Zey, & Greife, 2010) have discussed about the benefits accrued by accredited programmes in Safety and Industrial hygiene. The graduates from such accredited institutes come out with professional attributes that are well accepted by industries and are evident that such institutions are meeting the desired quality education. The further added that the staff and faculty involved in accrediting process also get benefited from such accreditation by building their competency. In essence accreditation increases the employability of student and enables faculty to enhance employability through appropriate course content, delivery mechanism and co-curricular activities pertinent to enhancing employability of students.

(G.Prasad & C.Bhar, 2010)in their study have compared the accreditation system followed by various countries, the official signatory of Washington Accord including India. The study discusses about the contribution made by National Board of Accreditation (NBA) since its inception and the shortcomings in the existing system. To make it more effective and acceptable to various stakeholders they further recommended some changes to be implemented in the existing system and policy.(Sharma, 2013)talked about the challenges being faced by Indian Higher Education in terms of access, equity and quality. To address these challenges, the initiatives taken by Government of India have also been discussed which includes Constitution of National Commission for Higher Education and Research (NCHER), Bill on Foreign University and off-campus centres of foreign universities, Bill on prohibition of unfair practices in unaided institutions, Proposal for differential pay scales to teachers and Mandatory

accreditation of institutions by NAAC. (Mathew, 2014)has tried to find out the strengths, weaknesses, opportunities and the challenges being faced by the Indian higher education system in the context of quality in Management Education. He also concluded customer/stakeholders trust as a major key factor to the dimension of quality in HEIs. He further showed the scope of possible research in the area of evaluation of expectation and benefits with respective to HEIs.

Expectations from Accreditation

The HEIs going for accreditation have some expectations from these accrediting bodies. They have always been curious to know whether their Institutions will really get the benefits claimed by these accrediting bodies. Similarly, the institutions which are already accredited follow-up the post accreditation processes with expectation of continuous improvements. The expectation in general is a belief that something will happen based on a series of actions. Expectation happens before the action therefore it is a pre-event activity whereas benefit is post event activity. In the act of benefits there are things to compare. It is an analysis of what perceived and what received. There may or may not be gap between the two. Less the gap, more the satisfaction. The more gap results less satisfaction, more anxiety & more frustration.

The claimed benefits by NAAC are as follows: Accreditation facilitates (NAAC, 2016):

- Institution to know its strengths, weaknesses, and opportunities through an informed review process.
- Identification of internal areas of planning and resource allocation
- Collegiality on the campus.
- Funding agencies look for objective data for performance funding.
- Institutions to initiate innovative and modern methods of pedagogy.
- New sense of direction and identity for institutions.
- The society look for reliable information on quality education offered.
- Employers look for reliable information on the quality of education offered to the prospective recruits.
- Intra and inter-institutional interactions.

It is natural that we expect from whatever we do and of course the better outcome. Institutions also work similarly. Institutions

go for accreditation for self-improvement. By preparing a self-study report and having it certified by an external agency, institutions can assess themselves and establish institutional development over time.

In general, institutions expect that by going for accreditation it will help them to move forward for advance academic quality. "Quality" in terms of inputs, such as quality of intake i.e. students with good profile, the qualified and experienced faculty, the new and updated pedagogy used in teaching learning process, equipments installed in particular laboratory, use of modern ICT tools and updated learning resources etc.

Accreditation helps institutions in planning. The results and recommendations made by accreditation time came for visit helps institutions in projecting institutional plans and budgets in few years down the line. Accreditation will work as a guiding force is surely an institutions' expectation from accreditation. The institutions leadership identifies accreditation as a moving force for strategic planning.

Not only the institutions expects from accreditation, the other stakeholder like general public has also have expectations from it, for them a very purpose of accreditation is consumer protection. The general public every time cannot be so resourceful that information about every aspect of institutions can be accessed. They have to rely on a third party i.e. accrediting agency to find out good institution of their choice. They could get the details of programmes offered, fee details, faculty profile, placements records and many more.

Stakeholders have a right to know about quality being delivered in the all aspect of quality education such as teaching learning, research, infrastructure and learning resources, quality of curriculum and its acceptance by corporate world, student support etc. Are the courses being offered have national and international acceptance? Are the system and processes work with high integrity? May be their matter of concern.

There are other stakeholders such as existing and prospective students; parents; banks and other financial institutions providing fanatical help to students; employers expect clear, consistent and coherent communication about the institution through accrediting body. (Dickeson).

Thus it is apparent that not only accrediting bodies have expectations from HEIs but HEIs have also expectations from accrediting bodies to respond to other stakeholders.

Research Gap

In the context of NAAC's role in India and its regulatory framework this study is an attempt to evaluate what HEIs in India expect from NAAC accreditation. In the process, it is also intended to understand, if there is any gap in the expectation and list of benefits claimed by NAAC. The study is attempt examined whether these Institutions are expecting these benefits claimed by NAAC or not and if yes what is its order i.e. what is most expected and what least or is there any mismatch of expectation and claimed benefits. It will also help in prioritizing expectations of HEIs from NAAC accreditation.

Methodology & Data Analysis

As has been summarized above, the expectations of HEIs from accreditation has different levels of granularity based on the nine claimed benefits of accreditation by NAAC. Further, these levels of granularity are complex and depend upon their respective attributes. It is important to consider the role of these attributes so as to arrive at some conclusive evidence about the significance of these attributes and the levels of granularity to expectations from accreditation. Hence Accreditation Expectation comprised of a chain of hierarchy of a few attributes, each attribute contributing towards the final analysis of understanding the degree of accreditation expectation. Analytical hierarchy process (AHP) was selected to guide us in choosing the right degree of Accreditation Expectation. The AHP technique (Saaty, 1980) allows to model a complex problem into a hierarchical structure showing the relationships of the goal, criteria, and the attributes.

AHP employs both quantitative and qualitative approaches to solve complex problems. Qualitatively, a complex problem is decomposed into a hierarchical structure. Quantitatively, it adopts pair-wise comparisons to rate the elements. Further, AHP employs redundant comparisons to ensure the validity of judgments. It also provides a measure of inconsistency for discarding inconsistent judgments (Lam & Chin, 2005). The AHP method includes three steps: the first step involves constructing the hierarchy; second, calculating weights of elements at each level

of hierarchy; and finally, computing the weight of each decision alternative.

AHP is used here to guide the HEIs in determining the degree of Accreditation Expectation while considering the major factors. The factors were derived from the literature research and interviews with HEI stakeholders. To apply AHP, in our study 130 HEIs were contacted with a questionnaire that contained the attributes of the Accreditation Expectation.

Based on the interactions with the HEI stakeholders and applying the AHP the following steps were carried out:

Step I: Structuring the hierarchy of levels and attributes For this study an Accreditation Expectation model has been proposed. The model is formalized and structured as a hierarchy, which enables navigation between the different levels of Accreditation Expectation. Furthermore, by combining this hierarchical structure with AHP, the model has been applied to quantitatively assess Accreditation Expectation in HEI

The study illuminates nine dimensions with their sub-attribute as shown in the Figure 1 and the Table

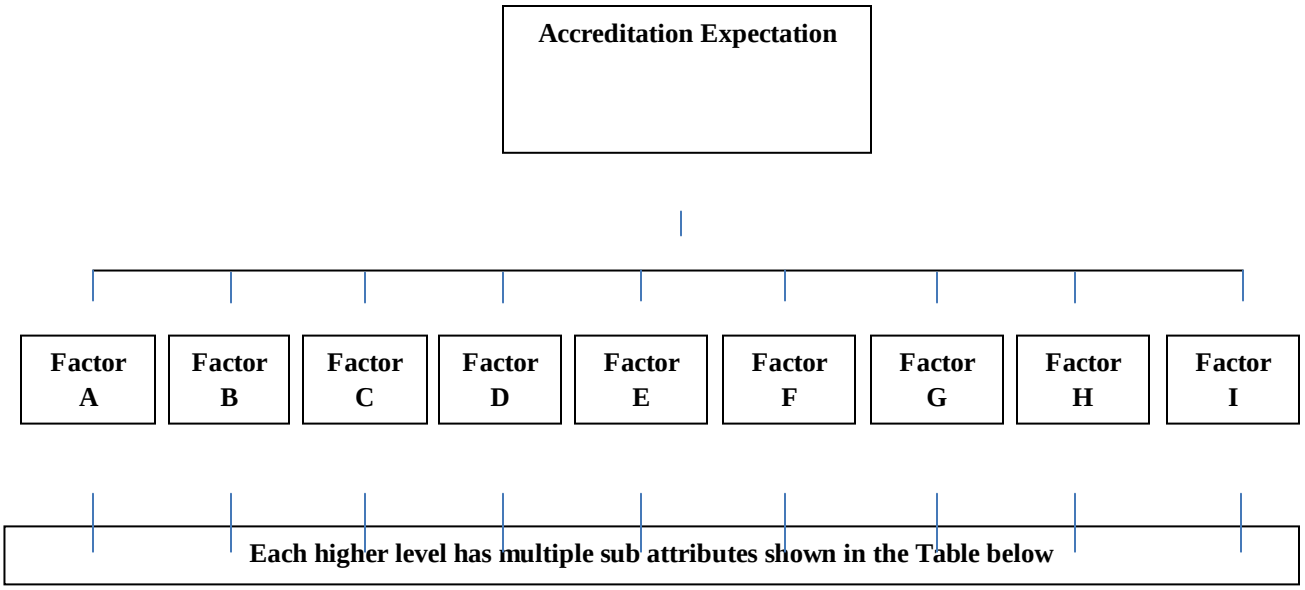

Figure 1: Hierarchy of Accreditation Expectation

Table 1: Factors and sub-attributes defined

Level 1 Factors	Level 2 Sub-Attributes
A Institution to know its strengths, weaknesses and opportunities through an informed review process.	[A1) Benefits the institution to know its strengths and weaknesses.]
	[A2) Helps in developing an informed review process as a part of integrated system.]
	[A3) Helps in identifying opportunities and threats for an Institution.]
	[A4) Helps in developing bottom-up approach of informed review process in Institutions.]
	[A5) Helps in developing top-down approaches of informed review process]
	[A6) Helps in developing mixed approaches of informed review process]
	[A7) Guides in identifying areas of improvement through feedback process.]
B Identification of internal areas of planning and resource allocation	[B1) Helps in identifying key areas of internal planning.]
	[B2) Helps and guides through providing direction for academic planning]
	[B3) Helps in better resource allocation & budgeting]
	[B4) Helps in planning nature of Human Resource recruitment.]
	[B5) Helps in providing guidelines for infrastructure planning.]
C Collegiality on the campus.	[C1) Improves peer relations and helps resolving conflicts]
	[C2) Helps in creating culture of healthy competition among different academic units]

	[C3) Ensures employees work united for the common purpose of the institution.]
	[C4) Helps create culture where peers mutually respect each other's commitments, goals and strategic plan]
	[C5) Helps in overall decision making process pertaining to Institution]
	[C6) Improves inter-departmental and Intra-departmental communication]
D Funding agencies look for objective data for performance funding.	[D1) Helps visibility of the institution to funding agencies.]
	[D2) Ensures higher funding opportunities to the research centers, researchers and the institutions.]
	[D3) Helps for funding agencies to decide institutions for funding]
E Institutions to initiate innovative and modern methods of pedagogy.	[E1) Introduces and encourages use of modern & innovative teaching pedagogy]
	[E2) Helps in consolidating teaching – learning process]
	[E3) Helps in building structured relationship between teachers and students for effective teaching learning]
	[E4) Helps faculty identify the areas where they need skill, knowledge and augmentation.]
F New sense of direction and identity for institutions.	[F1) Provides meaningful inputs for optimal decision making]
	[F2) Provides new sense of direction to top management]
	[F3) Helps Branding the Institution]

	[F4) Helps institutions indentify the processes required for continuous development]
	[F5) Provides a Unique identity to the institution]
G The society look for reliable information on quality education offered.	[G1) Helps institution provide appropriate information to the prospective students]
	[G2) Helps provides reliable information to promoters and funding agencies]
	[G3) Helps prospective parents choose the institution for their wards]
	[G4) Helps to set benchmarks that make external stake holders view the institution favorably.]
H Employers look for reliable information on the quality of education offered to the prospective recruits.	[H1) Helps prospective employer to choose the institution for recruitment.]
	[H2) Helps communicate to the prospective employers the quality of education offered.]
I Intra and inter-institutional interactions.	[I1) Provides clarity in roles and responsibilities of departments and individuals]
	[I2) Ensures operationalization of Standard Operating Procedures]
	[I3) Helps building Intra institutional communication structures]
	[I4) Encourages decentralized system of Governance.]

Step II: Data collection by pair-wise comparison of the elements

Using a five-point scale relative importance of HEI stakeholders for the sub attributes at the same level with respect to factors of their higher level is recorded.

Step III: Calculating the relative weights of factors

The weight, which is the priority of an attribute with respect to its preceding attribute, is calculated. The judgments are synthesized using the geometric mean approach as suggested by Saaty. Table 2& 3 gives the details of the local weights of the factors and the sub-attributes.

Table 2: Local Weights of the Level 1 Factors

Factors	**Sub Attributes**								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**Weighted Sum**	**Priority**
A	0.174335	0.160749	0.162766	0.137255	0.127972	0.124848	0.112076	0.127232	1
B	0.241177	0.23509	0.184774	0.16899	0.169968			0.123718	4
C	0.217733	0.154479	0.152677	0.148066	0.14508	0.144396		0.125685	2
D	0.34755	0.327451	0.324999					0.124213	3
E	0.263803	0.263698	0.236603	0.235896				0.106459	5
F	0.241597	0.233981	0.178465	0.175129	0.170828			0.103725	7
G	0.263617	0.261994	0.251027	0.223362				0.105561	6
H	0.452014	0.367261						0.094585	8
I	0.268581	0.249727	0.240996	0.240696				0.094536	9

Table 3: Local Weights of the Level 1 Factors and their sub-attributes

Level 1 Factors	Weights	Level 2 Sub-Attributes	Weights
A	**0.127232**	**A1**	0.21527387
		A2	0.18312293
		A3	0.18781943
		A4	0.133658306
		A5	0.116241143
		A6	0.110652625
		A7	0.08881081
B	**0.123718**	**B1**	0.292272496
		B2	0.277714225
		B3	0.17155961
		B4	0.143403206
		B5	0.144922282
C		**C1**	0.273485578
		C2	0.144247234

	0.125685	**C3**	0.14163113
		C4	0.132971096
		C5	0.127425674
		C6	0.126206084
D	**0.124213**	**D1**	0.362373524
		D2	0.321671915
		D3	0.316873128
E	**0.106459**	**E1**	0.278730053
		E2	0.278512352
		E3	0.224200859
		E4	0.222834256
F	**0.103725**	**F1**	0.292247352
		F2	0.274116584
		F3	0.159417348
		F4	0.153485137
		F5	0.146065377

G	**0.105561**	**G1**	0.278279535
		G2	0.274840957
		G3	0.252295916
		G4	0.199751504
H	**0.094585**	**H1**	0.408633006
		H2	0.269761633
I	**0.094536**	**I1**	0.288670391
		I2	0.249564988
		I3	0.232415244
		I4	0.231831209

Results & Discussion

As per the data collected and the analysis performed on the data the results are as follows:As has been discussed in the hierarchy of expectations, at the second level where the Institution looks at an assessment of its strengths, weaknesses and opportunities through an informed review process, it was found that the expectation of HEI's is to know more about their strengths and weaknesses [See Table 3 (value: 0.21527387)]. Amongst other factors,HEI's expect to identify opportunities and threats and develop an informed review process as a part of integrated system towards accreditation (See Table 3).

It is evident from the above table that a bottom-up approach of informed review

process is better than any other review process like top-down or mixed approaches.

It is interesting to note that although accreditation process claims to provide feedback to institutions for their development but the HEI are least expecting the benefit from the process of accreditation.

A factor that concerns accreditation process is about identification of internal areas of planning and resource allocation. The study concludes that HEIs expect that through accreditation process they can identify key areas of internal planning. Also an expectation is that the accreditation process shall guide the institutions in providing direction for academic planning and help in better resource allocation & budgeting, infrastructure planning. There is least expectation from accreditation in planning of human resource recruitment. The weights in Table 3 indicate the findings.

While the NAAC claims that the accreditation process will benefit collegiality on the campus, the expectations of the HEIs suggest that peer relations improve to resolve conflicts and creating a culture of healthy competition among different academic units. HEIs, although moderately expect that accreditation will ensure employees work in a united manner for the common purpose of the institution and create culture where peers mutually respect each other's commitments, goals and strategic plans. HEIs expect that accreditation will help them to a limited extent in overall decision making process and improving inter-departmental and intra-departmental communication.

Further, while analyzing data received on the claim made by NAAC on "funding agencies look for objective data for performance funding", it is found that higher education institutions highly expect that by going through NAAC process, it helps them in getting visibility of the institution to funding agencies, ensures higher funding opportunities to the research centers, researchers and the institutions and helps funding agencies to decide institutions for funding by going through NAAC accreditation process.

Regarding NAAC's one of the claimed benefits i.e. "Institutions to initiate innovative and modern methods of pedagogy", after analysis it is found that HEIs expect that by going through NAAC process it Introduces and encourages use of modern & innovative teaching pedagogy and helps in consolidating teaching-learning

process. Whereas, their expectation is a little low as compared to above, that it helps in building structured relationship between teachers and students for effective teaching learning and faculty identify the areas where they need skill, knowledge and augmentation.

On another claimed made by NAAC that it gives "new sense of direction and identity to institutions", the higher education institutions do expect benefits that it provides meaningful inputs for optimal decision making and provides new sense of direction to top management is high as compare to branding the Institution, helps institutions identifying the processes required for continuous development and providing a unique identity to the institution by going through NAAC process.

Another factor that concerns accreditation process is about the society look for reliable information on quality education offered. The study concludes that HEIs expect that through accreditation process they can provide appropriate information to the prospective students and can provides reliable information to promoters and funding agencies. Also an expectation is that the accreditation process shall guide the intuitions in helping prospective parents in choosing the institution for their wards. There is least expectation from accreditation in setting benchmark that makes external stake holders view the institution favorably. The weights in table x indicate the findings.

It was found that the expectation of HEI's on "Employers look for reliable information on the quality of education offered to the prospective recruits" is high about the prospective employer to choose the institution for recruitment and a little low on communicate to the prospective employers the quality of education offered.

On intra and inter institutional interactions HEIs' expect that by going through NAAC accreditation process it will give clarity in roles and responsibilities of departments and individuals, ensures operationalization of Standard Operating Procedures, helps in building Intra institutional communication structures and encourages decentralized system of Governance.

While analyzing data at first level it is observed that HEIs expect that the NAAC accreditation will help them in knowing its strengths, weaknesses and opportunities through an inform review process at top followed by collegiality on campus, funding agencies look for objective data for

performance funding and identification of internal area of planning and resource allocation. Thereafter it expects "Institution to initiate innovative and modern methodology of pedagogy, "The society look for reliable information on quality education offered" and "New sense of direction and identity for institution" The least expected were "Employers look for reliable information on the quality of education offered to the prospective recruits and "intra and inter-institutional interactions" by going through its process.

Conclusion& Future Research

The basic expectation of Higher Educational Institutions from NAAC accreditation is in knowing the strengths, weaknesses and opportunity available to them in the growth of the institution. HEIs' find that the accreditation process leads to strengthening collegiality on the campus indicating inter and intra departmental interactions for sustainability and growth. The HEIs definitely understand that a NAAC accreditation will help them to project a positive image of their institutions to external funding agencies.

As the accreditation process by NAAC is rigorous the run up to peer review process helps these HEIs in their planning and resource allocation very effectively. The process being outcome oriented HEIs feel that the process brings innovations to the teaching-learning.

The HEIs grossly expect that there will be image enhancements to their reputation. They seek opportunity to project a positive image to society as being an institution that offers quality education. As the image of the institution grows in society HEIs expect that this provides an opportunity to explore new directions and identity for them which is indirectly indicative of expansion plan of their institutes.

What is evident from the data that institutions expectations from NAAC is in strengthening the internal growth and sustainability, NAAC does not in any way aid in placement outcome of students. Further, data provide the evidence that institution least expect collaborations occurring from other similar institutions indicating silo-based orientation.

This study involved a sample of 130 institutions which were largely government aided affiliated colleges. It is necessary that the study be expended to include institutions which are self-funded and university

themselves. There may be variations in the expectations of these institutions thus it is relevant that such institution be also studied in future research.

This study involved assessment of only one facet of accreditation such as expectations, it will also be relevant that benefits assessment be also made and any gap arising out of expectations and benefits may form a policy document for both accreditation agencies and institutions of higher learning.

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Framework Analysis: A Qualitative Research Methodology

Atul Agrawal*, Dr. Anil Kumar**, Dr. T Joji Rao***

**Senior Executive Chancery, University of Petroleum and Energy Studies*
***Professor, CoMES, University of Petroleum & Energy Studies, India*
**** Associate Professor, CoMES, University of Petroleum and Energy Studies*

Abstract

Use of Qualitative research methodology is increased during recent time to pursue applied research, especially in the context of social policy. Qualitative research methodology understands and explores the diversity of public and social policy concerns. It provides a systematic approach to understand complex cultures, systems, needs and behaviors. Framework analysis is a qualitative research tool which is developed and refined over the years although basic concepts are same. This paper briefly discusses about the Framework Analysis Methodology and puts the lights on its interconnected stages.

Keywords: Research Methodology, Qualitative Research, Framework Analysis

Introduction

Research Methodology

Research is a scientific process which carries out systematic investigations to discover a new knowledge. The motivation of research is to discover a truth which has not been found out yet. Every research carried out, has its own aim, objective, challenges and implications . The value of the research does not depend on the topic of study, but it depends on the fact that how well the research is being designed and planned.

Research design gets various scientific concepts together to collect and analyze data in phased manner. Research design combines the significance of research purpose with an Economic Theory. A research design provides the conceptual and structural blueprint to collect, to measure and to analyze the data. Hence it is always recommended to develop an appropriate research design to follow.

Research Methodology is the way to perform research scientifically. Research methodology used in research solves the research problem systematically. Research methodology contains various research steps

which are applied in a research study along with a defined logic. It is important for the researcher to not only know about the research methods or techniques used in a research, but also the research methodology, i.e. the researcher must know that which research method or technique is the best fit for his study and what is the reason for the best fit. Research methodology used in various research studies can differ by the nature of the problem. The term "Research Methodology" has wider scope than the term "Research Methods".

Quantitative research:

Quantitative methods of research use numerical, mathematical or statistical analysis tools to solve a problem. In quantitate methods; data is being collected through surveys, questionnaires and polls. Qualitative research also consists various methods to manipulate preexisting data using statistical techniques.

Qualitative research:

Qualitative research is a primary exploratory research which consists a set of material and interpretive practices to make this world visible. The observer of the world is located by the qualitative research. Practices of qualitative research turn up every behavioral aspect into a sequence of representations. These representations can be made through memos, recordings, photographs, conversations, interviews or field notes. A naturalistic, interpretive approach for the world is being involved with the qualitative research. Concludes that the researchers who carry out the qualitative research; study particulars in the natural setting and interpret the particulars through the meaningful inputs given by different people.

Difference between Quantitative and Qualitative Research:

The main difference between qualitative and quantitative methods is the flexibility. Usually, quantitative methods are quite inflexible. In quantitative method, a researcher asks identical questions to all participants in the same order. Question asked in this method are close ended hence a meaningful comparison of answers across all participant can be done. Although, this method requires a deep understanding about both the statistical tools to be used and questions to be asked.

On the other side, Qualitative Methods are more flexible. Qualitative methods allow greater freedom to respondent to answer a question as the open ended questions are used in this method. In qualitative research,

respondents answer in their own words and these words are not necessary to be same. Hence the responses for this methodology are considered to be more complex than quantitative. In Qualitative methods, the communication between the researcher and respondent is less formal than quantitative. Also, in qualitative methods, researcher has an opportunity to react immediately to what the participant said by adding subsequent questions.

However, the degree of flexibility varies with method to method used in qualitative or quantitative research.

Framework analysis

Every organization is governed by the set of some policies and predefined procedures. These procedures and policies are reviewed periodically to ensure optimum utilisation and efficiency of available resources. The review process assesses the failure or success of the respective policy and simultaneously builds a path to implement that particular policy. The research methodology which undertakes this role is known as applied policy research. In applied policy research, researchers have the potential to generate workable outcomes by gathering specific information. Over the last decades, Qualitative Research Methodology has been recognized as the valuable approach to carry out research in management studies and studies related to social science and social policy fields.

Framework analysis is developed by the Jane Ritchie and Liz Spencer in 1994 at Social and Community Planning Research Institute; London. Framework analysis is considered as the most appropriate qualitative method which is being used for applied policy research.

Framework analysis provides some flexibility in analyzing the data. In this method, users either may collect all data before the analyzation part or else can do the analyzation while the collection. Framework analysis analyses the data through a five step process:

- Familiarization
- Identification of thematic framework
- Indexing
- Charting
- Mapping & Interpretation

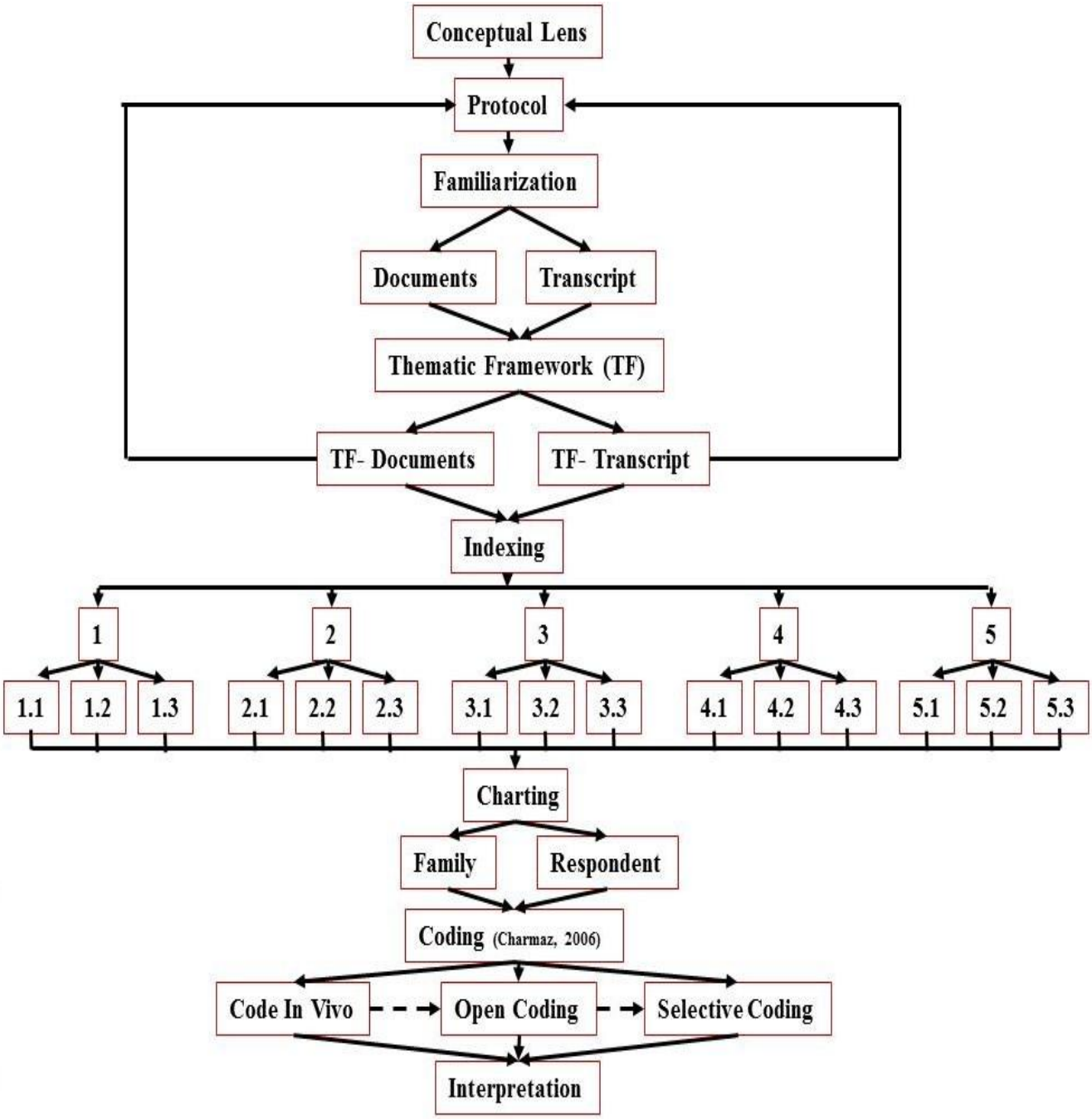

Figure 1: Flowchart: framework analysis

Familiarization:

Familiarization is the process in which researchers become familiarized with the transcripts and simultaneously get the understanding of collecting data. The transcript can be the output of field notes, observations, document analysis or interviews. Familiarization can be done

through the analysis of pictures/ images, or by seeing videos or by listening audios. In this step the researcher gets familiar with key ideas and particular themes and make a comment or memo on them. Since lengthy / heavy data is collected in qualitative research, it's difficult for the researcher to review all the information, hence a selection of data is made which can be based on certain aspects.

Identification of thematic framework: This is the second stage in framework analysis. Themes or issues are identified once the researcher had the familiarity of the collected data. These themes and issues are categorized based on the nature of collecting data. Here we can also say, that the data can be filtered and classified based on some themes.

Researchers need to be open in mind while doing the research. There should not be any force to set a data in a particular theme. However, since the study usually gets designed for a particular set of issues, the set of issues only guide to have a draft of thematic framework. This draft is considered to be rough and can be modified during the further analysis process. The refining work of a thematic process is not a mechanical or automatic process, but involves natural and logical thinking. It connects different ideas, judgments, importance and meaning of an issue. It also assures that all the research questions pertaining to research have been addressed properly.

Indexing:

Indexing is the third stage in framework analysis. Indexing provides sections or portions of the data which are related to a particular theme. Indexing is applied to all of the gathered textual data. Use of a numerical system is recommended before the text to provide a proper sequence and reference. Indexing may be done through the help of qualitative softwares like Atlas.ti, NVivo.

Charting:

Charting is the fourth stage in framework analysis. The indexed data of previous stage is arranged in the charts for different themes. In this, data is fetched from its' original background and arranged in charts which consists the headings & subheading drafted earlier in the thematic framework or during primary research inquiries.

Mapping and Interpretation:

Mapping and Interpretation analyses the key characteristics laid out in charts. Interpretation of the data set is received through a schematic map or diagram of the event. At this stage, the researcher becomes familiar with the outcomes of his qualitative study. The associations, concepts and technologies used to develop a strategy are based on the participant's observation, hence the strategy recommended as the output of research; reflects the true value, attitude and belief.

Interview questions

Interview questions to be asked are generally categorized into 3 categories, i.e. Structured Interviews, Unstructured Interviews and Semi – Structured Interviews.

In structured interviews, usually similar questions are asked from each and every respondent. Variation in questions does not occur in this type of method. While unstructured interviews are usually considered to be informal and do not have pre –determined bunch of questions. Here, a broad and holistic conversation occurs between interviewer and respondent. On the other hand, semi-structured interview uses the balanced approach between of the unstructured and structured interviews. In this approach, such environment is developed where the discussion may happen in detail. Therefore, the interviewer helps the respondent to drag into the area of research and this helps in the gathering of more detailed information having higher degree of depth. However, for every type of interview - a procedure is needed and framework analysis is the best way to provide a focused and repeatable procedure.

Summary

Framework Analysis uses creative and conceptual understanding ability of the researcher to determine connections, meaning and salience. A well-defined procedure is needed to give strength to the framework. Framework Analysis is a five step approach. In the first one, the researcher gets familiarized with both the diversity and range of the data and gets an overview about the collected data. During the stage, researcher reads a lot and may also listen to recorded audios etc. In the second stage, after reviewing of selected material, the researcher goes back to notes taken and identifies the key themes, concepts or issues under which data can be referenced. In the third stage, through the numerous judgments

about the significance and meaning of data, Indexing is done. Indexing provides a mechanism through which manageable data segments are created. In the fourth step, charting of indexed data is done. Charting involves abstraction and synthesis of data for a particular theme. In this, a summary or judgement about the respondent's view is entered. In the fifth and last stage of framework analysis, researchers find out key characteristics of the data. Researchers interpret and map the whole data at this stage. Hence, after this stage, the framework analysis approach used by research may map the ranges, create the typologies, find the associations, provide explanations or may develop strategies. This all depends on the area and topic of research.

Acknowledgements

Corresponding Author would like to thank the reviewers, editors and his family for their guidance and valuable suggestions.

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Health Care Delivery System in India
The progress after National Rural Health Mission

Reena Yadav*,Varsha Kumari**, Dr. Kiran Singh***

**Research scholar, Dept of Economics, University of Allahabad,*

*** Research scholar, Dept of Economics, University of Allahabad,*

**** Associate Professor, Dept of Economics, University of Allahabad*

Abstract

The best way to make the health facility closer to the needy one is to make them within reach of each and every person. No matter he is rich or poor; the main aim of government investment in health sector is to bring health to all. Since health being the necessary component of human well being its importance in life is not to be ignored. A healthy mind in healthy body slogan seems to prove it. It is true also because your physical and mental health will sound only when you are aware about good health and you are ready to take step to improve. Similarly health being the social good, the step of govt to improve public health is necessary, but it should be available to all is also the responsibility of public and government. The major drawback is seen in the field of health care delivery mechanism. Whether it is infrastructure deficiency, manpower shortage, fall in supply of medicine and diagnostic equipments, or the strong governing body that should strengthen the entire system systematically. These all are backbone of health care sector system of any country without tackling with these problem**,** health to all is far cry. The objective of the paper is to see the impact of change in health care delivery system and infrastructure after National Rural Health Mission in India on its major health and demographic indicators. Along with it also look at the shortage of infrastructure and man power. That still being the main cause of consideration for government.

Keywords: Health, Infrastructure, MMR, IMR, CBR, CDR

Introduction

Infrastructure is very important tool for any developing country. If we invest in it more we can achieve more productive result in favour of our economy .There two types of infrastructure in India one is physical and other is social .Social infrastructure includes health ,education

and sanitation etc. After independence there are more changes comes in health sector. India achieved some good status in heath sector but this is not sufficient for India .India is the one of the most populated country after China in the world. Rural population is very more in India. Rural sector is the home of 68% of rural people.

Poverty is the very impacting factor for rural people .In rural India poor people cannot afford good and qualitative health facility due to some leakages in health sector. The facilities of the scheme are not received by targeted poor rural people because they are unaware about the facility. Health infrastructure is very weak in India. There is lack of manpower, equipment and doctors and nurses in PHCs, CHCs, and SCs. If health infrastructure would be good and qualitative then our health indicators would be good. Health sector is very challenging for rural India from independence. Health is very important factor for any developing country for development and growth. In India Health condition are in crucial condition. To strengthen the primary basic health facility in rural India and to develop and to enrich the health infrastructure Government of India launched the mission National Rural Health Mission in India in 12 April 2005.

According to Sarma Arun (2008), NRHM, in its endeavour to improve the health care delivery in the rural India may be considered as a paradigm shift in the way health care delivery is to be executed. The professional and systematic approach adopted in the mission, has shown its impact. The visible impact has been in a form of revamping the infrastructure. He argues that almost all states have taken up the task of quantitative and qualitative improvement in the health care delivery infrastructure form the sub-health care centre to district hospital. The Public Health Foundation of India (2012), with the launch of NRHM the Indian Public Health system revamped and redesigned the requirement for functional grades of the health facilities. The current medical education system in India, focuses minimally on the development of managerial competence, NRHM having recognized this gap, has been providing valuable support to initiative, for motivating and empowering health personnel within the government health system. Hence strengthen decentralized planning process and outcomes.

National Rural Health Mission has started making a different as reflected in the health indicators. The infant mortality rate declined from 58/1000 live birth in 2005 to 47/1000 live birth in 2010. Maternal mortality rate declined from 245/100000 deliveries in 2004-o6 to 212/100000 deliveries in 2007-09. The JSY registered impressive gains with 1.13 crore women benefiting during 2010-11. The World Health Organization has decided to take India off the list of countries with active endemic wild polio virus transmission, since polio has been almost eradicated from the country. (The Hindu May 2012)

The findings of annual health survey should be of immense benefit in major public health initiatives, particularly the NRHM, which was successfully addressed the gaps in delivery of critical health services to rural areas. (The Indian Express, Feb. 2010)

Objective of the study:

There are more gaps in rural health sector in health infrastructure compare to urban area. The objective of the study is to find out the condition of the health facility in rural India and health infrastructure in rural India after NRHM (National Rural Health Mission).

Methodology:

Secondary data has been taken by different Government reports such SRS Reports, Census Reports, Rural Health Statistics reports, Economic Survey. The data has also been taken by Ministry of Health and Family Welfare and internet. The data has been analysed by percentage method.

Table-1 Demographic Indicators in India

Parameter	1951	1981	1991	Current levels
1. Crude Birth Rate (CBR) (per 1000 population)	40.8	33.9	29.5	22.5 (2009)
2. Crude Birth Crude death rate (CDR)(per 1000 population)	25.1	12.5	9.8	7.3 (2009)
3. Total Fertility Rate (TFR) (per woman)	6.0	4.5	3.6	2.6 (2008)
4. Maternal Mortality rate (MMR) (per 1000live births)	N.A.	N.A.	437 (1992-93) NFHS	254 (2004-06)
5. Infant Mortality Rate (IMR) (Per 1000 live births)	146 (1951-61)	110	80	50 (2009)
6. Child (0-4) Mortality Rate (per 1000 children)	57.3 (1972)	41.2	26.5	15.2 (2008)
7. Male Life Expectancy at birth	37.2	55.4	59.0	62.6 (2002-06)
Female Life Expectancy at birth	36.2	55.7	59.7	64.2 (2002-06)
Life Expectancy at birth Total	___	55.5 (1981-85)	59.4 (1989-93)	63.5 (2002-6)

Source: Economic Survey

Based on population norms, the primary health care infrastructure has been developed in rural areas as a three-tier system –Sub-Centre, Primary Health Centre and Community Health Centre; and the services of these three centres are also assisted by the presence of Rural Family Welfare Centres. The Sub-Centres provide first level contacts between the primary health care system and the community. Tasks assigned to these health institutions vary from state to state. In some states the Auxiliary Nurse Midwives (ANMs) stationed in sub-centres perform deliveries and refer only the complicated cases to PHCs or beyond. In some states the emphasis is on inter- personal communication so as to bring a

behavioural change in maternal and child health, family welfare, nutrition, immunization, diarrhoeal control and control of communicable disease. The PHC is referral unit for about five to six Sub-Centres. Activities of PHC include curative, preventive and primitive health care as well as family welfare services. CHCs serve as first referral units (Furs) for four to five PHCs and also provide facilities for obstetric care and specialist consultations. According to norm, each CHC should have at least 30 beds, one operation theatre, X-Ray machine, labour room, laboratory facilities, and to be staffed by four medical specialists - surgeon, physician, gynaecologist and paediatrician. According to data available for 2008-09 we have 145272 SCs, 22370 PHCs, and 4045 CHCs. (MoHFW, 2010).

Table-2 Rural Health Care Infrastructure after NRHM

Infrastructure/Human Resources	2005	2009	2015
Health Sub Centers	1,46,026	1, 46,378	153655
ANMs at Sub Centers/Primary Health Centers	1,39,798	1,87,902	212185
Primary Health Centers	16,023	20,236	25308
Doctors at Primary Health Centers	20,308	24,085 Plus 6,303 AYUSh doctors	27482 other than AYUSH
Community Health Centers	3,346	4,385	5396
Specialists Community Health Centers	3,550	5,062	4078
Nurses, Midwives at PHCs/CHCs	28,930	46,903	65039
LAB. Technicians at PHCs/CHCs	12,284	12,941	17154
Pharmacist at PHCs/CHCs	17,708	21,003	23131
Radiographers at CHCs	1,337	1,886	2110

Source: Rural Health Survey (2005, 2012, 2015).

Table-3 Health worker/ANM at Sub centers and PHCs

S.R. number	Required	Sanctioned	In Position	Vacant	Shortfall
2005	169262	139798	133194	6640	19311
2015	178963	195672	212185	20492	9326

Source; Rural health survey 2014-15

Table-4 Doctors at Primary health centres

S.R. number	Required	Sanctioned	In Position	Vacant	Shortfall
2005	23236	24476	20308	4282	1004
2015	25308	34750	27421	9389	3002

Source; Rural health survey 2014-15

Table-5 Total specialists at CHCs

S.R. number	Required	Sanctioned	In position	Vacant	Shortfall
2005	13384	7582	3550	3538	6110
2015	21584	11661	4078	7881	17525

Source; Rural health survey; 2014-15

Table-5 Pharmacists at PHCs and CHCs

S.R. number	Required	Sanctioned	In Position	Vacant	Shortfall
2005	26582	21072	17708	3380	2858
2015	30704	28268	23131	5456	8321

Source; Rural health survey, 2014-15

Table-6 Laboratories Technicians at PHCs and CHCs

S.R. number	Required	Sanctioned	In Position	Vacant	Shortfall
2005	26582	14571	12284	2287	7226
2015	30704	22626	17154	6139	13691

Source; Rural health survey, 2014-15.

Table-7 Nursing staff at PHCs and CHCs

S.R. number	Required	Sanctioned	In Position	Vacant	Shortfall
2005	46658	34061	28930	5280	13352
2015	63080	74098	65039	11757	12953

Source; Rural health survey, 2014-15

Table-8 Building Position of SCs

Total no/Year	2005	2015
Total number of SC functioning	146026	153655
Govt building	63901	103632
Rented building	50338	32879
Rent free panchayat sponsored	14295	17090

Source; Rural health survey, 2014-15

Table-9 Building Position of PHC

Total no/Year	2005	2015
Total number of PHC functioning	23236	25308
Govt building	16032	20975
Rented building	2826	909
Rent free/panchayat sponsored	1687	1541
Total no/Year	2005	2015

Total number of CHC functioning	3346	5396
Govt. Building	2822	5133
Rented building	5	35
Rent free/panchayat sponsored	254	228

Source; Rural Health Survey

Table-10 Allocation of health Infrastructure in India

States/UTs	Sub centers	Primary health centers	Community health centres	24x7 PHCs	24x7 health institution at all level	First Referral units (FRUs)
Arunachal Pradesh	592	116	44	55/25	86	10
Bihar	8858	1641	70	533/0	625	76
Himachal Pradesh	2071	449	73	95/0	204	51
Madhya Pradesh	8834	1149	270	212/180	533	87
Rajasthan	10742	1503	349	500/0	1267	100
Uttar Pradesh	20521	3690	515	648/225	1037	136
Nagaland	397	86	21	33/0	54	11
Assam	4592	844	103	343/229	464	60
Andhra Pradesh	12522	1570	167	800/0	1026	194
Delhi	41	8	0	1/0	35	25

Source: Ministry of Health and Family Welfare, GOI, (2010).

Findings: (Based on percentage analysis)

1) Crude death rate at the national level for 2013 is 7.0 % per thousand populations and it varies from 7.5 in rural areas to 5.6 in urban areas. Among the bigger states it varies from 4.1 in Delhi to 8.4 in Orissa. The states having death rate higher than or equal to the National level are Andhra Pradesh 7.3, Assam 7.8, Chhattisgarh 7.9, Karnataka 7.0, Madhya Pradesh 8.0, Odisha 8.4, Uttar Pradesh 7.7 and Tamil Nadu 7.3.

2) At the National level 12.4 % of the deaths are of infants death (<1year) whereas 52.7 percent of the deaths pertain to persons aged 60 years

and above. Toddlers (1-4) accounts for 2.5 percent of the deaths. The percentage of infant deaths to total deaths varies from a low 2.5 percent in Kerala to a high of 18.6 percent in Rajasthan.

3) At national level the share of infant deaths is 13.5 percent in rural areas to 8.4 percent in urban areas. In rural areas Kerala registered 2.7, the lowest percent share of infant deaths as compared ton20.3 in Rajasthan.

4) At National level IMR (per thousand live births) is reported to be 40 and varies from 44 in rural areas to 27 in urban areas. Among the bigger states, it varies from 12 in Kerala to 54 in Assam and Madhya Pradesh. Female infants experienced a higher mortality than male infants in all states. At the National level the neo-natal mortality rate is 28 and ranges from 15 in urban areas to 31 in rural areas. The percent of neo natal deaths to total infant deaths is 68.0% at the national level, and varies from 56.4 percent in urban areas to 69.9 percent in urban areas.

5) At the National level, child mortality rate is estimated at 11.0 and it varies from 12.3 in rural areas to 6.4 in urban areas. Among the bigger states this varies from 2.4 in Kerala to 16.5 in Madhya Pradesh and Uttar Pradesh. The Female children have higher death rates than male children in all the states except in Andhra Pradesh and West Bengal. The female children deaths are equal to male children in Jammu &Kashmir and Maharashtra.

6) At National level, 25.1 percent of the deaths occurred at Government hospital and varies from 23.2 percent in rural areas to 32.1 percent in urban areas. Among the bigger states Himachal Pradesh (49.6) has the highest percentage of deaths in government hospital and Jharkhand with 15.8 shares the lowest percentage. About 24.2 percent deaths were attended by

untrained functionaries and other (quacks and faith healers). The share of rural sector is higher than the total that is 27.4. Whereas the share of urban sector is 12.4 percent.

7) Despite an increase of 44% (between 2005 and 2015) in number of PHCs, only 36% at all India level and 27% in high focus states are functioning at 24x7 hour basis.

8) But the corresponding figures for CHCs are 93 % for all India level and 88 % in high focus states.

9) 11% of the PHCs do not have doctors (this is 17% in high focus states). At CHCs level only 49% of the required specialist have been sanctioned so far, and positioned at 25 percent. Less than a third of the required number of staff nurses has been positioned.Almost 90 percent of the village has been covered under ASHA scheme. About 95% of ASHA had received training of first module; only 24 percent received the fifth module of training.

10) About 69 percent of ASHA had received drugs kit, which is still low.

11) The shortage percent of Sub Centers in 2015 with respect to 2005 is 23 percent. The shortage percent of Primary health center in 2015 with respect to 2005 is 26 percent.The shortage percent of Community health center in 2015 with respect to 2005 is even high at 39.8 percent.

12) The shortage percent of manpower comprises (ASHA/ANM, comprises 3.8 % shortage, physicians at PHCs comprises 10.3 % shortage, Specialists at CHCs comprises 69.7 percent shortage, Radiologist at CHCs comprises the shortage of 52.9 %, laboratory technicians comprises the shortage of 43 %, whereas there is 23 percent shortage in nursing staff for the same time period.

Conclusion:

After the launch of the most ambitious health project of government NRHM in 2005, there is a considerable rise in health

infrastructure and man power supply in areas where the mission has been implemented. But if we look at the percent of shortage allowed by the existing requirement in the system, it visualizes the fact that still there is a long way to go as per Indian Health Standards norms, which has to be strictly implemented in order to improve the supply side of the healthcare delivery system of Rural India.

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Leadership Traits from Ramayana

Dr Gautam Srivastava*, Dr Neeraj Anand**, Dr Arvind Kumar Jain***

**Assistant Professor, Accurate Institute of Advanced Management, Greater Noida.*

***Senior Associate professor, University of Petroleum and Energy Studies, Dehradun.*

**** Associate Professor, University of Petroleum and Energy Studies, Dehradun.*

Abstract

This paper aims to act as an invaluable source towards giving a new interpretation to Ramayana (Sri Ramacharitmanas) aimed at telling readers about the knowledge of current management in the epic. It brings to light that Ramcharitmanas is not only for Hindu religious book but also it contains many principle and the example of the modern management also and now leading organizations are understanding that effectively managing human capital and right distribution of wealth is essential to achieving the results. Only when the right people on the board and their efforts are recognized then only organizational will become successful.

Introduction

Indian culture is one of the oldest and strongest cultures in the world. Whole world appreciate the Indian values and its tradition.

Thousand of year's Indian culture and values enlighten the whole world. Ramayana is one of the oldest and famous epic in the world. It represents the real Indian culture and values. It is able to enlighten the society in any prospect. Diwali and Dusheshra are two most beautiful and important festival in India, these festivals represent various aspect of human efforts.

Dusheshra and Diwali. Both festivals show our culture, values a thought process. Indian society and culture is one of the oldest cultures in the world. It has enlightened the world several times. Number of scholar visited India several times from various part of the world

.They gained knowledge from here and distributed in their home countries. West has taken various part of its knowledge from great Indian philosophy. Now a day we are living in different world, where we are talking about the technology advancement, but most of the time we forget, without the development of advancement of human beings there will be no use of progress and advancement. We can see, every part of the world is boiling, very few people are happy and have money power and they are exploiting rest of the world. Multinational people are making money. They are enjoying huge package and facilities but they are least bothered about their employees. So we can see world economy is going in recession, USA and Europe, Japan etc. are not capable in handling this situation. People are agitating, showing their frustrations and anger by various means. We have seen Anna movement in India also.

Actually nobody is ready to sacrifice, very few owners believe in the distribution of profit, most of the bosses behave like masters and juniors are treated as slaves. Companies are exploiting the resources of other countries, they want become global leader by hook and crook, they are exploiting resources for their own benefits so what is happening in the corporate, we can see huge infrastructure, beautiful offices, big packages of few peoples, big cars, big penthouse for few executives various big CEOs and MDs have their own helicopters and not bothered that last employee of their companies is not capable

to buy a scooters also. It is just like a "Golden City – Lanka (Sone ki Lanka) of Ravana, Pushpak, big mahals (palace) of Ravana and his ministers, but what is happening with lankabasi (People of Lanka). For any growing economy tasks and goals are important, without accomplishment of goals, no society can progress, progress should not one way, but human effort should also be recognized and appreciated in accomplishment of work and wealth distribution must be proper. Diwali and Dusheshra are celebrated in the remembrance of these two things. In Dusheshra we are celebrating and recognizing the human efforts and we appreciate, we celebrate Diwali for new leadership, it is the beginning of new era, new commitment. It is really interesting to compare the Ravana and

Traits of Leadership from Ramayana

Ram and Ravana both were successful but the point is this that who is most desirable for the society and business. Gandhi and Hitler both were successful in their way but the success of Hitler is not useful for the human beings. This is the month of celebrations; we are celebrating two most famous festivals Dusheshra and Diwali. Both the festivals are correlated by the Sri Ram, one of the most accepted Hindu incarnations of God as human beings.

Now a day's everybody is talking about the leadership. Every society and corporate organization needs more leaders for running the system smoothly. We need more leaders who can take more accountability and responsibility. One Anna Hazzare, social activist of India has proved if some body is adroit in work as well as in handling the human resource, he can lead the society and the organizations. This month, we are celebrating two great festivals Dusheshra and Diwali. Lord Ram is most famous incarnation. He was incarnated as a human

and handled all the situations and conditions as a human. He did not use his super natural power in solving the problems. He set up great example how we can nurture ourselves as a great human being and leader as well. We celebrate Dusheshra because Sri Ram killed Ravana on this day; this was great example of human effort. This is the occasion where we can discuss the leadership style of Sri Ram and Ravana. Understanding the leadership style of Sri Ram and Ravana both will be useful, because if we want the leadership of Sri Ram we have to nurture ourselves as Ram and if we want the leadership of Ravana then we have to develop ourselves according to Ravana's style. And second festival is Diwali. Diwali is celebrated because Sri Ram came into Ayodhya on this day and it was the starting of Ram-Rajya.

We can compare the leadership style of Sri Ram and Ravana. One end Ravana was not ready to give-up any thing, he had taken every move for himself, he had no succession plans and other end Sri Ram who was ready to any sacrifice for the society and family. Sacrifice will be the key factor to run good and healthy business. Until the top management of the companies will not ready to give up and lower level will not feel happy, the real progress will not happen.

We can compare the Ram-Rajya and Ravana Rajya. Ravana had golden Lanka, his economy was based on only the materialism, he had only one dimension but Ram-Rajya focused on physical, mental and materialism well being. Tulsidasji mentioned in his great epic SriRamcharitramanas that wealth and prosperity was unlimited and it could not be counted in the Ram-Rajya. It is very clear that wealth is important for running any organization but it come with mental and physical stability and with out a good leadership no organization can prosperous and wealthy so Ayodhya became prosperous

due to leadership of Sri Ram. There were three dimensions of Ram-Rajya- Dehik (Physical attributes), Devik (Mental attributes) and Bhotik (Materialistic or Monetary attributes). Everybody was physically fit and very much clear about his duties so there was no role conflict, and every part of the organization was working properly and due to this reason organization or state was capable in earning the huge profit. But there is one Sudh Labh and other is Sub Labh, until unless this Sudh Labh will not convert into Subh Labh, no society or organization will become happy. Sudh Labh means profit of company or profit of owner but Sub Labh is prosperity or profit for every body. Subh Labh means owner or leader is ready to distribute his wealth among his team members. There must be sharity in profit of the organization, if owners are not ready to share their profit then they will become rich and the infrastructure will become rich but people who are working under them they will feel cheated and become poor. Ravana was rich and his Lanka was rich but the people of Lanka were not so happy. This was the major difference between the ruling of Sri Ram and Ravana. Sri Ram did not believe on Sudh Labh (Absolute profit), he believed on Subh Labh (Auspicious Profit). He converted Sudh Labh into Subh Labh.

When we are talking about the team handling or care about human resource we again find that Ravana was least bothered about his team members. Ravana was the mighty demon king. He possessed high quality team of individuals and his team was equipped with high class technological weapons on the other hands Sri Ram had equipped with less technology but his team had high morale.

Sri Ram always appreciated the effort of his team members and distributed the rewards as per their performance. The story of Sri

Ram was the great example of leadership and team building. Sri Ram first developed himself as a great team leader and team builder and then he could establish Ram-Rajya. Sri Ram went exile only with his wife Sitaji and brother Laxmanji. He had no power, no kingdom but when he returned to Ayodhya; he had killed Ravana, built a strong team of Sugreev, Jamvant, Hanumanji, Angad, Nal-Nil etc. and he became the king of whole the earth. This is very interesting story of leadership and even in new modern business we can learn lots of leadership traits from the Life of Sri Ram. New modern business concepts emphasize to develop more and more leaders for the organization, who can handle the responsibilities; and can take ownership. Sri Ram had established cross-cultural relations with Vanara (Sugreev, Hanumanji etc.), Bhalu (Jamvant), and demons (Vibhishan). He did not only the develop the relations but manage beautifully also. Sri Ram showed various characters in making, developing and nurturing his team. He empowered his team members and showed the trust on their abilities. Two great scholars of management Blake and Mouton had given a managerial grid and according to them the best management practice shows high concern of human welfare and same time high concern for task also. We found various examples in the life of Sri Ram where he showed high concern for task and high concern for human resource as well. Sri Ram never forgot the effort of his team. One example we found when Ravana was killed, the king of Gods Indra paid his tributes to Sri Ram and asked what could he do for Sri Ram, we can just imagine project has successfully completed and management is asking to the team leader or manager what they can do for him and generally manager will say hike his payment, his designation and more facilities for him; he forget his team members and their effort; and management also happy to

give the appraisal to the manager and forget the rest of team members, this will give the depression among the team members because they are not appreciated well so either they will not ready with that manager next time or they will try to search a new job or new organization where their effort can be appreciated. But Sri Ram did not do, because he was more concern for his team, he wanted that first his team should be appreciated and rewarded then only he could think about himself. Sri Ram could make any demand from Indra but he said to Indra that these Vanaras and Bhalu were killed for my work so if you could alive them. Here Sri Ram showed his absolute concern for his team; he was not worried for him. He ordered to Vibhishan also for distributing the wealth in among the Vanaras and Bhalu. So Sri Ram established the example that completion of task is important but after completion of task the effort of human resources must be recognized and rewarded.

On the other side Ravana was the task oriented autocratic leader, he required only work and he did not recognized the effort of his people. Ravana wanted Sitaji, his major project was abduction of Sitaji and for this he chosed to Marich, he visited to Marich cottage; first he praised him and informed the reason to come but initially Marich refused his proposal; he said if he would do this, he was killed by Sri Ram and he already met to Sri Ram in Vishwamitra Ashram. Then Ravana warned to Marich and said him if he would not do this, he would be killed by him. We find many managers now a day in modern corporate world they require only work, first they praise and when people show their limitation then they threatened to people in the same manner as Ravana did. Marich had to go to Sri Ram's cottage and he was killed; Ravana abducted to Sitaji but when he was returning to Lanka, he did not think about the Marich because his task had completed so he did not

bother about his team member. Most of the managers behave this way and then they complain that people do not want to work.

So most of the people will not like the leadership style of Ravana, even we can not live in the state of Ravana where there is no distribution of wealth and there is no appreciation of the efforts. Ravana may be good manager but he was not great leader. We require the leadership of Sri Ram and we require the Ram-Rajya for prosperous and happy society or organization.

Conclusion

This has been already proved that the appreciation and recognition is important for handling human resource. If organizations convert its human resource in human asset then they have to really approve the effort

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Managing Information Entropy with Probability Theory

Naveen Chandra Pandey*

****Assistant Professor, University of Petroleum & Energy Studies.***

Abstract

The paper attempts to explain social or community behavior based on Shannon's theory of information and entropy along with a simple concept of probability theory. Not only social behavior but many aspects of individual and organic behavior may also be explained in this way. The paper also explores various areas where the principles apply.

Keywords: Information Entropy, Probability

Introduction

Information theory was proposed by Claude E Shannon in 1948 to find fundamental limits on signal processing and communication operations such as data compression. His seminal work has found application in diverse areas. Information theory studies the transmission, processing, utilization, and extraction of information. Abstractly, information can be thought of as the resolution of uncertainty. In the case of communication of information over a noisy channel, this abstract concept was made concrete in 1948 by Claude Shannon in his paper "A Mathematical Theory of Communication", in which "information" is thought of as a set of possible messages, where the goal is to send these messages over a noisy channel, and then to have the receiver reconstruct the message with low probability of error, in spite of the channel noise. Shannon summarized the fundamental problem of communication as that of reproducing at one point, either exactly or approximately, a message selected at another point. Interestingly this transmission of information could be between points in space or time. Transmission through space or time is the same problem.

The issue being discussed comes in the category of "now to then" rather than "here to there", since it is a case of developments happening over time. Shannon's Information theory, which discusses the dynamics of information transmission over space or time, can be a relevant framework to understand the phenomenon being discussed.

Review of Literature

As the paper attempts to model the behavior of intelligent entities based on Shannon's theories of information and entropy, we need to understand these in that order.

Information

Per Shannon's Theory, Information is the amount of information that can be gained from an event. Or, it is also the amount of surprise factor in an event. The Expression for the amount of information that can be had from an event is depicted as:

$$\mathrm{I(p)} = -\log_b p$$

Where p is the probability of an event happening. b is the base of the Logarithmic calculation (Base 2 for bits as unit of information). As an example, we can look at the tossing of a coin. In this event, the probability of a head or tail is ½. So, the amount of information we can get from the tossing of a coin is

$$\mathrm{I(p)} = -\log_2(½) = 1 \text{ bit.}$$

If there is no surprise factor involved; in other words if the probability of an outcome is 1, the amount of information obtained is 0 (Zero). Greater the information obtained, lesser is the certainty.

Information leads to the probability of an action. So, Information and action go together. Information is essential to do something in the short or long term. We may need information to go from New Delhi to Mumbai.

Information can be the information we receive from our environment; or something that makes us, like our DNA. Fundamentally, it is the stimulus received from the environment.

Entropy

It is the average (expected) amount of information obtained from an event. Represented by

$$\mathrm{H(p)} = -\sum_{k=1}^{n} p_i \log_b p_i$$

So, we can see that the amount of information that can be had from an event and the entropy are positively related. Less information can be obtained with lesser entropy; and more information is obtained with greater entropy. Entropy, even in engineering disciplines, is referred to as the degree of disorder. So, Entropy can be said

to be a situation where there are ever greater possibilities. Since information leads to a possibility (in action), more and more information would be an indicator of greater entropy in the environment. In the modern era, we are bombarded with more and information through connectivity with various media. Due to a great deal of information, greater numbers of ways in which we can act are created. In other words, it can be said to situation leading to lesser and lesser predictability in us.

As Entropy is zero, when the outcome is certain; in Zero entropy the predictability is maximum. In a similar way, predictability can be maximized by maneuvering a lower impact of entropy.

As an example, there is a greater predictability in a religious bigot, who doesn't know much more than his sacred texts. On the contrary, a person with a greater exposure to the world has a lesser predictability.

Through scientific experiments, we discovered that the universe is expanding. This expansion is happening not only in space, but also in time, where it manifests as maximizing the overall diversity of accessible future paths of the world. This ever increasing entropy seems to be the property of nature, which leads to the various entities contained within it (A. D. Wissner, 2013). However, On the contrary, when we look at the survival strategies of intelligent entities, they work towards a greater predictability. All the time they seem to be struggling against the increasing entropy. The paper attempts to discuss a connection of this struggle of the intelligent entities with their behaviors, especially in a social context.

Further, we explore how simple laws of probability are in action, while survival or continuity is being ensured by intelligent entities.

Intelligent Entity

In artificial intelligence, an intelligent agent (IA) is an autonomous entity which observes through sensors and acts upon an environment using actuators (i.e. it is an agent) and directs its activity towards achieving goals (i.e. it is "rational", as defined in economics). Intelligent agents may also learn or use knowledge to achieve their goals. What makes Shannon's theory so contextual is that any intelligent entity can also be said to be a set of information,

which in turn sparks a possibility of a particular kind of action or behavior in response to stimuli based on the knowledge inherent in the entity (eg. Experience, Genetic information)

Tendency Probability Set (TPS)

Let assume a set of probabilities as {p1,p2,p3,p4,……pn-1,pn}, which are the probabilities for a set of 'n' tendencies { t1,t2,t3,t4,……tn-1,tn}. We can very safely assume the behavior of any intelligent entity as a set of these probabilities in the direction of said set of tendencies. Let's call it the Tendency-Probability Set (TPS). It is these tendency-probabilities that define an entity (esp. intelligent) and the continuity of this TPS would indicate the continuity of the entity. The TPS is something abstract which gives rise to more tangible, noticeable and perceivable behaviors. On a micro level, TPS would manifest as an individual entity; A community, a group would be the Macro manifestation of the TPS. In the latter form, this concept would be quite close to the concept of the Morphogenetic Field. Morphogenetic field could be the tendency set of the whole set of such intelligent entities. Each individual entity is a representative of this field and has the same TPS with minor variations. (More on Morphogenetic Fields)

Survival

Since TPS is the identity/configuration of the entity; the continuity of this TPS can be said as survival.

Probability

The extent to which an event is likely to occur, measured by the ratio of the favorable cases to the whole number of cases possible.

Let's toss a coin. The sets of outcomes can be{H,T}. Thus, the probability of Heads(H) or Tails(T) is ½.

Now let's toss two coins. The set of outcomes are {HT,TH,HH,TT}. The probability of at least a Heads (or Tails) now turns out to be ¾. With greater number of coins tossed, the probabilities of getting at least a Head(H) or Tails(T) increases further. The set of tendencies in this situation is 2 (H & T)

Similarly let's take a dice. The probability of having any face is 1/6. But if we throw two dices the probability of having the above face at least once 11/36. The set of tendencies in this situation is 6 (the 6 faces

of the dice). We observe that the probability of appearance of each aspect of a coin, dice, etc increases by increasing the number of the coins, dices, etc. In other words, probability of the appearance of aspects of an entity would increase with the count of the entities. This simple mathematics indicates the fundamental principle in play towards ensuring TPS continuity.

Research Gaps

So far, we have theories of Information and entropy by Shannon in the area of Information Science, which deal with the dynamics of information transfer, the Cognitive dissonance theory telling us how organisms behave in face of conflict. Then, there are simple laws of probability, in mathematical language, which indicate chances of future courses. In the paper, we explore parallels in these theories and simple underlying mathematics unifying them.

Research Methodology

Data has been predominantly collected form secondary sources comprising literature around theoretical premises of Shannon's Theory, Information entropy and organism evolution.

The methodology tries to integrate divergent thoughts around the above theories along with field observations of the researcher.

Discussion

As discussed earlier, increasing entropy would increase the number of tendencies, which in turn would lessen the probability of each of the tendencies of the entity. Irrespective of this change being good or bad, the entity (being a particular set of tendency probabilities) would construe this only as a threat. The scenario can elicit two modes of responses:

Positive Tendency-Probability Continuity (PTPC)

Replicating the TPS. This can happen by having more entities of the same tendency-probability configuration. The basic crux is to have more of the same configuration. It can happen in many possible ways. In simpler organisms cellular fission would be a way. In complex organisms it may happen as having a partner, friend, offspring, community, group, herd, etc. From a distant perspective, this is same as having many copies of information or file, in order to preserve the information or file, which is one of the Information security best practices.

Negative Tendency-Probability Continuity (NTPC)

Destroying any differing TPS, because there is a threat of dilution of the original configuration. Killing or converting others just because they are not of the same belief system is an example. Religious or other ideological conversions would be another example.

In such a case, the object of NTPC action resorts to TPS discontinuity. It is a case of Cognitive Dissonance on part of the object. This can happen in two ways:

- ***TPS Mutation*** –
  The object would mutate its TPS to suit the new environment. Evolution of species is such a mutation.
- ***TPS Neutralization*** – If mutation is not deemed a possibility, the object would tend to neutralize its TPS. It could manifest as a suicidal tendency. Passively it can be an extinction of species.

Both, PTPC and NTPC can be described as an effort for survival by an entity in an ever entropying environment. It can also be summarized as a desire to live. In that sense, variety would preclude the continuity of a TPS.

Observations & Conclusion

- Shannon, in his seminal work on Information Theory, suggested that many copies of the information had to be sent over the channel to make sure that at least one reached the other end of the channel.
- It's no coincidence that cultures that talk about all-inclusiveness, and embrace everyone have pondered over the nature of death or the transitoriness of life – Oriental cultures like Hinduism, Buddhism, Taoism, etc. They generally promote union between non-similar lineages, which would ensure limited survival instinct and propel an individual towards higher goals as asserted by these cultures.
- This would specially be the case with cultures which have thrived in extremes of environment. So, survival being their highest priority, they would tend to reproduce much and be very particular about their culture or beliefs (TPS). They would adhere to the prescriptions of their culture or tradition. To remove any

contrast in their environment, they would resort to conquering and conversions or eliminating non-believers of their belief/faith (NTPC). It could go to the extent of very strongly inculcating a single philosophy, and discouraging the influence of any greater amount of information; thereby leading to illiterate and uneducated members. To further the TPS, unions of an incestuous flavor are prevalent here.

Cognitive Dissonance Theory

Cognitive dissonance theory refers to a situation involving conflicting attitudes, beliefs or behaviors, which induces discomfort. To neutralize the discomfort, the affected entities resort to alteration in one of the attitudes, beliefs or behaviors to reduce the discomfort and restore balance etc. The theory suggests that we have an inner drive to hold all our attitudes and beliefs in harmony and avoid disharmony (or dissonance). According to Festinger, we hold much cognition about the world and ourselves; when they clash, a discrepancy is evoked, resulting in a state of tension known as cognitive dissonance. As the experience of dissonance is unpleasant, we are motivated to reduce or eliminate it, and achieve consonance (i.e. agreement). (McLeod, 2008).

In other words, a dichotomy between one's knowledge of the world and the actual world makes one feel threatened. Since one's knowledge of the environment and its workings drive ones actions, this knowledge and one's TPS cannot be separated. In other words they are inseparable. In fact, they are one and the same.

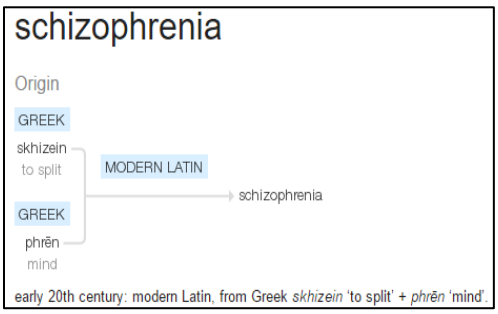
- The homogeneous culture and high degree of social connectedness of a community can contribute to teenage suicide as well as thwart prevention efforts. The lives of adolescents in this highly integrated community are intensely regulated by the local culture. The town's cohesive social networks facilitate the spread of information, amplify the visibility of actions and attitudes, and increase the potential for swift sanctions. This combination of cultural and structural factors generates intense emotional reactions to the prospect of failure among adolescents and an unwillingness to seek psychological help for adolescents' mental health problems among both parents and

youth. Ultimately, these high levels of integration and regulation within a social group can render individuals vulnerable to suicide. (Anna S Mueller, 2016/10),

- Less informed societies are seen to be more closely knit compared to the highly educated or more informed societies, where nuclear families and divorces have become common. This is just an observation.

Scope of Future Research

- Excess sensory information or over stimulations have been found related to schizophrenia, which can be literally described as a schism in the mind. (Schizophrenia - Causes)



- Cancer is ultimately the result of cells that uncontrollably grow and do not die". (Cancer: Facts, Causes, Symptoms and Research). It could be a case of extreme PTPC perhaps as extreme response to entropy in the environment, for example electromagnetic waves from Cell Phone towers, irritants such as chemicals or organic material. More research could be done on this.
- In order to strengthen survival possibilities, companies resort to diversification, and splits in extreme cases of threat from regulations or business environment. In either case the TPS of the company or organization is expanding its scope. More research on business entities would be helpful.
- This can be looked at in another perspective. A disposition towards unpredictability, readiness to be affected by entropy may be an indication of lesser involvement. In an extreme case scenario, it could be an indication of suicidal tendency in an individual. Extreme cases of the other kind could be potential criminals of the highest order.

The same could also be tested on inanimate objects and business entities.

Acknowledgements

I would to acknowledge several people who have helped me visualize the thoughts

around this research. Besides, the people who I have observed demonstrating Shannon's theory & Information entropy, I would like to thank – Dr Deepankar Chakrabarti, Dr Alka Dwivedi and all my other colleagues at the University of Petroleum & Energy Studies in visualizing this innovative thoughts.

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Conceptual Paper

PR Aspects (awareness, knowledge and publicity) of oil and gas sector and how does it matter?

Pankaj Mohan Prasad*

**Assistant Professor ,CoMES, University of Petroleum and Energy Studies Dehradun*

Key words: Oil and Gas, personnel, life, jobs, preferences, media coverage

Abstract:

What makes a person look for the kind of life he longs for? Besides his suit and match with the environment and his credentials there is something that speeds up his attachment with the sectors. One of the factors that has gone highlighting this in this paper in just the same. It is the speedup through the exhilaration of the glitterati or the ambience for a better life fulfillment. Regularity defines this momentum that a Man feels on a regular basis. This paper highlights and conceptualizes the scenario delving into the reasons as to what factors enthuse a person in his career and his personal life and otherwise, and most critically what factor recognition of the job factor plays.

Introduction:

Oil and gas sector has been typified as a narrowed down specialized area of lesser interest to the masses. Its existence is thought to be sustained by the necessitated question of its contributions valued by oil and its power to fill the gaps of domestic running of the vehicles and industries and the need to fill the gaps of availability of resource scarcity.

What is the ad-sell of this feature is:

1. A secure job it offers

2. The job is typified by the good remuneration packages and sustainability till retirement.

3. The companies of oil and gas are fairly well placed in terms of perks and benefits and so on.

The prospects and associated repute form a small part of its overall image. Though associated with the largest economic contribution and as a critical GDP growth factor, it still lags behind in competition to those of manufacturing, tourism, services etc.

Apart from these main sectors of mainstream sectors which are characterized by:-

1. Large product demand from the consumers.
2. Quick defined needs and prompt frequent replenishment of the customer's needs increases its popularity.
3. The trade and transactions are of immense size as is also the largest generator of income and revenue.

4. Consequent to its business volume, it employs a massive resource of human populace, resulting in lots of jobs for the people and means of support to their families.

5. The media profile as a consequence for these companies such as Railways, Power Plants, Steel companies, Banking Companies are much capable to adapt to the changing needs of the people characterized by the nature of the process, the product, the need fulfillment and the associated names etc.
6. These companies form media chunk of media releases and public attention.

7. Services industry for example goes with highly associated glitterati and glamour. That is it comes with the nature of the job and the customer

segment and its associated need is another feature to be studied.

The oil and gas sector (nationally) is a confined area of work as is perceived by the people. What it may be so, because?

1. Oil and gas forms the crude energy resource from the earth.

2. Processing and refining: it is thought to be a dirty job with grime and grease, often thought often thought of as a occupation of necessity rather than interest and enthusiasm or even less pleasure.

3. It is not to say that the people in this trade are less educated or the associated technology is in any way inferior.

4. Oil and Gas excels in process flow systems and the downstream sector can boast of the latest and state of technologies in the play.

The paper delves into critical question.

Analysis:

What are the factors that close this sector from public enthusiasm, and even news headlines? These could be characterized on the following heads:

1. A willful choice of the validity of the sector with sub-factors associated as:

   a. A high tech product to be generated for mass consumption from a crude source

2. The nature of these would remove the workers from cities and metropolis to remote areas.(x).

3. The nature of job specialization would be too demanding in terms of knowledge and experience. Surely the job in line would not be a fun-time.(x)

4. The safety aspects also have a high reach and impact factor associated with the nature of the work connected. Concerns for the families and self

matter the most, follows with the earning , livelihood and the rest.(x)

5. The returns are better than the industry average, that is a plus point.(y)

6. Time away from home and families, especially with the related shipping co.s and even related colonies drives the people away from the city life (the mainstream), as being cut off and concluded to it to be out of compulsion.(x)

Thus we see that there comes a point driven out of the above which is which is of compliance by compulsion. This is not with the nature of human traits or of the demands of modern livelihood.

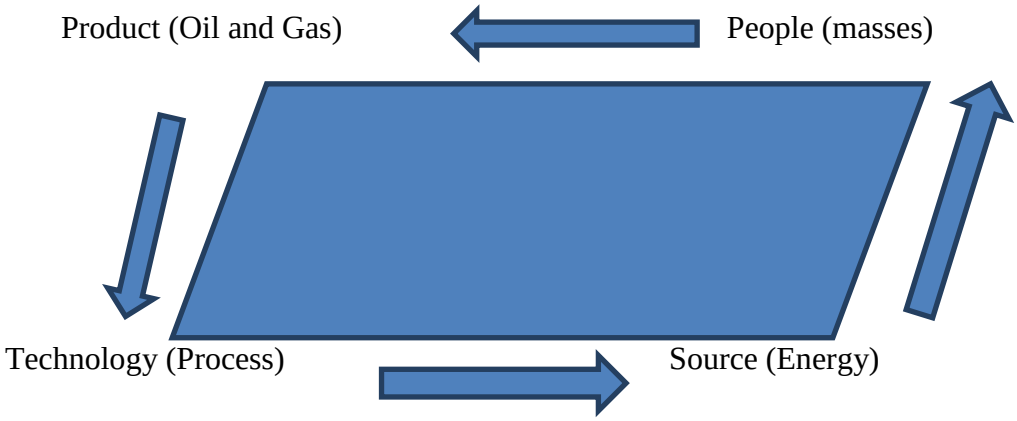

Figure.1 A depiction of the trapezoidal moving momentum generation between the factors.

Compulsion alienated people and the names drawing the sector further in a peculiar state of conflict.

Policy related issues of Budgetary constraints for media advertisement and the constraints related to the propriety of oil and gas products for regular and glamour filled ads for this restrictive factor numbing the enthusiasm of the workforce and the rest of the masses.

So we come across a series or a pattern of (x)'s reining more on the people's thoughts and minds stronger than the materialism associated. The plus(y)

come out weaker by a majority vote/point.

This can be further researched associating point values and drawing out a correlation between the parallelisms, corner points in giving a *momentum* of sustainability.

This momentum goes anticlockwise (assumed) for a proper allocation and clockwise (assumed) for a retrogressive struggle.

Being out of scope at the moment, it would be consonance, state to be satisfied with a niche associated term that redefines a consolation in spite of otherwise an excelling situation.

That is where the ‘nose twitches’ and the ‘the shoe pinches’.

Conclusion:

Suggestions would be to, which may seem paradoxically impossible to make awareness the prime mover, run in the system is a cyclical (synch) and then ensure a mutual flow of reversible associated factors compliant and at the computation with equal opportunities of gain and flourish be recognized as one of the associated goals.

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Ready Property Hand over possession: A perspective on Ready-to-move Space selling

Pradhuman Singh*

**Manager And Executive Assistant To ED Marketing ,DLF, Universal Limited*

Abstract

Due to factors presently beyond the control of the market such as demonetization, the housing sector has taken a hit in terms of sales showing a downward trend. There are serious concerns raised by the property owners who may have bought with the intent of investment and looked forward to a rental income or capital gain. The reality, however, does not correspond to the expectations. However, there is a silver lining with certain sections of the urban infrastructure community vouching for selling ready to move in property instead of advance booking prior to construction and eventually selling it in a fully furnished and livable condition.

Keywords**:** Accessibility, Appreciation, Commercial development, Floor plans, Layout map, Livability, Residential Property, Retail space

Introduction

Ever since the dawn of time, human beings have sought shelter in the laps of nature ranging from under the trees to caves and moving on to improvised sheds. With the discovery of fire, things have changed and usage of heated bricks in addition to precision cut rock and cement has brought in a revolutionary change. Also, land and property had become synonymous with wealth owing to the fact that the supply of the underlying raw material, which is land itself, is in itself limited. However, in the modern times, man has superseded that due to the ability to develop technology that can even reclaim land out of sea and group housing which is built upon multiple surfaces and not just a single patch of land. There are however, a few challenges that have come about to the forefront that have made investing in property slightly less lucrative due to various factors, as a result of which, the realty markets are losing the sheen in spite of the fact that the most powerful nation in the world is headed by a real estate tycoon.

Literature review

Cushman, Wakefield (2016) suggests that there is a demand for commercial space in the wake of startups coming into the picture from the developing countries such as India and South East Asia. While the Chinese economy has shown signs of slowing down, there is a lot of real estate space that is lying vacant and hence, does contribute to loss of buoyant sentiment in the larger perspective [1].

CB Richard, Ellis (2016) feel that an innovation-driven new economy would move out of a usual office setting and subsequently move towards cloud-oriented businesses that may bring down the demand for organized office space which may be commercial, industrial or IT in nature, but give a boost to SOHOs coming in a big way which double up both as a workspace as well as living space. This is a phenomenon much prevalent in startup Meccas such as Amsterdam, but not so much in the developing world [2].

Knight Frank (2016) have concluded that the residential space demand is in a way directly proportional to office space demand but the same holds good only in a condition when there are white collar jobs that are added to the office floor. It implies that a larger number of middle executives would demand living spaces which come along with businesses expanding beyond Central Business Districts (CBD) and hence there is a demand for rental accommodation for its managerial manpower [3].

LJ Hooker (2016) has brought to light the fact in spite of huge lands a parcel nation such as Australia, Russia, United States, Canada, China, and Brazil, there is a tendency of the population to move towards politico-economic centers which are partly a cause for international and intra-national migration observed in Asia. Whether it is a home renter or a home buyer, at the end of the day, there is a preferred choice is always proximity to the place of work [4].

Jones Laing Lasalle (2016) during their tenure as both as a property consultant as well as a property management firm, have found that there is a tendency of the customer to be attracted towards property nearing completion. Also, instead of booking in for a project prior to construction, there is a greater affinity for already built up property in the present market scenario [5].

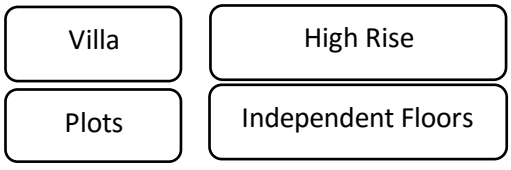
Colliers (2016) deduced that there is a need for high degree of transparency between the approval sanctioning authorities, developer community, and the customers. The delay in delivery of projects may not always be the shortcoming at the developer end but also due to factors that suggest cumbersome bureaucratic processes and untimely or non-payment of dues by the customer. Without a doubt, there is a necessary need to streamline the approval and sanctioning authority [6].

Understanding the Urban Infrastructure markets

The basic classification of real estate or urban infrastructure may be divided into four basic premises.

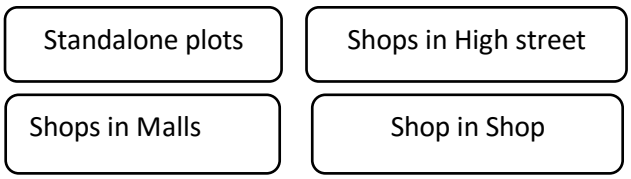
Residential

This is what the housing sector is implicitly implied in the broader sense. Residential infrastructure may further be classified into 3 major subclasses.



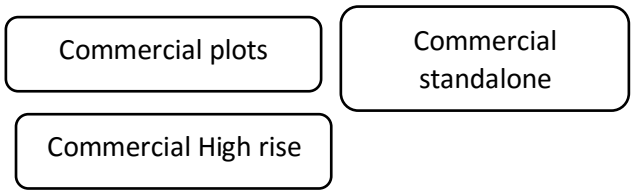
Retail

This primarily refers to shopping space in multiple formats. It also includes spaces serving Food & Beverages. The formats may be as follows.



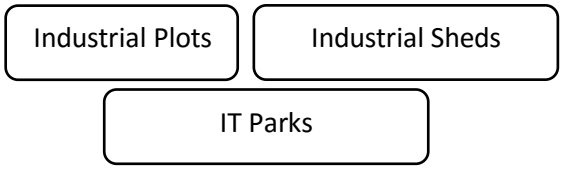
Commercial

This is a property primarily meant to use for office and workspace. This is of 3 types.



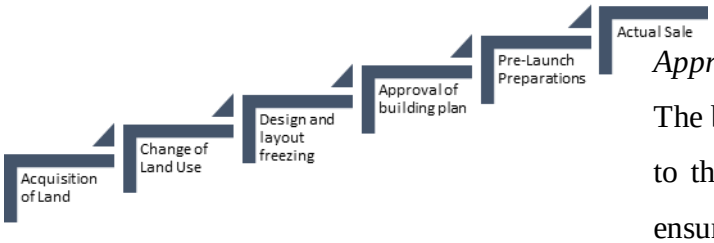
IT/ Special Economic Zone/ Industrial

They are large spaces built for developing, designing and manufacturing adapted to large businesses and rebates from the Government.



The Sales/ leasing process explained

The projects of either nature involve a series of very basic steps:-



Acquisition of Land

This is done primarily by an entrepreneur with intent to creating a land bank. Various features of the land are also examined in terms of future usage in either of the above land types. Land may be acquired either directly from owner/farmer or from the state authority which has acquired land prior to the developer.

Change of Land Use (CLU)

A fee is paid to the development authority or the municipal council for specifying and providing the rights of converting the existing parcel of land into either of the above formats. Depending upon whatever the nature of the final development, a fee is paid. It is to be noted that Commercial property usage incurs a higher fee.

Design and layout freezing

The project is subsequently designed and a plan is made to be executed in form of a built structure. The service of a competent architect and engineer is sought for the same.

Approval of building plan

The building plan, once ready, is presented to the district development authorities for ensuring compliance with the requirement pertaining to a minimum number of necessary factors such as stairs, escalators, lifts, sprinklers etc. Also, a preliminary audit is done to assess the qualities such as green building guidelines and building bylaws.

Pre-Launch Preparations

This involves marketing campaigns which could be Above The Line (ATL) and Below The Line (BTL) and usage of outdoor as well as digital media for raising awareness. This may also include funding from banks and/or investors.

Actual Sale

This could be direct or this could be done through a property consultant/broker. Sometimes online channels may also be used. Even bulk bookings can take place when multiple buyers approach the developer as a single collective body. The booking amount could be a percentage of the total cost of property.

Post sale processes

After the project is purchased, there are various types of payment plans that are offered to the customer depending upon the customer's financial convenience. The plan could be down payment or time linked or construction linked.

Payment of installments

Customers make payment in dues as per their prescribed payment plan. The cash flow from the payment plan serves as the capital for construction of the project.

Site visits

Construction progress is monitored by customers by conducting site visits. At times the developer may also provide web page and newsletter based updates.

Final Handover

Post completion and receiving of Occupancy Certificate from the concerned authorities, the project is offered for possession. Once the dues are cleared, keys are handed over to the customer and maintenance agencies take over.

Registration

This involves payment of stamp duty and/or other charges that the state government levies in order to accord the customer legal ownership of the property.

The core issue of the current times

In the Indian context, multiple projects have been delayed and that has resulted in the loss of confidence and market sentiment in the prospect customer base. Also, the existing customers, as well as banks, are at the receiving end due to delay in completing the projects and there are multiple causes of it. The causes range from developers diverting funds in acquiring new land parcels to court litigation and non-paying customers. The government contemplating Real Estate Regulation Act would mean, a lot of smaller developers would not be able to launch projects, leave alone sell it, due to the clause which suggests 70% of total cost of the project to be available in an Escrow account.

The Likely solution

A new idea that is under discussion stage in multiple real estates think tanks is selling projects once they are fully ready to move and ready to live in. This is further established by the fact that prospect home buyers have exhibited greater faith in ready properties over those on floor plans. Also, the developer can ask for a higher

price for the same instead of the launch and under construction state rates.

One may argue that how does one organize the funding for it. The answer lies in collaboration with Indian as well as International funds as exhibited in some of the projects that have undergone completion and are fully occupied. Also, giving equity to state Government authorities in exchange for funding till completion is a way to get a project executed in a ready to sell the package.

Future Implications

Increased customer confidence

There would be a resultant increase in trust and faith in the developer community once the execution and occupation of projects have taken place.

Increased developer initiative

A preference of buyers for a ready property allows the developer community to exercise greater enthusiasm in the execution of projects at a faster pace without compromising on the quality of construction.

Improvement of overall market sentiment and economy

Real estate by far has emerged not just as a major employer but also a great contributor to the GDP of the nation. Every time a house is purchased and occupied, a plenty of white goods come along with it including new appliances and furniture and fittings. This, in turn, helps drive the economy.

Conclusion

Besides affordable housing, it is important to provide high quality of construction that is ready to occupy, thus saving on the rental expenditure of the end user. It is important to have an immovable asset not just as a form of wealth but also insurance towards future generations and a place to retire. Giving built up property to the customers without giving them an inherent fear of project delay or stalled construction can go a long way in revitalizing the markets and increase the overall flow of funds into the economy.

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Internal Business Environment

A Conceptual Study on Supply Chain Risk Management

Pankaj Singh*, Dr. Deepankar Chakrabarti**, Dr. Saurabh Tiwari ***

** Vice President Ducere Technologies*
*** Professor University of Petroleum & Energy Studies*
**** Asst. Professor University of Petroleum & Energy Studies*

Abstract

The ratio of trade to GDP for the world as a whole has increased from 39% in 1990 to 59% in 2011. The total value of global trade today exceeds US$ 20 trillion.

Supply Chain is now an integral aspect and key value creator in the global value chain. The World Economic Forum estimates that global GDP could increase by USD 2.6 trillion (4.7 %) through improvement in cross border movement of goods and transportation infrastructure.

Geographically dispersed supply chains are now a norm in the pursuit of efficiency. However, with globalization there is now a substantial presence of disruptive factors that contribute to the risk to business operations.

Supply chain operations are today a cauldron of divergent pressures with an increasing quantum of suboptimal outcomes and chaos. As a result of the current ecosystem different kind of risks manifest in the Supply Chain.

This paper is an account of research and practices around the different supply chain risks and management thereof.

Keywords

Supply Chain Management, Risk Management, Mitigation, Vulnerability, Control

Introduction

Background

Supply Chains today are intertwined in a way as has never happened before. It has been gaining in importance and becoming more collaborative in practice and is no longer a piece meal solution structure.

This change has largely been driven by changing market dynamics. Post the 90s there has been a sea change in the manner

customers interact with products. Customers are now demanding as against manufacturers creating demand in the decades gone by.

Because of this evolution, the supply chain needs to be responsive to customer demand and this has led to the integration of functions. It is now imperative that a supply chain to be efficient would need to integrate the supply chain with the value chain. This ensures that there is an alignment with all stages where value addition takes place.

This amalgamation has led to supply chains becoming longer and more geographically dispersed. Thus, supply chains today are more complex and increasingly vulnerable to disruptions often being detrimental to the financial performance of firms.

With these increased dependencies, there has been an exponential increase in the risk and threats to supply chain, the constructs of which is the focus of this study.

The supply chain strategies in vogue for the past few decades of JIT, lean and outsourcing has led to a transfer of risk from internal to the organization to external.However, the moot point being missed by scores of supply chain managers is that whilst the risk is external to the organization it is still internal to the supply chain.

Below is a graph showing how risks have morphed in nature over the past few decades

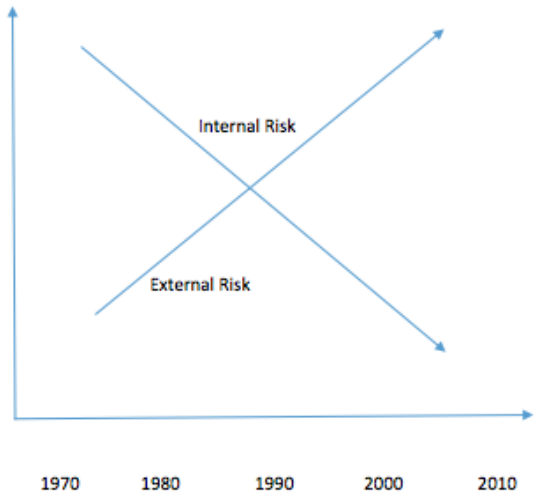

Fig 1. Evolution of risk over the years

There have been divergent views in industry about how supply chain risks are being managed.

Bob Lutz of GM mentions that managing procurement with an emphasis on efficiency and cost control is myopic and could lead to serious business repercussion's in case of an disruptive event.

Bob Fischer however maintains that being agile in reacting takes primacy over scenario modeling. A quick response mechanism coupled with an ability to roll out contingency plans is an integral aspect of supply chain continuity planning.

Extrapolation of the past is no longer a lens for the future as we are no longer sure what the future holds. Supply chain has evolved rapidly over the past three decades and is becoming increasingly collaborative in nature. With the rapid evolution of globalization the ephemeral concept of the extended enterprise and become real and epitomizes the fact that current day supply chains are intertwined in ways as never before.

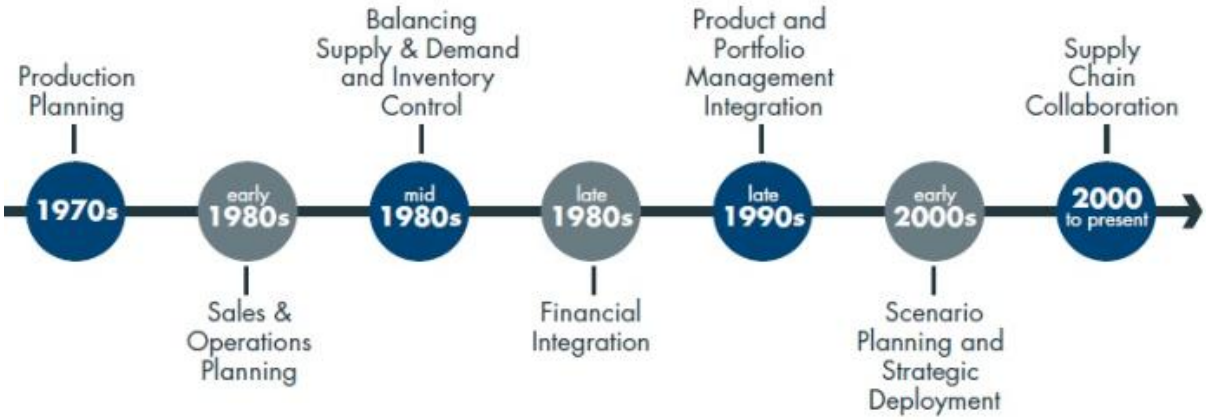

Fig 2. Evolution of the supply chain (Source: Transitioning from Sales & Operations Planning to Integrated Business Planning, Oliver Wight Americas)

The remainder of this paper is structured as follows –

- Literature related to Risk & Supply Chain Risk Management (SCRM) is studied and summarized to give a contextual insight into the topic.
- The paper attempts to understand risk as an individual construct whole and its adaptation in a supply chain context.
- The paper ends with a supply chain risk management decision

framework which could be used to contain the supply chain risks

Supply Chain Risk Management

The theoretical basis for this research is that supply chain operations entail dependencies between multiple firms. The multiple stakeholders in the supply chain exist to create value for the consumer.

There have been various definitions for supply chain, one definition which captures the essence of these dependencies is the description of the supply chain as a network of autonomous or semi-autonomous business entities collectively responsible for procurement, manufacturing & distribution activities associated with one or more families of related products."

Svensson (2002) has categorized the supply chain relationships into two groups – time dependencies and relationship dependencies. It is also a known premise that all the stakeholders in the supply chain face uncertainty in their business operations. Uncertainty can be value accretive or depreciate stake holder value.

The key aspect in decision making within the enterprise is to ascertain the degree of uncertainty acceptable to the business.

VUCA, an acronym for volatility, uncertainty, complexity, and ambiguity has become a catch word in the twentieth century. It is now a business imperative that an optimal equilibrium is maintained between meeting organizational goals and related risks.

What is Risk?

Risk as a construct is multidimensional. It is seen both as cause and effect (Zsidisin 2003) and shows itself up at both the macro and micro level. Deloach (2000) spoke about understanding the quantum of uncertainties and proactively deploying response mechanism whilst executing business activities that are value accretive to the organization

Businessdictionary.com has given a definition of risk which describes risk as probabilistic disruptive occurrence with causal factors both internal &external. It also speaks about the need of contingency planning as an ameliorative approach to contain the negative fallout of disruptive events

ISO defines risk as "The effect of uncertainty on objectives".(Lark, 2015)

There are several constituents which are an integral part of this definition and are highlighted below

- An effect is a variation from an outcome and could be both beneficial and harmful.
- Objectives accommodates different aspects and encompass Financial, occupational health &hazards, safety and environmental goals
- Objectives could also relate to other organizational perspectives i.e. strategic, project, process and product related.
- The attributes of risk are generally linked to events that could occur and resultant consequences or both in conjunction.
- Uncertainty is the lack of knowledge or understanding of an event that has occurred along with the resultant consequences and probability of occurrence.

Over the years there have been several definitions of risk put forward. Below is a compilation of some definitions: -

Author	Definition
Markowitz (1952)	Risk is "variance of return ".
Rowe (1980)	Risk is the potential for unwanted negative consequences to arise from an event or activity
March and Shapira (1987)	Risk refers to the negative variation in business outcome variables such as revenues, costs, profits, etc.
Lowrance (1980)	Risk is a measure of the probability and severity of adverse effects
Miller (1991)	Risk refers to the variance in outcomes or performance that cannot be forecasted ex-ante
Yates and Stone (1992)	Risk refers to the possibility of loss
Mitchell (1999)	Risk is defined as a subjectively determined expectation of loss; the greater the probability of this loss, the greater is the risk

Risk Management

There has been various risk assessment frameworks both formal and informal which have been developed. These frameworks have been rapidly evolving over the past decade and have documented varied approaches and definitions to risk management. Most of these approaches are prescriptive and process oriented.

Risk management is a structured approach to methodically identifying and addressing the risks that arise due to the business as usual operations of the organization. There are various stages in the risk management process and typically involve risk identification and mitigation.

ISO has suggested a risk management framework under the aegis of the ISO 31000 standard which provides principles and guidelines for effective risk management. The standard specifies a process to create a risk management framework as depicted below

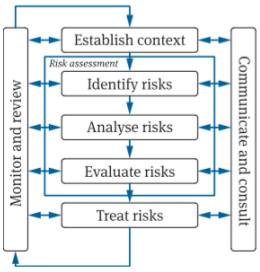

Fig 3. Source ISO 31000 standard: ISO 31000 Risk Framework

Committee of Sponsoring Organizations of the Treadway Commission (COSO) also released in 2004 an integrated framework for Enterprise risk management focused towards achieving four objectives namely –

1. Strategic;
2. Operations;
3. Reporting; and
4. Compliance.

Themodel has eight aspects which in tandem constitute the management process to address risk. The aspects include the reactive redressal mechanisms to cope with the fallout of risks as well as proactive management practices which consider the identification of leading indicators to highlight the occurrence of an event as also an evaluation activity to quantify the probability of occurrence

The model has a triad perspective with the enterprise SBUs as another dimension. The integrated framework is shown below -

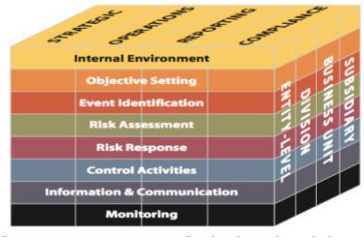

Fig 4. Source COSO 2004:COSO ERM framework

Classical risk management describes four ways of dealing with risk. These are -

- Avoid
- Reduce
- Transfer
- Retain or Accept.

In this approach risks treatment is conducted based on probability and business impact

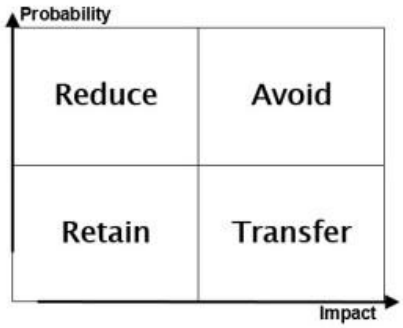

Fig 5. Source: www.husdal.com

In essence risk management is the approach which encompasses the protection of assets and involves anticipating and preparing for potential adverse event thereby ensuring business and operational continuity.

Supply Chain Risk

Supply chain risks come in many hues. The classical definition of supply chain involves managing the flow of product, material & information from point of origin to point of consumption. Based on this definition the risk within the supply chain is the impact the information, material & product work flows. In general risks within the supply chain has deleterious consequences in meeting end customer demand.

There has also been a distinct change in the risk profile of supply chain operations. In the past risks were largely internal in nature and classic containment strategies using key supply chain drivers of Inventory and capacity distribution were effective in dealing with the risks.

Supply chain risk has been an oft debated topic for many years now and in the process there have been various definitions for it.APICS defines supply chain risk as

> "Decisions and activities that have outcomes that could negatively affect information or goods in a supply chain ."(APICS, 2015)

March &Shapira (1987, p. 1404) / UtaJettneretal (2003) define supply chain risk as

‘‘The variation in the distribution of possible supply chain outcomes, their likelihood, and their subjective values’’. (Uta Jüttner , 2010)The Supply Chain Leadership Council has in its definition of

supply chain risk mentioned about the probability and outcome of an event across the entirety of the supply chain. Taking cognizance of the multiple links in supply chain there exists considerable threat of a risk not getting noticed and hence it is imperative that there exists a foolproof mechanism to contain risk and monitor the consequences in the supply chain.

Since supply chains operate over a network and are a multi-echelon model there is a multitude of risks that manifest themselves over all the collaborating entities. Additionally, there is a real threat of the risks amplifying over the value chain and thus causing a business disruption.

Inter-organizational risks are heightened in transnational relationships (Arnold etal 2012). Collaboration as a mechanism to contain supply chain risk has also been researched (Chen et al 2012)

Supply chain risks can impact organizations in a variety of different ways. Organizations require a defined risk response to address the factors causing the disruption.

Krasimiv Kirov has identified various factors that are potential sources of risk within the supply chain.

S.no	Attribute	Factor
1	External	• Natural Disaster • Accidents • Sabotage • Government Compliance • Political Uncertainty • Market Challenges • Lawsuits • Technology trends
2	Internal	• Operational risk • Inventory • Equipment loss • Process issues • Capacity • Quality • Government Compliance • Political Uncertainty • Demand variability • Labor unavailability • Design uncertainty • Planning • Financial uncertainty • Losses

		• Facility unavailability • Enterprise underperformance • Supplier relationship management
3	Supplier	• Planning • material unavailability • Unethical practices • Regulatory non-compliance • Capacity • Set up times • Lead times • Quality • Financial viability • Competition • Management risk
4	Distribution	• Infrastructure unavailability • Lack of capacity • Accidents • Labor unrest /unavailability • Cargo theft • Cargo damage • Warehouse inadequacies • Long multiparty supply pipelines • Long lead times

However, given the current ecosystem of supply chain operations, the risks have morphed to being external in nature and are frequently with inadequate control or containment strategies.

A holistic approach to supply chain risk management (SCRM) is essential. In addition, it is also important to look at the strands and the interlinking between them.

SCRM is now an integral part of Enterprise Risk Management strategies and its complexity is a function of the number of elements and actors in the supply chain. It is accepted that the supply chain is an extended enterprise which however does not operate as a single entity given that there are several different decision makers within each enterprise (Corominas 2013)

Rangel et al (2014) speak about a classification system and mapping the same to the management process defined by SCOR.It has been observed that previous research studies have mainly focused on qualitative frameworks often resulting in informal and semi structured approaches on SCRM (Michelietal 2014). Schaltegger and Burritt (2014) posit about

sustainability performance of supply chains (SPSCs) measures and further extending these measures into measuring risks

SCRM has been positioned as an emergent subset in the larger framework of Enterprise Risk Management (ERM). Zsidisinetal (2004) spoke about SCRM on inbound supply chains mainly focused towards the purchasing process.

Jüttner, Peck, and Christopher (2003) pointed on the significance of the concepts and constructs that make up supply chain vulnerability. Svennson (2002) spoke about understanding the logistics flows to analyze supply chain risks and manage them.

Supply chain risks can hit organizations from a number of outside arenas. Adequately evaluating and preparing for risks can assist the organization in avoiding costly and profitability threatening events.

Supply chain analysis and evaluation can be conducted using qualitative and quantitative methods. SCRM research has moved beyond the traditional supply & demand variability and now encompasses impact due to amplified connectedness and network interdependencies.

The aim for this research is to provide a definition and decision framework to aid in the development of strategies and techniques that support identification, assessment and mitigation strategies for supply chain risk. These taken together form the overall structure of SCRM.

SCRM involves defining an approach that is contextual to the supply chain operations of the organization and is appropriate to the design, logistic flows, and distribution structure and demand patterns. It also should consider the scale of potential threats, hazards, risks, and consequences to the supply chain performance.

There have been several studies on SCRM and following from that various definitions for SCRM has been postulated as given below

Author	Definition
The Supply Chain Council Risk Research Team Dr.	Supply chain risk management is the systematic

Kevin McCormack et al (2008)	identification, assessment, and quantification of potential supply chain disruptions with the objective to control exposure to risk or reduce its negative impact on supply chain performance. Potential disruptions can either occur within the supply chain (e.g. insufficient quality, unreliable suppliers, machine break-down, uncertain demand, etc.) or outside the supply chain (e.g. flooding, terrorism, labor strikes, natural disasters, large variability in demand, etc.). Management of risk includes the development of continuous strategies designed to control, mitigate, reduce, or eliminate risk.
APICS (2015)	At the tactical level, risk management is the continual activity of detection, measurement and evaluation of potential supply chain disruption caused by all varieties of supply chain risk, emanating both from within or outside the supply chain. Supply chain risk management seeks to manage, control, reduce or eliminate real or potential risk exposure to supply chain performance.
Norrman and Lindroth (2002)	Supply chain risk management is to [collaborate] with partners in a supply chain apply risk management process tools to deal with risks and uncertainties caused by, or impacting on, logistics related activities or resources.
Supply Chain Risk Leadership Practice (2011)	The coordination of activities to direct and control an enterprise's end-to-end supply chain with regard to supply-chain risks.
UtaJüttner, Helen Peck & Martin Christopher (2010)	The identification and management of risks for the supply chain, through a coordinated approach amongst supply chain members, to reduce supply chain vulnerability as a whole.
Andreas Wieland Carl Marcus Wallenburg (2012)	SCRM is defined as the implementation of strategies to manage both everyday and exceptional risks along the supply chain based on continuous risk assessment with the objective of reducing vulnerability and ensuring continuity.

It is argued that a successful approach in managing SCRM is through systems modeling and thinking (J. Oehmen et al 2010).Taking forward the theory of cause and effect any supply chain detrimental event would arise from a source and have a consequence.

UtaJettneretal (2010) have described SCRM as having four dimensions -

1. Supply chain risk sources
2. Risk consequences
3. Risk drivers
4. Risk mitigating strategies.

Simangunsong et al (2011) mention that supply chain uncertainty can be characterized into two dimensions -

1. Identifying sources; and
2. Uncertainty management.

Proactively managing uncertainty is essential to manage supply chain risk.

Arnoud De Mayer (2002) mention that uncertainty based management which involves monitoring four uncertainty types as mentioned below is a more forward thinking approach is risk management -

1. Variation;
2. Foreseen uncertainty;
3. Unforeseen uncertainty; and
4. Chaos.

It would be further appropriate to breakdown the channel and assess risk at the individual constituent level of the supply chain. Superior insight into the supply and demand dynamics of the supply chain is an important aspect of this.

Research at the Cranfield School of Management has given the following risk profile for supply chain risk

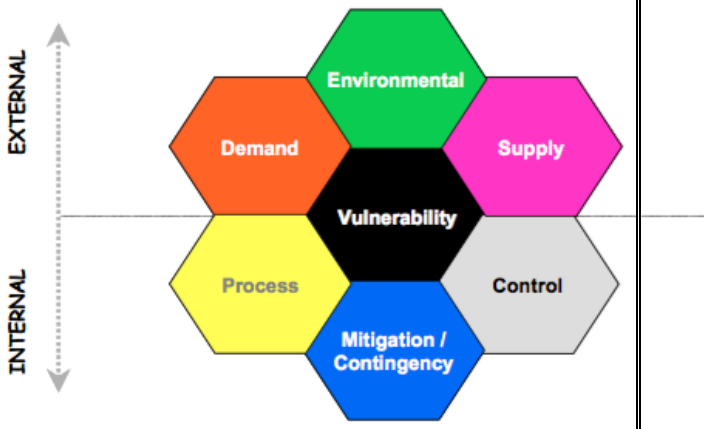

Fig 6: Cranfield Risk Model

Supply Chain Risk – Construct & Scope

During the course of the literature review it has been observed that there exist several areas that contribute to supply chain risk. Furthermore given that supply chain is a multi-echelon network the scope of risk is diverse and manifests itself across the entirety of the chain.

Figure 7 below gives a summary of the scope of risk published by various research papers

Articles (in chronological order)	Scope of risk
Jüttner et al. (2003)	Based on sources: environmental risk sources, network risk sources, and organizational risk sources
Spekman and Davis (2004)	Six dimensions of supply chain as risk sources, (1) inbound supply, (2) information flow, (3) financial flow, (4) the security of a firm's internal information system, (5) relationship with partners, and (6) corporate social responsibility
Cavinato (2004)	Based on five subchains/networks as risk sources, (1) physical, (2) financial, (3) informational, (4) relational, and (5) innovational
Chopra and Sodhi (2004)	Categorize supply chain risks at a high level as disruptions or delays. These risks pertain to (1) systems, (2) forecast, (3) intellectual property, (4) receivable, (5) inventory and (6) capacity risk
Christopher and Peck (2004)	Categorize supply chain risks as (1) process, (2) control, (3) demand, (4) supply, and (5) environmental
Kleindorfer and Saad (2005)	Based on the sources and vulnerabilities of risks, (1) operational contingencies, (2) natural hazards, and (3) terrorism and political instability
Bogataj and Bogataj (2007)	Categorize supply chain risks as (1) supply risks; (2) process risks; (3) demand risks; and (4) control risks
Sodhi and Lee (2007)	Categorize supply chain risks in the consumer electronics industry broadly as those requiring strategic decisions and those requiring operational decisions, in three categories: (1) supply, (2) demand, and (3) contextual risks
Tang and Tomlin (2008)	Categorize supply chain risks as (1) supply, (2) process, and (3) demand risks, (4) intellectual property risks, (5) behavioral risks, and (6) political/social risks
Manuj and Mentzer (2008a)	Categorize supply chain risks as (1) supply, (2) operations, (3) demand, and (4) other risks including security and currency risks
	See Manuj and Mentzer (2008b) for another categorization: (1) supply, (2) operational, (3) demand, (4) security, (5) macro, (6) policy, (7) competitive, and (8) resource risks
Oke and Gopalakrishnan (2009)	Consider low-impact high-frequency and high-impact low-frequency risks in three major categories: (1) supply, (2) demand, and miscellaneous risks in the retail sector
Rao and Goldsby (2009)	Categorize supply chain risks as (1) framework and (2) problem specific, and (3) decision making risk

Fig 7: Source: ManMohan S. Sodhi and Byung-Gak Son (2011)

A further detailed study on risk areas was conducted to identify specific areas of risk and is detailed below

S.no	Author	Risk Area
1	GöranSvensson (2002)	• Time • Relationships • Logistics flows
2	George A. Zsidisin Lisa M. Ellram Joseph R. Carter Joseph L. Cavinato, (2004)	• Supplier quality • Supplier Performance • Supply interruptions
3	Pankaj Raj SinhaLarry E. WhitmanDonMalzahn, (2004)	• Standards • Suppliers • Technology • Practices
4	Andreas Norman Ulf Jansson, (2004)	• Business Control • Hazard management • Business Interruptions
5	Martin Christopher Hau Lee, (2004)	• Visibility • Control • Flowtime
6	H. Peck (2006)	• Risk in strategic networks
7	Ila Manuj John T. Mentzer, (2008)	• Supply • Demand

		• Operational • Security
8	Shashank Rao Thomas J. Goldsby, (2009)	• Environmental factors • Industry actors • Organizational factors • Problem specific factors • Decision maker factors
9	Serhiy Y. Ponomarov Mary C. Holcomb, (2009)	• Resilience • Capabilities- Demand, Supply , Information
10	UtaJüttner , Helen Peck & Martin Christopher (2010)	• Risk Sources(Environmental, Network, Organizational) • Risk Mitigation (Avoidance, Control, Cooperation , Flexibility)
11	Josef Oehmen , Arne Ziegenbein , Robert Alard& Paul Schönsleben (2009)	• Risk Causal System • Risk Effect System
12	Stephan M. Wagner, NikrouzNeshat (2012)	• Demand side • Supply side • Supply chain structure
13	Archie LockamyIIIa, Kevin McCormack(2010)	• Supplier Environment • Supplier Attributes • Interactions & Relationships
14	T. Wakolbingera ,J.M. Cruzb(2011)	• Information Acquisition • Information Sharing • Risk Sharing Contracts
15	Rao Tummala Tobias Schoenherr, (2011)	• Demand risks • Delay risks • Disruption risks • Inventory risks • Manufacturing risks • Capacity risks • Supply risks • System risks • Sovereign risks • Transportation risks
16	JieChen ,Amrik S. Sohal& Daniel I. Prajogo(2012)	• Operational Risk • Disruption risk
17	BorutJereb*, Tina Cvahte and BojanRosi (2012)	• type of risk • logistics resources on which risk has influence • publics exposed to risk • risk origin • domain of risk management (Business/technological)

18	Andreas Wieland Carl Marcus Wallenburg(2012)	• Robustness (proactive) • Agility (reactive)
19	E. Simangunsongy, L.C. Hendry* and M. Stevenson (2012)	• Supply Chain Uncertainty • Sources OfUncertainty • Uncertainty Management
20	AvinashSamvedia, Vipul Jaina and Felix T.S. Chanb* (2013)	• Supply Risk • Demand Risk • Process Risk • Environmental risk
21	Yong-fei Ma, Li-wen Chen, Shao-dong Meng& Cong-qin Yi (2014)	• Node Management • Network management
22	Kanchan Das & Reza S. Lashkari (2015)	• Production related risks • market related risks
23	William Ho, Tian Zheng, HakanYildiz& Srinivas Talluri (2015)	• Demand risk • Manufacturing risk • Supply risk • Financial risk • Information risk • General risk
24	Faisal Aqlan& Sarah S. Lam (2015)	• Risk Likelihood • Risk Interactions • Risk Predictability • Risk Impact • Risk Duration • Risk type
25	Marco Habermann ,JenniferBlackhurst,Ashley Y. Metcalf(2015)	• Supply Side disruption • Demand Side disruption • Customer side disruption

Supply Chain Vulnerability

There have been several studies on supply chain vulnerability.

Svensson (2000) characterized a model to evaluate supply chain vulnerability as comprising of three components –

1. Source of disturbance;
2. Category of disturbance; and
3. Type of logistics flow.

This was further granulated into vulnerability scenarios.

From the studies conducted it can be derived that vulnerability is contextual to the kind of supply chain and is impacted by -

- The supply chain design;
- Industry;
- Type of networks;

- Logistic flows; and
- Inventory policies

Vulnerability often manifests itself in complex ecosystems. It has been increasingly researched and understood that with increasing complexity it is imperative that to have greater control and prediction there exists a quantitative framework to quantify the uncertainty within the ecosystem. There has been various research done on vulnerability and it has been defined in different ways. Most definitions of supply chain vulnerability consider characteristics like dependencies of the supply chain and functional practices.

Below are various definitions put forward in the context of supply chain risk management (Source: Stephan M. Wagner and NikrouzNeshat (2012)

Authors	Definitions
Albino and Garavelli (1995, p. 73)	". . .aimed to estimate the system sensitivity to changes, in terms of damages to performance due to the intrinsic system incapacity of reaction to unexpected events."
Asbjørnslett (2009, p. 18)	". . .concept that may be used to characterize a supply chain system's lack of robustness or resilience with respect to various threats that originate both within and outside its system boundaries. The vulnerability of a supply chain system may be manifested both in its infrastructures – both nodal and modal, its processes, as well as the operation and management of the supply chain."
Bakshi and Kleindorfer (2009, p. 588)	". . .possibility of occurrence of a disruption. It is determined by a combination of the kind of infrastructure already in place for risk mitigation, as well as environmental factors such as political turmoil, proximity to a fault line/volcano, etc.'. . . 'Mathematically, we capture the concept of vulnerability through the supplier's marginal probability of disruption as a function of investment.
Barnes and Oloruntoba (2005, p. 527)	". . .susceptibility or predisposition to change or loss because of existing organizational or functional practices or conditions."
Svensson (2002, p. 169)	". . .condition that is caused by time and relationship dependencies in a company's business activities in supply chains. The degree of vulnerability may be interpreted as proportional to the degree of time and relationship dependencies, and the negative consequence of these dependencies, in a company's business activities towards suppliers and customers."
Wagner and Bode (2009, p. 278)	". . .susceptibility of the supply chain to the harm of [a supply chain disruption] is of significant relevance. This leads to the concept of supply chain vulnerability. The basic premise is that supply chain characteristics are antecedents of supply chain vulnerability and impact both the

	probability of occurrence as well as the severity of supply chain disruptions."
Svennson(2002)	"Vulnerability is a condition that affects a firm's goal accomplishment dependent upon the occurrence of negative consequences of disturbance. The degree of vulnerability for a given disturbance may be interpreted as being proportional to the chance of disturbance and the expected negative consequence of the disturbance, given that it has occurred."
UtaJüttner, Helen Peck & Martin Christopher (2010)	Supply chain vulnerability is "the propensity of risk sources and risk drivers to outweigh risk mitigating strategies, thus causing adverse supply chain consequences."

Conclusion and Implications

This paper attempts to reference the various aspects of supply chain risk management and its manifestation i.e vulnerability of the supply chain.

Connected networks have enhanced process effectiveness and greatly enhanced the efficiencies enabling the supply chain design to venture into previously untapped areas. A further evolution of this trend is enabled by technology and the creation of high speed networks which allow fulfillment of customer orders with alacrity previously unseen.

It is now imperative that supply chain executives must consider aspects related to risks when designing their processes and networks. To aid in this effort this paper presents a decision matrix describing the lens through which the supply chain risk may be characterized.

The matrix presented enables a firm to gain insights into the various hues of vulnerability within their supply chain and implement risk mitigation measures to contain the negative fallout of a disruption.

The decision model proposed is based on the classical definition of a supply chain which considers the flow of information, product and cash.

DECISION MATRIX - VULNERABILITY ASSESSMENT & CONTROL						
CRITERIA	DIMENSION	RISK TYPE	SCOPE OF RISK	IMPACT ANALYSIS	RECOVERY STRATEGY	CONTROL MECHANISM
Information	Visibility across the chain	Operational				
	Identification of metrics	Strategic				
	Methodology of measuring metrics	Operational				
	Quality of data	Operational				
	Technology enablement for collaboration	Strategic				
Product	Globality of operations	Strategic				
	Interconnectedness of nodes	Operational				
	Demand patterns	Operational				
	Supply capacity	Operational				
	Inbound (Shipment & delivery accuracy)	Operational				
	Outbound (Shipment & delivery accuracy)	Operational				
	Distribution systems	Operational				
	Supply chain operating model	Strategic				
	Logistics networks	Operational				
	Supply chain design	Strategic				
	Product compliance	Operational				
Financial	Economics of the supply chain	Financial				
	Financial viability of suppliers	Fnancial				
Miscellaneous	Role definition and structure	Strategic				
	Disaster Management	Operational				

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A review on barriers to the development of hydropower in India

B.C.K. Mishra[*], Anil Kumar[**], Mohammed Yaqoot[***]

**Director(O), UJVN Limited*

***Professor, CCE, University of Petroleum and Energy Studies*

**** Associate professor, CoMES, University of Petroleum and Energy Studies*

Abstract:

Worldwide, policy makers are promoting sustainable development to counter the challenges of climate change and energy security. Hydropower offers several advantages and is considered to promote energy security and sustainable development. However, during last few years, the growth of hydropower has experienced several impediments. This paper is a review of the barriers to the development of hydropower with special reference to Indian power sector.

Introduction:

India has recorded remarkable economic growth during last decade. Access to reliable and affordable electricity is considered as one of the major input factors to the economic development. Thus, to support the accelerated economic development, India's power sector has also experienced accelerated growth trajectory during the phase. Capacity-wise, India has 5th largest electricity generating capacity in the world with a reported installed capacity of 307.28 GW as on 31st October, 2016. Fuel-wise, thermal (coal, gas, diesel) and hydropower contribute 69 % and 14 % to India's power generation capacity and the rest is contributed from energy sources namely solar, wind, small hydro, biomass and nuclear (Figure A)[1]. As evident in Figure 1, the fuel-mix clearly indicates the dominance of coal in India's power.

Hydropower has significantly lower share in India's power generation capacity, though if offers several advantages over coal and other fossil fuel based sources of power generation.

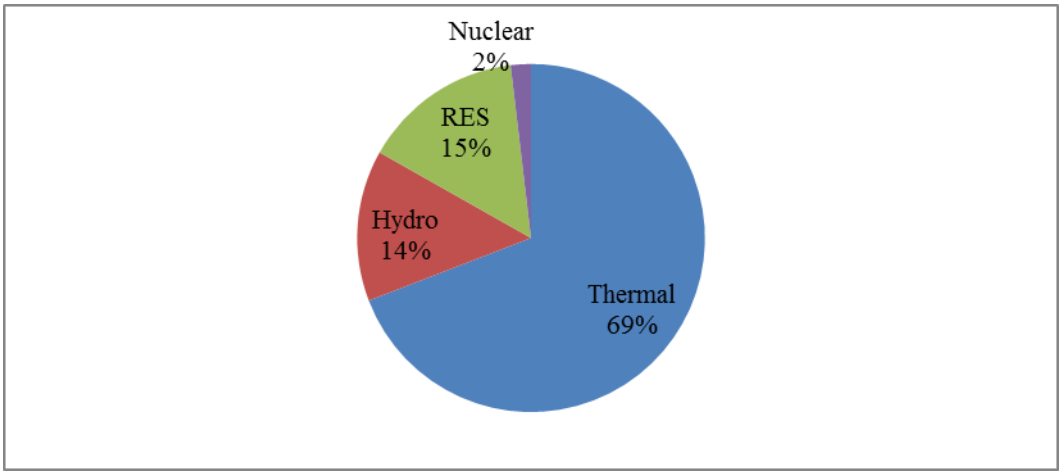

Figure A : The fuel-mix clearly indicates the dominance of coal in India's power

Advantages of hydro powered electricity:

The following are the advantages of hydropower:

- *Hydroelectricity is renewable*: Hydro power projects utilize energy of water flowing in rivers or natural streams to generate electricity. As hydro power projects use water flow in a non-consumptive way and mother nature replenishes water bodies through rainfall cycle, all hydroelectric power projects (small and large; with storage or run-of-river), are considered renewable energy projects [2,3].

- *Hydroelectricity facilitates utilization of other renewable energy sources:* Hydro power projects equipped with reservoirs offer wide operational flexibility, as hydro power plants can respond in real-time to address power demand-supply fluctuations. Energy storage and flexibility offered by hydro power plants make them economical and efficient in supporting intermittent renewable energy sources such as solar and wind [2].

- *Hydroelectricity promotes energy price stability:* It helps in reducing energy import bills for the country as river water is a domestic resource which is not subject to market fluctuations as experienced by fossil fuels. Hydro powered electricity is inflation free power as natural water is used for power generation [2, 3, 4]

- *Hydroelectricity increases stability and reliability of power systems:* To address peak demands, maintain system voltage and quickly renew supply after blackout, power generated by hydroelectric stations can be fed into the grid much faster than other sources of electricity. The ability of hydroelectric systems to reach maximum generation capacity from zero quickly makes it desirable to address alterations in the demand and supporting ancillary services to the grid system, thus ensuring balance between the electricity demand and supply [2, 3, 5]

- *Hydroelectricity addresses climate change concerns:* As hydro powered electricity is emission free during operation, it helps in reducing carbon footprint and helps combat climate change [2, 6].

- *Hydroelectricity improves air quality:* Hydroelectric power stations don't emit pollutants into the atmosphere and thus helps in reduction of acid rain and smog [2].

- *Hydroelectricity promotes sustainable development:* Hydroelectric installations fetch several infrastructure facilities such as electricity, roads, telecommunications, commerce, health services and schools to rural communities, leading to sustainable development in that area [2]. Local population in remote areas experience several advantages including improved job opportunities, education, health care and communication facilities [3, 7].

- *Hydroelectricity ensures clean energy supply for long-term:* With an average useful life of 50-100 years, hydroelectric power projects provide long-term benefits spanning over several generations [2]. These projects can be easily upgraded and uprated to incorporate modern technologies and also offer the benefits of low O&M costs [3,7].

- *Hydroelectric power projects support flood control and drinking water storage:* Hydroelectric reservoirs offer enough storage

capacity to accommodate flood water during heavy rainfall, preventing damage due to flood in downstream areas. Water stored in reservoirs can also be used to support irrigation and drinking water supply projects. Reservoirs also reduces our vulnerability from low rainfall and droughts [2,5].

These advantages of hydropower make it a desirable constituent of the fuel-mix of a country's installed power capacity.

Hydropower potential in India:

As per CEA, the hydropower potential in India is about 1,48,701 MW of which only 36,482 MW capacity has been developed, 12,738 MW is under construction and 96,100 MW (about 66% of potential capacity) is yet to be developed (Table B).

Such large unutilized potential indicates huge opportunity for India to generate cheap and clean electricity through large scale hydropower development. Potential-wise, Uttarakhand, Himachal Pradesh and Arunachal Pradesh are the top three states in India with hydropower potential of 18,175 MW, 18, 820 MW and 50,328 MW respectively (Table B). However, as presented in Table 1, Himachal Pradesh has 37.84% of its hydropower potential remaining unutilized whereas Uttarakhand and Arunchal Pradesh have 71.85% and 93.40% potentials lying unutilized respectively.

Arunachal Pradesh is in north-eastern part of India that faces law and order issues and thus large scale hydropower development in that state may not be feasible. Average unutilized hydropower potential of 92.81% for north-eastern states is indicative of the law and order challenges and subsequent feasibility issues for hydropower development in the region (Table B). After Arunachal Pradesh, Uttarakhand ranks next with large unutilized hydropower potential of about 12,932 MW (Table B).

Table B: State-wise identified hydroelectric potential and development [8]

Region/State	Identified capacity (MW)		Capacity developed		Capacity under construction		Capacity yet to be developed	
	Total	Above 25 MW	MW	%	MW	%	MW	%
Northern								
Jammu & Kashmir	14146	13543	2669	19.71	1630	12.04	9244	68.26
Himachal Pradesh	18820	18540	8908	48.05	2616	14.11	7016	37.84

Punjab	971	971	1206	100.00	206	21.22	0	0.00
Haryana	64	64	0	0.00	0	0	64	100.00
Rajasthan	496	483	411	85.00	0	0.00	72	14.91
Uttarakhand	18175	17998	3988	19.04	1640	9.11	12932	71.85
Uttar Pradesh	723	664	502	75.54	0	0.00	162.40	24.46
Sub Total (Northern)	53395	52263	17122	32.76	6092	11.66	29049	55.58
Western								
Madhya Pradesh	2243	1970	2395	100.00	400	20.30	0	0.00
Chattisgarh	2242	2202	120	5.45	0	0.00	2082	94.55
Gujarat	619	590	550	93.22	0	0.00	40	6.78
Maharashtra	3769	3314	2487	75.05	0	0.00	827	24.95
Goa	55	55	0	0.00	0	0.00	55	100.00
Sub Total (Western)	8928	8131	5552	68.28	400	4.92	2179	26.80
Southern								
Andhra Pradesh	2366	2341	1747	74.62	50	2.14	544	23.25
Telengana	2058	2019	431	21.35	360	17.83	1228	60.82
Karnataka	6602	6459	3585	55.51	0	0.00	2874	44.49
Kerala	3514	3378	1882	55.70	100	2.96	1397	41.34
Tamil Nadu	1918	1693	1782	100.00	0	0.00	0.00	0.00
Sub Total (Southern)	16458	15890	9427	59.33	510	3.21	5953	37.46
Eastern								
Jharkhand	753	582	170	29.21	0	0.00	412	70.79
Bihar	70	40	0	0.00	0	0.00	0	0.00
Odisha	2999	2981	2028	68.00	0	0.00	954	31.99
West Bengal	2841	2829	272	9.62	160	5.66	2397	84.72
Sikkim	4286	4248	669	15.75	2622	61.72	957	22.53
Sub Total (Eastern)	10949	10680	3139	29.39	2782	26.05	4759	44.56
North Eastern								
Meghalaya	2394	2298	282	12.27	40	1.74	1976	85.99
Tripura	15	0	0	0.00	0	0.00	0	0.00
Manipur	1784	1761	105	5.96	0	0	1656	94.04
Assam	680	65	375	57.69	0	0	275	42.31
Nagaland	1574	1452	75	5.17	0	0.00	1377	94.83
Arunachal Pradesh	50328	50064	405	0.81	2854	5.70	46805	93.49
Mizoram	2196	2131	0	0.00	60	2.82	2071	97.18
Sub Total (North Eastern)	58971	58356	1242	2.13	2954	5.06	54160	92.81
All India	148701	145320	36481	25.10	12738.00	8.77	96100	66.13

Risks and barriers that affect the development of hydropower projects:

Globally, development of hydropower faces several barriers that consequently accentuate project risks. To manage these project risks, it is imperative that the root cause of the risks i.e. the barriers are accounted and addressed appropriately.

- Longer gestation period: Due to unavailability of reliable hydrological, geological, seismological and environmental data it take longer period for formulation of projects. Thus hydro power projects generally has a long gestation period when compared with thermal power projects (coal or natural gas fired) [3,9].

- Shortage of competent contractors: Execution of large hydro power projects need highly skilled and dedicated team of construction engineers and managers mobilized by competent contractors and their shortage often leads to time and cost overruns [9].

- Inter-state jurisdiction issues: Several hydro power projects share water of the same river that flows through two or more states and due to variations in inter-state legal and regulatory policy issues, these projects get stuck and face time overruns [3,9,10].

- Environmental and rehabilitation issues: Hydro power projects, especially storage based, have significant impact on environment and often result in displacement of nearby local population. Issues associated with hydroelectric projects are rehabilitation of project affected people, deforestation, submergence of nearby areas, protection of flora and fauna, etc. Rehabilitation of project affected people is a critical issue especially in case of storage based hydro power projects and many times it is the main reason for delay in project execution. Sardar Sarovar, Tehri, Indira Sagar, and Bansagar Tons are some of the hydro projects that had faced immense opposition during project execution by social and environment activists and project affected people [3,4,9].

- Land acquisition issues: As hydro power projects require large land area, land acquisition for such projects is very challenging. The challenges of land acquisition hydro power project often results in suspension and/or delay of construction activities [9,10].

- Geological surprises: Hydro power projects are site specific and its features depend on geology, topography and hydrology of the project site. The construction schedule of a hydro power project is influenced by the topography and geology of the site and its accessibility. Generally, an element of uncertainty and risk remains in the sub-surface geology during construction that adds to the construction risks [9, 10].

- Power evacuation: Hydro power projects are often located in remote sites having difficult terrain with no grid access for power evacuation. Developing power evacuation system at such locations present many challenges that could result in high transmission cost [9].

- Lack of private sector participation: Unavailability of adequately researched and investigated projects, construction risks, etc. has discouraged private sector developers from the hydro power sector [9].

- Location disadvantage : Development of hydro power projects often suffer as a result of inaccessibility of sites, lack of power evacuation facility, investigation and construction challenges, land acquisition, challenges in financing , inadequate institutional support, and in some cases law and order issues. For example, Arunachal Pradesh in India has biggest hydro power potential, but it takes minimum 2 days to reach project sites, and in the event of landslides, hundreds of vehicles could get stuck on road for several days without access to basic amenities like food and water. At such far flung sites, it is quite challenging to transport project equipment and machinery [9,10, 11, 12].

- Long lead time involved in DPR Preparation and Clearances: Cumbersome process of DPR preparation and clearances involving uncertainty of time schedule by clearing agencies e.g. environmental and forest clearances, etc. result in long lead time of hydro projects [9,12,13].

- Financial Constraints: High costs are involved in developing the transport infrastructures bridges, housing infrastructure, security costs, royalty, custom duties,(roads, protective measures for roads), etc. [9,10,11,12, 14, 15].

As a result of the abovementioned barriers, several risks get attached to hydropower projects. Some of the risks are financial risk, construction risk, environmental risk, political risk, legal risk and regulatory risk [2]. For example, long gestation period of hydropower projects lead to financial risk whereas remote location of the site

exacerbate construction risk. Similarly, inter-state flow of river may lead to political risk.

Conclusion:

Hydropower is a desirable constituent of power generation mix of a country as it promotes sustainable development. Worldwide, hydropower development faces several barriers and risks. Longer gestation period, environmental and rehabilitation issues, land acquisition problems, geological surprises, location disadvantages, financial constraints, and lack of public awareness are the major barriers to the development of hydropower.

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Capturing Volatility with Stata to forecast Coriander Price by Applying SARIMA Model

Nidhi dwivedy*

**nidhidwivedi@yahoo.com*

Abstract

Purpose

The price behaviour of a commodity plays crucial role in farm level crop production planning. Volatility is defined as the degree to which the price of an underlying variables tends to fluctuate over a period of time. A variable that has a wide trading range is said to have a high volatility. Similarly, a variable that has a narrow trading range is said to have a low volatility. Volatility in addition can be stated as short-term fluctuation in the variable prices in the market due to various factors that influences it. It is crucial to throw light on the matter that volatility is a relative term which means high and low volatility are determined by the volatility relative to each specific underlying variable. The objective of this paper is to elucidate the monthly Coriander price forecast for the period of May 2015 to April 2017 using statistical time-series modelling techniques.

Methodology

Box-Jenkins Seasonal Autoregressive Integrated Moving Average (SARIMA) was employed by considering and analysing domestic monthly wholesale Coriander price data from April 2011 to April 2016. The forecasting performance of these models have been evaluated and compared by using common criteria such as: mean square error MSE, mean absolute percentage error MAPE, root mean square error RMSE, tracking signal TS, Akaike Information Criteria (AIC) and Schwarz's Bayesian Information criterion (SBC). MAD

Findings

By working on stata 13, a seasonal ARIMA (p,d,q) $(P,D,Q)_{12}$ model is constructed based on autocorrelation and partial autocorrelation. Finally, forecasts were made based on the model developed. On validation of the forecasts from these models, Seasonal ARIMA (2, 1, 2) $(1, 1,0)_{12}$ model performed better than the others for Coriander price. The validation percentage ranged between 91 to 122 per cent from May 2015 to April 2016. The forecast results did not reveal any specific pattern in the coriander prices.

Originality/Value

The author has developed a SARIMA model. Thus, SARIMA model can be used to predict the domestic monthly wholesale Coriander price.

Key words: Coriander price; Coriandrum sativum; Price Forecast; SARIMA model;

Introduction

India is known as the 'Home of Spices' and still continues to hog the lime light as far as spice cultivation, production and export are concerned. India is the largest producer, consumer, and exporter of spices in the world. No wonder, history shows that spices have played a hugely important role in the European Renaissance, and supplier for most of the countries in Europe was India. The estimated growth rate for spices demand in the world is around 3.19%. There are about 109 spices listed by International Organization for Standardization and India grows about 60 of these spices.

A spice is a dried seed, fruit, root, bark or vegetative substance used in nutritionally insignificant quantities as a food additive for flavour, colour or as a preservative that kills harmful bacteria or prevents their growth. In India a wide variety of spices are grown and many of them are native to the subcontinent. Out of 109 spices crops, twenty crops have been identified as seed spices out of which cumin, fennel, coriander and fenugreek are major seeds. Both Gujarat and Rajasthan accounts for about 80 percent of area and production in India. The seed spices are well distributed over different agro-climatic regions in India. But the major belt spread from semi-arid covering larger area in Gujarat and Rajasthan. Among seed spices, cumin seed export value is the highest, followed by coriander.

Coriander or *dhaniya* is an indispensable spice in Indian as well as in all other cuisines. There is no distinct evidence on its place of origin but it is believed to be a native of southern Europe. Although it is now widely cultivated all over the world for its green leaves, seed production is largely concentrated in India. It is scientifically known as Coriandrum *sativum*.
Well drained silt or loamy soils are suited for cultivation. For rain fed cultivation soil should be clay in nature and the pH should be 6 – 8. Coriander is mainly a rabi crop in India and sowing starts in the middle of October and extends until November- end and new crop starts arriving in the month of February. Coriander performs well at a temperature range of 20 – 25 ℃. Cool and comparatively dry, frost free climate is the best suited for its cultivation.

Fresh coriander seeds should be dried in shade to retain seed colour and quality. After drying, seeds are separated by light beating with sticks and winnowing. An average yield of 12–25 q/ha under irrigated condition and 7–8 q/ha under rain fed condition can be easily obtained. Coriander is susceptible to frost damage. Clean gunny bags are used for packing coriander

seeds which are stored in damp-free aerated store rooms.

Coriander whole plant is used for consumption as a spice in various preparations. Tender plant & leaves are used in various cuisines and also for dressing/topping. Seeds, crushed or powdered, are used in a variety of cuisines particularly in India. Roots are also used for flavour in Thai preparations.

There are no authentic estimates available on world production of coriander. However, it is known to have been cultivated for seed purpose in India, Morocco, Canada, Romania, Russia, Ukraine, Turkey, Egypt, China, US, Argentina and Mexico.

India is the largest producer and consumer of coriander seed. Coriander production has increased significantly in the past decade and currently hovering around 5 lakh tonnes. The rise in output was primarily on account of rise in yields. However, coriander production has moderated in 2012-13 due to adverse weather conditions.

Coriander production is concentrated in north-central India and Assam. Largest producer of coriander seed in the country is Rajasthan accounting for about 58% followed by MP with about 15%, Assam and Gujarat with 8% each of total coriander seed production in the country.

Coriander futures in India are traded on National Commodity & Derivatives Exchange Limited (NCDEX). India being the largest producer of coriander seed, is the largest exporter of the same. India exports around 40000 tonnes of coriander either in the form of whole seed or in powdered form. India is the major exporter to Malaysia, Pakistan, UAE, Saudi Arabia, US, Yemen and other Asian countries. While Italy, Bulgaria, US, Russia, Ukraine are the major import markets.

Factors like extent of area sown under the crop, condition of the crop & output expectation, rainfall & weather conditions that could affect the crop output, any changes in demand both in domestic as well as international markets, demand & supply situation in major import markets and any change in government policy relating to change in tariffs etc. can influence prices of Coriander.

Material and methods

The various price forecasting Seasonal Autoregressive Integrated Moving Average (SARIMA) models were tried to identify the most suitable model which suits to actual market price of coriander. The secondary data of monthly wholesale coriander prices were collected for the study from the published source of Regional Offices of the Spices Board. The data of coriander price for the period from April 2011 to April 2016 was utilized for model fitting and data for the priod i.e. from May 2015

to April 2016 was used for validation. The details of various price forecasting Seasonal ARIMA models are as follows:

Box-Jenkins Model

Box-Jenkins (ARIMA) model was used to measure the relationship existing among the observations within the series. In its general form, the seasonal ARIMA model is characterized by a notation as ARIMA (p,d,q) (P,D,Q)s, where s is the number of periods per season. We use uppercase notation for the seasonal parts of the model and is given by the equation

$$(1- ø_2B)\ (1- \Phi_1B^{12})\ (1-B)\ (1- B^{12})yt = (1 + \theta_2B)\ (1 + \Theta_0B^{12})e_t$$

where, B is the backshift operator (By1-yt-1, B2yt-yt- 2 and so on), the seasonal lag, 'e' and 't' a sequence of independent normal error variables with mean 0 and variance σ2. ø and Φ are the non-seasonal and seasonal autoregressive parameters, respectively. θ and Θ are non-seasonal and seasonal moving average parameters, respectively. The p and q are orders of non-seasonal autoregressive and moving average parameters respectively, whereas, P and Q are that of the seasonal auto regression and moving average parameters, respectively. Also'd' and 'D' denote non-seasonal and seasonal differences, respectively.

The Main Stages in Fitting Box-Jenkins Seasonal ARIMA Model are

i) Identification, ii) Estimation of parameters, iii) Diagnostic checking, and iv) Forecasting.

Identification of Models

The foremost step in the process of modelling is to check for the stationarity of the series, as the estimation procedures are available only for stationary series. There are two kinds of stationarity, viz., stationarity in 'means 'and stationary in 'variance'. A cursory look at the graph of the data and structure of autocorrelation and partial correlation coefficients may provide clues for the presence of stationarity. Another way of checking for stationarity is to fit a first order autoregressive model for the raw data and test whether the coefficient '1 φ ' is less than one. If the model is found to be non-stationary, stationarity could be achieved mostly by differencing the series or go for a Dickey Fuller test. Stationarity in variance could be achieved by some modes for transformation, say, log transformation.

The next step in the identification process is to find the initial values for the order of seasonal and non-seasonal parameters, p, q, and P, Q. They could be obtained by looking for significant autocorrelation and partial autocorrelation coefficients. Say, if the second order auto correlation coefficient is significant, then an AR (2), or MA (2) or ARMA model could be tried to start with. This is not a hard and fast rule, as sample autocorrelation coefficients are poor estimates of population

autocorrelation coefficients. Still they can be used as initial values while the final models are achieved after going through the stages repeatedly. Yet another application of the autocorrelation function is to determine whether the data contains a strong seasonal component.

Estimation of Parameters

At the identification stage one or more models are tentatively chosen that seem to provide statistically adequate representations of the available data. Then we attempt to obtain precise estimates of parameters of the model by least squares as advocated by Box and Jenkins. Standard computer packages like Stata 13 are available for finding the estimates of relevant parameters using iterative procedures.

Diagnostic Checking of the Model

After having estimated the parameters of a tentatively identified ARIMA model, it is necessary to do diagnostic checking to verify that the model is adequate. Examining Autocorrelation Function (ACF) and Partial ACF (PACF) of residuals may show up an adequacy or inadequacy of the model. If it shows random residuals, then it indicates that the tentatively identified model was adequate. The residuals of ACF and PACF considered random, when all their ACF were within the limits of

$$\pm 1.96 \sqrt{\frac{1}{(n-12)}}$$

The minimum Akaike's Information Co-efficient (AIC) can be used to determine both the differencing order (d, D) required to attain stationary and the appropriate number of AR (p) and MA(q) parameters. It can be computed as follows

$$AIC = n(1 + \log(2\pi)) + n \log \sigma 2 + 2m$$

Where, $\sigma 2$ is the estimated MSE, 'n' is the number of observations being used and 'm' is the number of parameters (p+q+P+Q) to be estimated.

Measurement of Forecast Accuracy

Forecast accuracy is a significant factor when deciding among forecasting alternatives. Accuracy is based on the historical error performance of a forecast. Three commonly used measures for summarizing historical errors are the MAD, MSE, RMSE and MAPE. MAD is the average absolute error, MSE is the average of squared errors, RMSE is the root mean square of errors and MAPE is the average absolute percent error. The formulas used to compute MAD, MSE, and MAPE are as follows:

$$MAD = \frac{\Sigma|\text{Actual} - \text{Forecast}|}{n}$$

$$RMSE = \sqrt{\frac{\Sigma(\text{Actual} - \text{Forecast})^2}{n}}$$

$$MAPE = \frac{\frac{\Sigma|\text{Actual} - \text{Forecast}|}{\text{Actual}} \times 100}{n}$$

$$TS = \frac{\text{Running sum of forecast error (RSFE)}}{\text{MAD}}$$

Using Stata package for different value of p, d and q (0, l or 2), various Seasonal ARIMA models were fitted and appropriate model was chosen corresponding to minimum value of the selection criterion i.e. Akaike Information Criteria (AIC) and Schwarz's Bayesian Information criterion (SBIC). The monthly wholesale domestic prices data of coriander were used in the SARIMA analysis.

Result analysis and findings

The results of SARIMA model are presented in Table 1 and 2 and figure 1, 2 & 3. It can be seen from the Table 1 that autocorrelation function (ACF) declined very slowly and as many ACF's were significantly different from 0 and fell outside the 95 per cent confidence interval, the price of coriander was non-stationary. It can be observed that the partial autocorrelation function (PACF) declined rapidly after the first lag period, which also indicated the non-stationarity of the price series. It was corrected through appropriate differencing of the data.

The best model was chosen from the following SARIMA models viz., SARIMA (0,1,1) $(0,1,1)_{12}$, SARIMA (1,1,1) $(1,1,1)_{12}$, SARIMA (2,1,2) $(1,1,1)_{12}$, SARIMA (2,1,1) $(1,1,1)_{12}$, SARIMA (2,1,2) $(1,1,0)_{12}$ and SARIMA (2,1,3) $(1,1,0)_{12}$ on the basis of the least Akaike Information Criteria (AIC) and Schwarz Bayesian Criteria (SBIC). The above SARIMA models were estimated through Stata 13 version of Stata package. The SARIMA model (2,1,2) $(1,1,0)_{12}$ observed least AIC and SBIC values. The MAD, MSE, RMSE, MAPE & TS for SARIMA (2,1,2) $(1,1,0)_{12}$ was also lowest. Thus, SARIMA model (2,1,2) $(1,1,0)_{12}$ was the most representative model for the price forecast of coriander.

The graphical examination of augmented component-plus-residual plot in figure 1 clearly shows the relationship between variables is nonlinear. The graph shows a polynomial pattern as well but goes around the regression line.

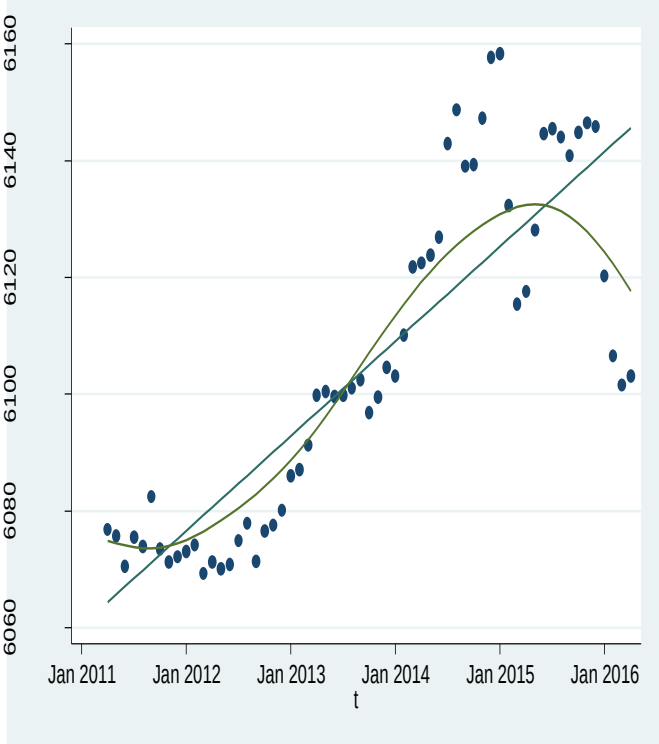

Figure-1: Augmented component-plus-residual plot

Table 1: Correlogram of Coriander Price

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. corrgram yt
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LAG	AC	PAC	Q	Prob>Q	[Autocorrelation]	[Partial Autoc
1	0.9551	0.9552	58.428	0.0000		
2	0.8851	−0.3531	109.46	0.0000		
3	0.8237	0.2745	154.42	0.0000		
4	0.7879	0.1729	196.28	0.0000		
5	0.7536	−0.1602	235.25	0.0000		
6	0.7051	−0.2541	269.99	0.0000		
7	0.6433	0.1262	299.44	0.0000		
8	0.5961	0.2289	325.2	0.0000		
9	0.5676	0.0029	349.01	0.0000		
10	0.5485	0.1744	371.69	0.0000		
11	0.5147	−0.1862	392.05	0.0000		
12	0.4507	−0.3755	407.98	0.0000		
13	0.3838	0.1235	419.77	0.0000		
14	0.3200	−0.3423	428.14	0.0000		
15	0.2656	0.0777	434.03	0.0000		
16	0.2100	−0.3214	437.8	0.0000		
17	0.1416	−0.5761	439.55	0.0000		
18	0.0682	−0.1619	439.97	0.0000		
19	0.0075	−0.1814	439.97	0.0000		
20	−0.0512	−0.9327	440.22	0.0000		
21	−0.1081	−0.3211	441.34	0.0000		
22	−0.1632	−0.4044	443.97	0.0000		
23	−0.2068	0.0503	448.29	0.0000		
24	−0.2374	−0.0560	454.14	0.0000		
25	−0.2624	−0.2361	461.49	0.0000		
26	−0.2828	0.0747	470.27	0.0000		
27	−0.3015	0.3233	480.54	0.0000		
28	−0.3222	−0.2327	492.64	0.0000		

Table 2(i): Correlogram of differenced Coriander Price

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LAG	AC	PAC	Q	Prob>Q	[Autocorrelation]	[Partial Autocor
1	0.3310	0.3312	6.9092	0.0086		
2	−0.1606	−0.3070	8.5632	0.0138		
3	−0.3095	−0.1911	14.814	0.0020		
4	−0.0286	0.1376	14.868	0.0050		
5	0.2546	0.2260	19.254	0.0017		
6	0.1015	−0.1691	19.964	0.0028		
7	−0.2301	−0.2577	23.679	0.0013		
8	−0.2570	−0.0273	28.405	0.0004		
9	−0.1292	−0.1966	29.623	0.0005		
10	0.2000	0.1648	32.599	0.0003		
11	0.3593	0.3424	42.401	0.0000		
12	0.0418	−0.1732	42.537	0.0000		
13	−0.0586	0.2860	42.809	0.0000		
14	−0.1223	−0.1640	44.019	0.0001		
15	0.0512	0.1672	44.236	0.0001		
16	0.1887	0.2080	47.245	0.0001		
17	−0.0003	−0.2868	47.245	0.0001		
18	−0.1439	−0.2336	49.079	0.0001		
19	−0.0301	0.3728	49.161	0.0002		
20	−0.0085	−0.5290	49.168	0.0003		
21	0.0125	−0.3871	49.183	0.0005		
22	−0.1649	−0.6801	51.845	0.0003		
23	−0.1517	−0.4322	54.158	0.0003		
24	−0.0125	−0.2294	54.174	0.0004		
25	−0.0627	−0.5083	54.592	0.0006		
26	−0.0386	−0.7713	54.755	0.0008		
27	0.0243	−0.6828	54.821	0.0012		
28	−0.0316	−2.2692	54.937	0.0017		

Table 2(ii) Correlogram of seasonally differenced Coriander Price

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LAG	AC	PAC	Q	Prob>Q	[Autocorrelation]	[Partial Autocor
1	0.1424	0.1424	1.0357	0.3088		
2	−0.2700	−0.3056	4.8382	0.0890		
3	−0.2452	−0.1903	8.0436	0.0451		
4	−0.0267	−0.0280	8.0824	0.0886		
5	0.3630	0.3964	15.435	0.0087		
6	0.0883	−0.1220	15.881	0.0144		
7	−0.3723	−0.3652	23.996	0.0011		
8	−0.1537	0.1237	25.413	0.0013		
9	0.0551	−0.0247	25.6	0.0024		
10	0.3838	0.3514	34.904	0.0001		
11	0.2062	0.0231	37.661	0.0001		
12	−0.4038	−0.4762	48.534	0.0000		
13	−0.1163	0.5250	49.461	0.0000		
14	0.0370	−0.1347	49.557	0.0000		
15	0.0687	−0.0769	49.901	0.0000		
16	0.1617	0.6297	51.862	0.0000		
17	−0.1291	0.0914	53.153	0.0000		
18	−0.1416	0.1875	54.757	0.0000		
19	0.1273	1.0147	56.099	0.0000		
20	0.0767	0.5607	56.603	0.0000		
21	0.1257	1.1275	58.008	0.0000		
22	−0.1621	1.1057	60.433	0.0000		

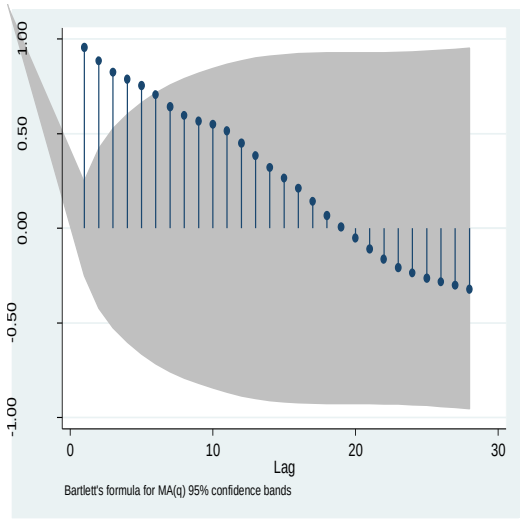

Figure-2: Autocorrelation of Price

Table 3: Comparative Performance of Different Price Forecasting Seasonal ARIMA Models

Seasonal ARIMA Model (p,d,q) (P,D,Q)	AIC	BIC
(0,1,0) $(0,0,0)_{12}$	419.08	423.26
(0,0,0) $(0,1,0)_{12}$	438.64	442.42
(0,1,0)$(0,1,0)_{12}$	365.55	369.29
(0,1,1)$(0,1,0)_{12}$	365.74	371.36
(0,1,0)$(0,1,1)_{12}$	356.60	362.21
(0,1,1)$(0,1,1)_{12}$	353.79	361.28
(1,1,1)$(0,1,1)_{12}$	355.79	365.15
(1,1,1)$(1,1,1)_{12}$	354.66	365.89
(0,1,2)$(0,1,0)_{12}$	364.98	372.46
(0,1,2)$(0,1,1)_{12}$	355.79	365.14
(1,1,2)$(0,1,1)_{12}$	357.66	368.88
(1,1,2)$(1,1,1)_{12}$	convergence not achieved	
(2,1,2)$(1,1,1)_{12}$	348.57	363.54
(2,1,1)$(1,1,1)_{12}$	353.80	366.90
(2,1,1)$(0,1,1)_{12}$	354.93	366.16
(3,1,1)$(0,1,1)_{12}$	355.72	368.82
(2,1,2)$(1,1,0)_{12}$	346.61	359.71
(2,1,3)$(1,1,0)_{12}$	348.59	363.56

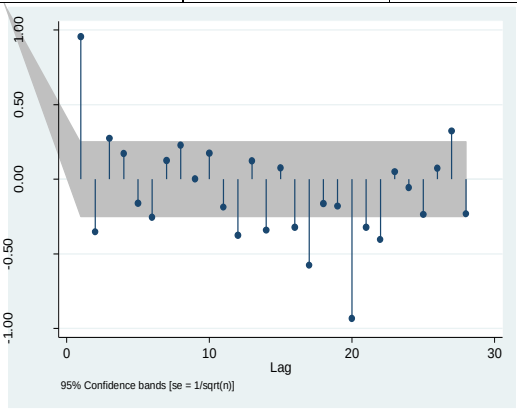

Figure-3: Partial Autocorrelation of Price

Diagnostic checking of residual was carried out to check the adequacy of the models. The residuals of ACF and PACF were obtained from the model which is identified as best fit. The adequacy of the model was judged based on the value of AIC and BIC. The values of the statistics are shown in Table 3. The model (2,1,2) $(1,1,0)_{12}$ was found to be the best model for coriander prices. It can be seen in the table that not only the value of AIC & SBIC of this model are least but also the it had the lowest statistic for MAD, MSE , RMSE and MAPE. AIC tends to be more accurate with monthly data. Also the co-efficients with this model are signicant.

The autocorrelation and partial autocorrelation of various orders of the residuals of Seasonal (2,1,2) $(1,1,0)_{12}$ upto 22 lags were computed and shown in Figure 4 and 5, respectively. The figures depicted the absence of autocorrelation as the autocorrelation and partial autocorrelation functions at various lags fall within the 95 per cent confidence interval. This proved that the selected Seasonal ARINA model was most appropriate for forecasting the price of coriander during the period under study.

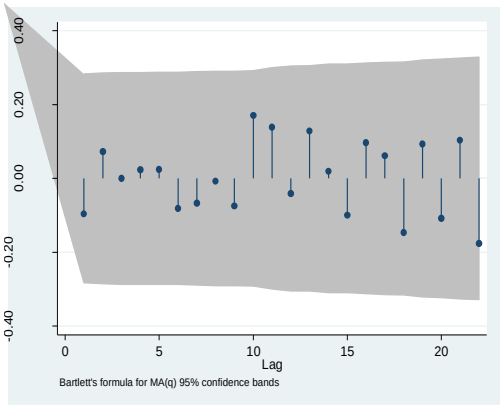

Figure-4: ACF of residual from SARIMA (2,1,2) $(1,1,0)_{12}$

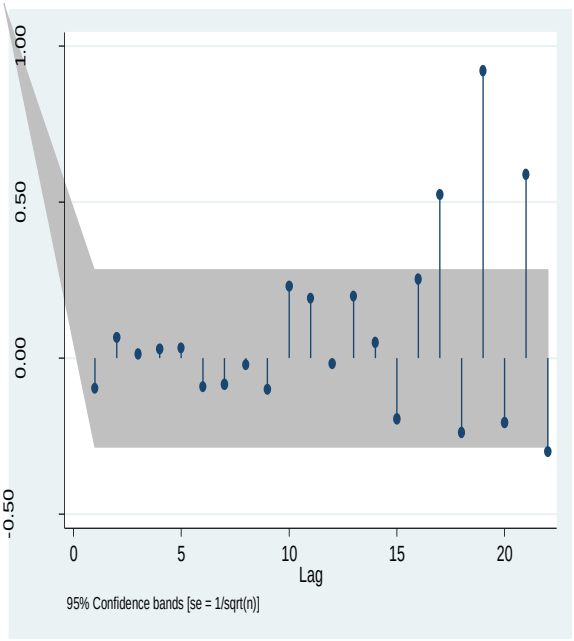

Figure-5: PACF of residual from SARIMA $(2,1,2)\ (1,1,0)_{12}$

The performance of the seasonal ARIMA forecast was measured in terms of Mean Absolute Deviation (MAD), Mean Standard Error (MSE) and Mean Absolute Percentage Error (MAPE). The comparative performances of different seasonal ARIMA models are presented in Table 4.

Table 4:Extent of Accuracy through Different Criterion

Criteria	$(0,1,1)(0,1,1)_{12}$	$(1,1,1)(1,1,1)_{12}$	$(2,1,2)(1,1,1)_{12}$	$(2,1,1)(1,1,1)_{12}$	**$(2,1,2)(1,1,0)_{12}$**	$(2,1,3)(1,1,0)_{12}$
MAD	6.34	6.28	5.97	6.26	**5.97**	5.98
MSE	76.62	72.54	59.22	69.41	**59.26**	59.13
RMSE	8.75	8.52	7.70	8.33	**7.70**	7.69
MAPE	0.08	0.08	0.07	0.08	**0.07**	0.07
TS	3.61	3.27	3.82	4.30	**3.55**	3.59

From the Table 4, it can be inferred that the SARIMA $(2,1,2)\ (1,1,0)_{12}$ model is the preferred model for forecasting coriander price due to the minimum value of MAD (5.97), MSE (59.26), RMSE (7.70), TS (3.55) and MAPE (0.07) when compared to the other models. The actual prices of coriander and the statically predicted price values for these months through seasonal ARIMA models are presented in Table 5. In order to check the validity of these statically forecasted price values, they were compared with the actual values of price of coriander during the period from May-2015 to April-2016 (twelve months) which is shown in Table 5. The accuracy percentages vary from 91 to 122 per cent.

It was observed that the accuracy percentage out of different SARIMA models, the market price of coriander based on seasonal ARIMA $(2,1,2)\ (1,1,0)_{12}$ model was very close to actual value as compared to other predicted model prices. This proved that the seasonal ARIMA $(2,1,2)\ (1,1,0)_{12}$ model was the best fit model for forecasting the price of coriander during the period under study. Finally most parsimonious model whose co-efficients are significant has been selected for the forecast.

Static and Dynamic Forecasts from a seasonal ARIMA model that passes the required checks for the two years are shown in Figure 6. The forecasts follow the recent trend in the data.

Table 5: Forecast Price of Coriander by different Seasonal Models (Rs/Kg) for the year May-2015 to April-2016

Month	Actual price	Predicted Price											
		(0,1,1) $(0,1,1)_{12}$		(1,1,1) $(1,1,1)_{12}$		(2,1,2) $(1,1,1)_{12}$		(2,1,1) $(1,1,1)_{12}$		(2,1,2) $(1,1,0)_{12}$		(2,1,3) $(1,1,0)_{12}$	
		%	Figure	%	Figure	%	Figure	%	Figure	%	**Figure**	%	Figure
May-15	104.1	91%	94.52	91%	94.45	91%	94.36	91%	94.47	**91%**	**94.36**	91%	94.36
Jun-15	120.63	91%	109.64	92%	110.41	91%	110.09	91%	110.34	**91%**	**110.06**	91%	109.99
Jul-15	121.5	115%	139.96	116%	141.17	115%	139.73	115%	140.30	**115%**	**139.63**	115%	139.53
Aug-15	120	101%	120.69	99%	119.12	96%	115.70	97%	115.93	**96%**	**115.69**	97%	115.89
Sep-15	116.87	94%	109.61	93%	108.97	92%	107.58	93%	109.07	**92%**	**107.72**	92%	107.53
Oct-15	120.9	99%	119.18	99%	119.94	106%	127.93	101%	122.13	**106%**	**128.00**	106%	128.00
Nov-15	122.5	105%	129.09	106%	129.36	106%	130.06	105%	129.10	**106%**	**129.97**	106%	130.12
Dec-15	121.87	107%	130.31	106%	129.65	99%	120.67	105%	128.40	**99%**	**120.58**	99%	120.55
Jan-16	96.25	124%	119.29	123%	118.28	121%	116.94	124%	118.95	**122%**	**117.00**	122%	116.99
Feb-16	82.5	75%	62.14	72%	59.73	84%	69.36	76%	62.42	**84%**	**69.60**	85%	69.99
Mar-16	77.5	93%	71.99	94%	73.12	97%	75.27	102%	78.78	**97%**	**75.19**	97%	74.94
Apr-16	79.13	102%	80.49	102%	80.85	104%	82.37	104%	82.14	**104%**	**82.23**	104%	82.36

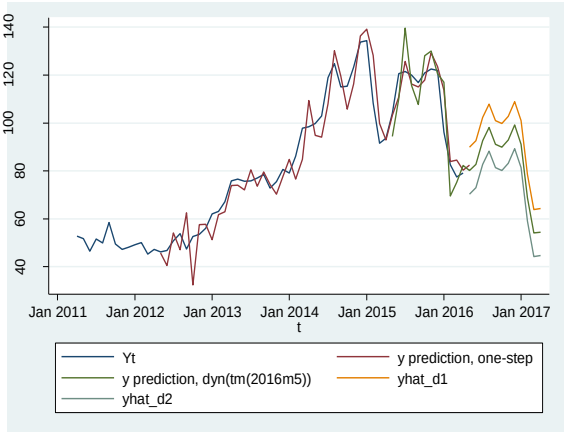

Figure-6: Price Forecast from SARIMA (2,1,2) $(1,1,0)_{12}$

Percentage as well as absolute figures of the Static Forecasts from different seasonal ARIMA models for the year May-2015 to April-2016 are presented in table 5 and absolute figures of the Dynamic Forecasts along with lower and upper limits for the following year from SARIMA (2,1,2) $(1,1,0)_{12}$ Model are presented in table 6.

Table 6:Forecast Price of Coriander from SARIMA (2,1,2) $(1,1,0)_{12}$ Model (Rs/Kg) for the year May-2016 to April-2017

Month	Predicted Price	Lower limit	Upper limit
May-16	80.15	70.36	89.94
Jun-16	82.73	72.94	92.52
Jul-16	92.57	82.78	102.36
Aug-16	98.11	88.32	107.90
Sep-16	91.15	81.36	100.94
Oct-16	89.96	80.17	99.75
Nov-16	92.94	83.16	102.73
Dec-16	99.12	89.33	108.91
Jan-17	91.11	81.32	100.90
Feb-17	68.78	58.99	78.57
Mar-17	54.08	44.29	63.87
Apr-17	54.44	44.65	64.23

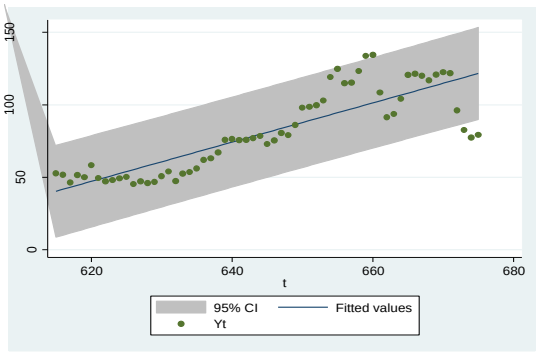

Figure-7: Line of best fit of the Forecast from from SARIMA (2,1,2) (1,1,0)$_{12}$ Model

Figure 7 abuve depicts the line of best fit with 95% confidence intervals. This fit is looking pretty good. So, we can say that our model fitting is good.

With this the prediction equation is

$(1- ø_2B)\ (1- Φ_1B^{12})\ (1-B)\ (1- B^{12})yt = (1 + θ_2B)e_t$ (1)

$(1-B-ø_2B+ø_2B^2-Φ_1B^{12}+Φ_1B^{13}+ø_2Φ_1B^{13}-ø_2Φ_1B^{14}-B^{12}+B^{13}+ø_2B^{13}-ø_2B^{14}+Φ_1B^{24}-Φ_1B^{25}-ø_2Φ_1B^{25}+ø_2Φ_1B^{26})yt=(1+θ_2B)e_t$ (2)

$Y_t = (1 + ø_2)\ y_{t-1} - ø_2\ y_{t-2} + (1 + Φ_1)y_{t-12} - y_{t-13} – (ø_2 + Φ_1 + ø_2Φ_1\ )y_{t-13} + (ø_2Φ_1 + ø_2\ )y_{t-14} - Φ_1\ y_{t-24} + (Φ_1 + ø_2Φ_1)y_{t-25} - ø_2Φ_1\ y_{t-26} + e_t + θ_2\ e_{t-1}$ (3)

Forecast Results by SARIMA (2,1,2) (1,1,0)$_{12}$ Model

In order to forecast one period ahead that is, y_{t+1}, the subscript of the equation y_t is increased by one unit throughout as given by

$Y_{t+1} = (1 + ø_2)\ y_t - ø_2\ y_{t-1} + (1 + Φ_1)y_{t-11} - y_{t-12} – (ø_2 + Φ_1 + ø_2Φ_1\ )y_{t-12} + (ø_2Φ_1 + ø_2\ )y_{t-13} - Φ_1\ y_{t-23} + (Φ_1 + ø_2Φ_1)y_{t-24} - ø_2Φ_1\ y_{t-25} + θ_2\ e_t + e_{t+1}$ (4)

The term e_{t+1} is not known because the expected value of future random errors has been taken as zero.

Using $ø_2$ = -.7484275, $Φ_1$ = -.6435474 , $θ_2$ = 0. 7506069, we have $ø_2Φ_1$= 0.4816486, equation (4) is given as

$Y_{t+1} = 0.2515725\ y_t + 0.7484275\ y_{t-1} + 0.3564526y_{t-11} - y_{t-12} + 0.9103263y_{t-12} – 0.2667789y_{t-13} + 0.6435474y_{t-23} – 0.1618988y_{t-24} - 0.4816486y_{t-25} + 0. 7506069e_t + e_{t+1}$

Conclusion and discussion

Figures 1, 2 and 3 confirm that the coriander prices exhibit volatility. The volatility can be attributed to several economic factors

In the present investigation, series of tentative seasonal ARIMA (Box-Jenkins) models were developed to produce forecast and to measure the forecast accuracy. But, the best model was chosen on the basis of least values of Akaike Information Criteria (AIC), Schwarz Bayesian

Criteria (BIC), MAD (average absolute error), MSE (average of squared errors), RMSE (root mean square of errors) and Mean Absolute Percentage Error (MAPE). After performing series of diagnostic test, it was observed that AIC (346.613), BIC (359.7114), MAD (5.97), MSE (59.26), RMSE (7.70), TS (3.55) and MAPE (0.07) were least for SARIMA (2,1,2) $(1,1,0)_{12}$ model . It came out to be the most representative model for the price of coriander. The model can be used for reaching dependable price forecast for this agricultural produce that have immense policy implications.

Coriander displays huge volatility in pricing as it is affected by domestic and international supply demand patterns. While the demand has been rising, the supply is highly volatile.

There are so many causes leading to low productivity of this high valued coriander spice crop but deficient area under cultivation, poor weather conditions due to climate change and lack of knowledge about proper management of the crop are few of them. In 2013, coriander prices rose 47% as output went down drastically due to fall in area under cultivation and bad weather. However, there was a price fall towards the middle of the year (April-August) from Rs 7,646 a quintal to Rs 5,000. But the trend changed soon after due to lean supply and high exports.

Another reason for coriander price rise in the first quarter of the 2014 was due to fall in stocks. Going forward, prices take cues from export demand and output in other major producing countries such as Morocco, Canada, Pakistan and Romania. Coriander productivity got severely affected by weather adversities during the year 2014-15. Year 2014-15 witnessed a drastic fall in Coriander production. Unseasonal rains during the harvesting stage across Rajasthan and Madhya Pradesh had damaged the crop severely. Coriander production in 2014-15 was recorded at 4.62 lakh tons, while in 2012-13 production was 5.27 lakh tons from a similar acreage. The main reason for a drop in production was the unseasonal rains before and during the harvesting season that damaged the crop to a great extent. However, during the year 2015-16, soil moisture was severely affected by the deficient monsoon in the pre sowing season. But, favourable post sowing weather conditions remained conducive during the growth stage thus making the crop productivity satisfactory overall.

While India has a unique position in the global spice scenario as the largest producer, consumer and exporter of seed spices, it is important to note that unbeatable environmental challenges is one of the few challenges that interplay to make spices cultivation taxing.

Overall, environmental constraints do hamper coriander spices cultivation and production in

the growing countries. Changes in climate and subsequent drought or excessive flooding are macro-level phenomena that would be tackled through appropriate technologies that combine conservative agriculture with cutting edge sciences.

Proper management of plantation in its cultivation, processing, packing, storing and transportation, diseases and pests is the prime reason for successful cultivation. Promising coriander varieties coupled with optimum inputs & technologies and increasing the area under its cultivation for increasing the productivity will help in maintaining demand-supply balance of this crop, hence volatility in pricing of the crop can be checked.

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Case study: Claim Reduction at ABC Logistics

Aman Dua*, Deepankar Sinha**

*Assistant Professor, CoMES, University of Petroleum and Energy Studies

** Associate Professor, Indian Institute of Foreign Trade

Today it's heavily raining in north India. Mr. Khanna today, has a meeting with Nitin Singh, vice. President, Manufacturing of Leading Automobile Company. (Here onwards abbreviated as LAC). During Lunch Mr. Singh raised concern over the increasing number of claims and he has a strong mindset that operation at ABC need to be aligned to reduce these claims. Mr. Khanna assured him that he will make every attempt to reduce the number of claims. Mr. Khanna is Manager of ABC Logistics Service Ltd. LAC has given contract for logistics of spare parts required by dealers and distributors of LAC

Claim is a request triggered by customer for re sending the consignment in case of anomalies. A claim can be generated by customer in following conditions.

ABC is incurring unwanted cost under the claim head. Claims are generated by customer in following conditions

- The material/spare part is supplied which was not demanded.
- Material hasn't supplied in appropriate quantity as per demand.
- The material is damaged in transit.
- The product does not function properly for the promised duration in its life cycle, i.e. Warranty claims.

The condition IV is due to in built technical characteristics of the product, working condition and handling skill. It does not come in control of a Third Party Logistics Service Provider. But an increased number of top three (chronologically) may lead to reduced efficiency, effectiveness and dissatisfaction of the client for ABC logistics.

In case of claims arising due to condition iii the claims are settled by insurance company assigned by LAC. As the claim is generated by customers in case of condition III and condition IV the decision is taken by LAC personnel, what course of action should be consequent in response to the

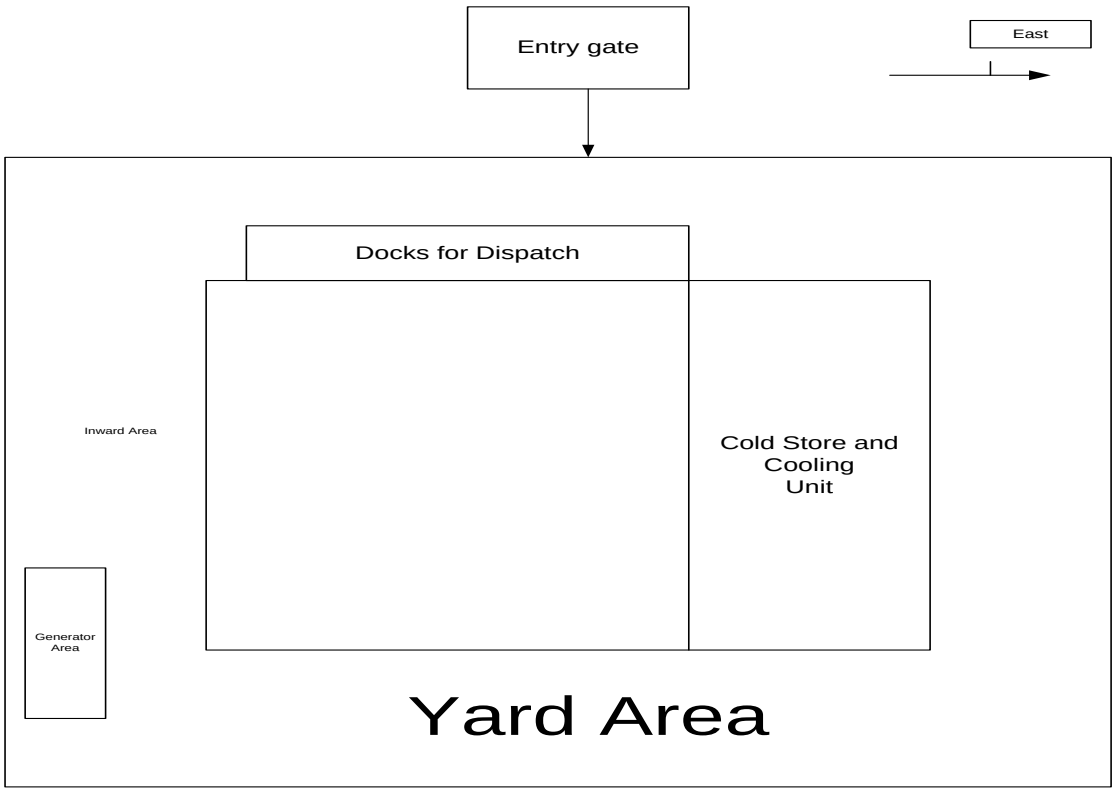
particular claim. In case of Condition I and condition II the liability lies with the third party logistics service Provider.

ABC wants to reduce the number of claims in order to improve the customer service and reduce the cost involved. To achieve they have constructed a team in leadership of general manager of the warehouse

THE ABC logistics

ABC Logistic Service Limited is a third party logistics service Provider. It provides storage, transportation and distribution for its clients. It has its footprints in Cold storage businesses. It has a total warehousing capacity of 1 Million. Sq. ft. Approximately. It has the envisaged concept of spokes which will serve the need of local logistic development sectors.

The LAC is one of the major Clients for ABC. It is largest revenue provider for the Palwal facility. Palwal is one of the regional warehouses for LAC. It caters to the need mainly for the northern region for states of Rajasthan, Punjab, Uttar Pradesh, and Uttrakhand etc. At time of needs when components are not available in other warehouses, it supplies to other parts of the country too. If any demand comes from International dealers, then MJLSL completes the documentation required in that particular destination and transport operation is outsourced to service Providers. In other words fourth party logistics service provider is involved in the case of International spare parts delivery



Outer layout of regional ware house Palwal

Fig1:outer layout of regional ware house palwal

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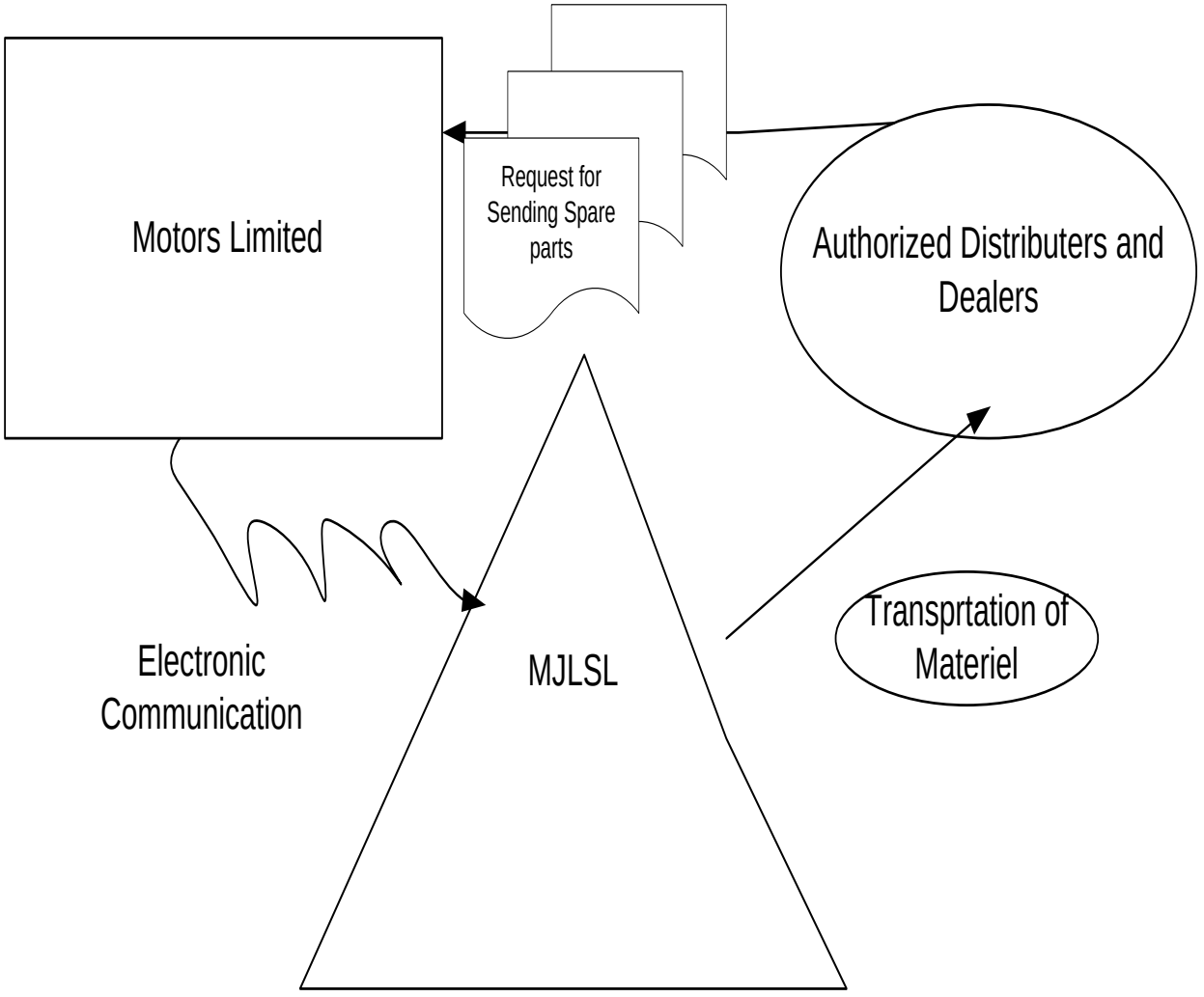

Fig 2: Association between ABC and its Client

The Operation in MJLSL.

There are six departments in the warehouse, namely Inward, Store, Outward, Documentation, and Customer Care & Exports. As soon as the vehicle the truck for unloading materiel comes, it stopped at the gate and its documents are verified. Thereafter, it leads to the inward section. It

is unloaded and Flow diagram for receiving material

At Inwards gate the material is unloaded by contracted labor and checked by quality control department that it is as per the invoice raised or not. Corresponding inward entries are made in software which tells where the space is empty in the warehouse and where other units of this SKU are stored. The product is identified by a 12 digit number. This number is generated by Tata Motors limited and contains all technical attributes. If the material comes from the Tata manufacturing facility, then it is directly stored into the racks after inspection and counting. Before this it is put, into pallets to store conveniently. The materiel may be coming from the vendors supplying directly to the warehouse, in this case the unit consolidation with packaging is done and label of spare part for Tata is pasted. The empty space is identified by the materiel management suite and it is stored at the decided location. While allocating the space following guidelines s are used. The classification of rack is in two types, namely, heavy duty racks indicated by A, and shelving racks indicated by S, T, U and V.

Slow moving items are stored in upper floors, making a considerable tradeoff in size and weight because warehouse has sophisticated storage and handling systems. Fast moving items are stored at Low heights and Shelving racks Nut-Bolts and other small component are stored at low height of shelving rack. There is strong room

Fig 3: material movement in the plant

for small and high value items like spark - plug. There is a dedicated space for the fuel injector. There is an attached storing area for storing high value and heavy items like engine, wind screen.

Depending upon the requirement and circumstances, flexibility is exercised in allocating the space. It is marked & stored. At this stage is stage transitional halt happens at the processes. The retrieval and Packaging Process is triggered by a request from the customers of Tata Motors Limited.

The mapping of space at Regional warehouse Palwal.

The space in the warehouse is mapped by a seven alphanumeric number, structured as shown following. The first alphabet indicates the type of rack. The two types of rack used are

A/S	D1	D2	D3	D4	D5	D6

D1 & D2 ➔ The number of the rack . For A type of rack the number are from 1 to ----- and for S type of the number are from

D3 & D4 ➔ The number of column in that row.

D5 & D6 ➔ D5 indicates the floor and D6 indicates the sub column number in column indicated by D3 & D4.

The second type of racks has four floors and binning and retrieval is done by manual movements only. They are used for storing relatively small, fast moving Items. The alphabet S, T, U, V indicates first, second, third & fourth floor respectively.

The dispatch process is triggered by receiving of customer order. As soon as a customer order is received , here the LAC and ABC are integrated by an ERP. After that the Challan is prepared which contains the customer details and order details. This Challan (transport order) is given to Picker, who instructs the labor to retrieve the material from the designated packaging area.

The ERP provided the feature that on entering the 12 digit area; it gives the location by seven digit alphanumeric code. The picker identifies the product with a twelve digit code only. He gets this code and quantity from the challan. In one round picker brings approximately order of 30 transport orders. The handheld scanner is also available which either can take the input of seven digit alphanumeric code or part number by infrared scanning or keyboard. It tells the details of the product and its locations (if stored at multiple locations). It provides the facility that an operator can check that product is at appropriate location or not.

The picker brings the order as per challan by fork lift if it is to be retrieved from the heavy duty racks or manually brings the order is it is stored in shelving racks to the packaging area. At packaging area the small articles are consolidated in corrugated boxes. As ABC is catering to an automobile company some products are of irregular, hence the are not packaged, if required they are wrapped by plastic.

Then as per the transport orders the retrieved articles in requisite number and quantity are brought to the packaging area. Three types of label for sticking are generated at the packaging area , namely part identification slip , shipping manifesto and MRP label. The part identification slip contains the description of the product, part

number and other coded info in bar code. Shipping manifesto contains the case dimensions, new weight, gross weight and quantity of units, & customer ID number and shipping address.

Then, as per designated with coordination between supervisor of dispatch , dock for the consignment is decided and lift operator stores the consignment there. It is loaded by labor into the truck. While loading a person counts the number of boxes and truck is dispatched.

Teaching Note

Synopsis

The ABC logistics is third party logistics service provider and involved in spare part delivery of leading Automobile Company. The count of wrong delivery is increasing. In three out of four reasons for claim mentioned, the operation at ABC logistics deems responsible. The customer request LAC on the web portal and at backend ABC logistics has access to this. Hence a team has been made to find out a improved process design and work environment modification can reduce the number of claims.

Target Audience

Students of Graduate and post graduate programs of operation Management, Logistics Management, Business Process Management, Work Study.

Prerequisite for this case

A Student must have knowledge of Work flow structure, Business Process, Fundamentals of Supply Chain concept.

Learning Objective

This work will expose the students to intricacies of actual problem which arises in front of a third party logistics company.
Importance of operations management
Role of Standard Operation procedure
Process design
International labor standards

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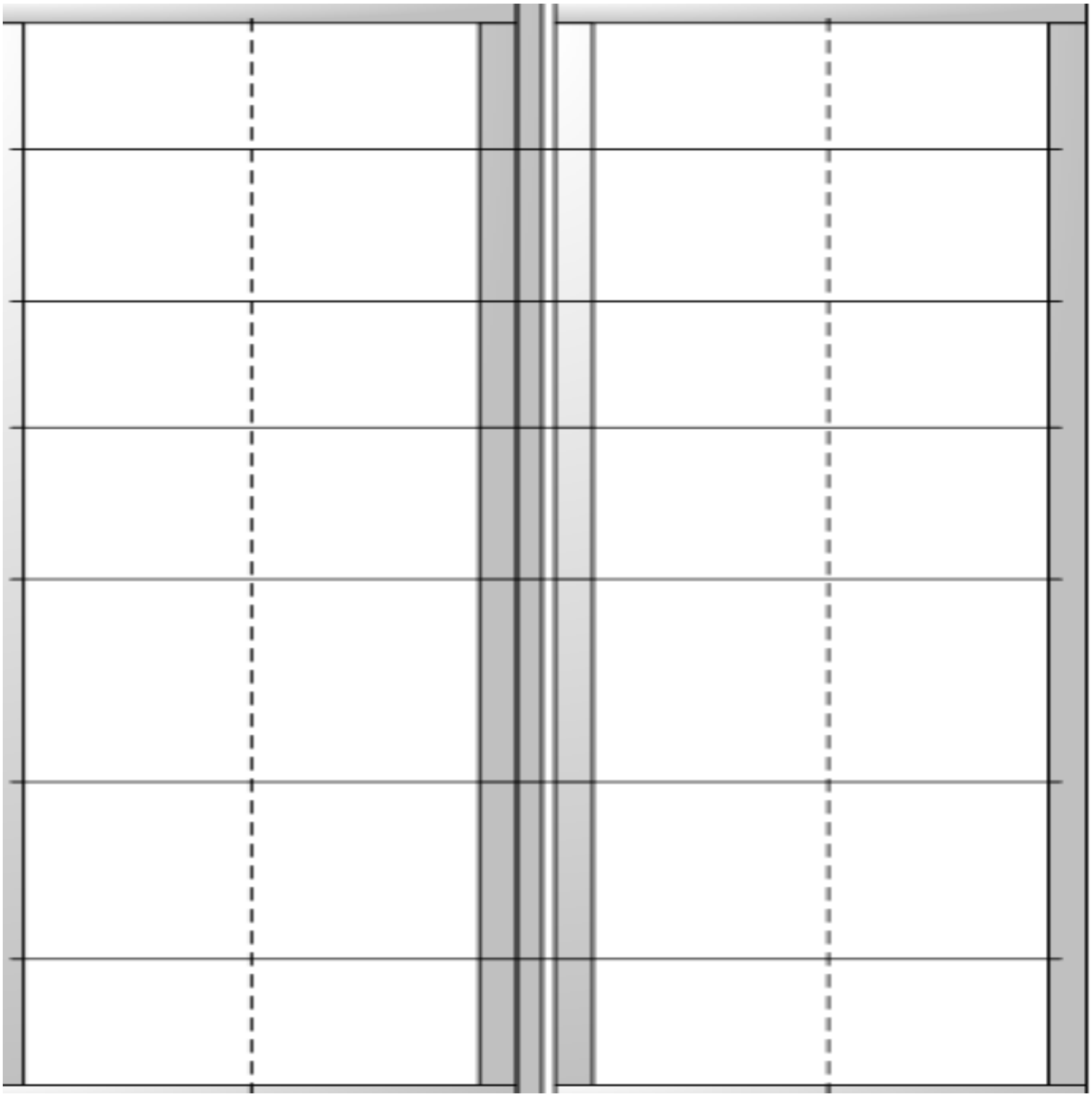

Dig. 1 The vertical Cross section of two Racks

The dotted line indicates that there is no Physical boundary between them, but bifurcation of space exists. In the diagram Shown there are four marked spaces in a horizontal row and seven cells in a column of six floors

Challenges in sourcing skilled manpower for small hydro power projects in India: A review

Neetika Sharma Mehta*

**Research Scholar,CoMES, University of Petroleum and Energy Studies*

Abstract

This review paper has been written with an aim to undertand the vatious challenges faced by the Hydro Power industry. During this study theirwere many challenges listed and eountered. One issue which seemed significant was sourcing of 'skilled' manpower for the construction of the hydro power projects. Skilled manpower- is considered to be the biggest challenge for the industry and very little human resource can becounted in this category. The reason behind such a deficit can be that the experts/technicians involved have very low will power to work in the rural areas unless they get a substantially higher pay and special benefits. Further research leaded us the challenge of including the local workforce to help us solve the above stated problem. The discussions lead us to understanding the possibility of socially including the local workforce and the significance of imparting training to them. Teaching the benefits of renewable energy as well as training and providing employment to the locals in the installation and maintenance of renewable energy technologies was the most straight forward way to tackle the above issue.

Introduction

It has been identified that the majority of the SHP projects do not require heavy investment both in terms of infrastructure and human resource being budgeted projects. However, the profitability of the projects can be increased by adopting practices like - alternate fundings, more formalised clearances procedure and many others. On the back drop, when compared to the current scenario the practices such as high interest rates, delay in government clearances, poor grid connectivity, high upfront costs are only resulting in increasing the cost of the projects and other valuable resources

One of the major determining factors in setting a new SHP project are its influences on the river eco-system and other environmental factors.

It is a well known fact that setting a new SHP project certainly influences the river eco-system and other enviornmental factors. Therefore, in order to make such projects viable and sustainable many eco friendly projects have to be undertaken.

In retrospect, the positive aspects of implementing the SHP project is that it helps in connecting the remotest parts of India with the urban areas, thereby resulting in socio-economic prosperity of the areaas well as generating more employment opportunities on the rural area.(Khan, 12/15/2014)

Another important benefit of SHP is that it ensures long term and decentralised energy supply which not only favours the rural population but also ensures the sustainability of already overstretched power sector in India.(Sharma, Tiwari, & S, 11/22/2012)

As per a study, it has been realised that even after evaluation best possibilities it would not be probable to increase the efficiency of the projects in coming 20 years. But on the basis of this study which focuses on macro level estimates for CDM potential of SHP projects, technological improvement may result in ultimately helping in increasing the profits. To ensure more efficiency of the projects as compared to the existing ones, the two simple steps required to be followed are:

- The policies are to be designed in favourable manner and
- For allocating the SHP projects, CDM can be leveraged as a tool in order to accelerate the transmission process.

Considering the latest estimates which suggest that the major issue, which has been emphasised over and over again, is the lack of supply of electricity in rural areas. On conducting the research work it has been figured the contribution of employees. It has been understood that in the process of distributing the electricity each employee involved directly influences the cost of the project.(Purohit, 4/18/2008)

Therefore, with the help of this research work we will try to establish the degree of influence of human factor on the cost of project in order to ensure optimal performance capabilities. Not only this, the paper would also address the various other problematic areas such as- how to develop an optimal distribution channel by leveraging the human resource, various investment alternatives and many others.(Sahoo, Varma, & Prabhak, 10/30/2015)

On applying the sensitivity test and its analysing, the fact that has emerged is that the production cost of generating the electricity is influenced by capital cost, interest cost, capacity of the unit and factors like: life span of the project and O&M Cost. On further study, it is also figured that SHP is not utilised to its full capacity. The efficiency of SHP can be increased by increasing the span of supply of electricity in the remotest areas or cities in India.(Mishra, Khare, & Agra, 6/19/2015)

During the study, another consequence of having non-trained or less trained human resource in the department is that in the urban states there is acute shortage of skilled technicians for standard maintenance and repair work. It is being suggested that if certain level of training can be imparted to the employees involved, it might lead to emergence of another level of R&D and can be a source of many alternatives for income generation, like one can be that inspite of giving subsidy to consumer the amount can be utilised in promoting the use of renewable source.(Aggarwal & Chandel, 2/6/2010)

From a socio-economic point of view the implementation of SHPs has become more complex as in the age of information the expectations of local residents have increased and they expect that with the establishment of a new project, new employment opportunities will be generated which will in turn help them to increase their standard of living and holistically will benefit the society/community. Therefore, the mutual trust between the employees and the project developer is utmost important. (Kumar & Katoch, 1/10/2015) The only barrier that comes in a way for smooth implementation of any SHP is the lack of infrastructural support and geographical changes which adds to the cost of the project and as a result delays in meeting the set deadlines.

Time and again the factors that are being brought to the notice is that there is deficit of experienced staff in the industry. The recruitment of the skilled employees has become one of the major pain area.and it has become really difficult to retain the talented work force.Even the local contractors are facing challenges in hiring skilled talent for electrification projects. With the help of this paper an attempt would be made to find solutions for problems like- strategies to recruit required talent, identification of local resources, better governance and management practices to ensure sustainable growth of the industry(C.Bhattacharyya, 4/10/2010)

By applying several permutations of the sources through which high growth rates can be achieved, it was figured that few materials like: PV (module manufacture), solar water heaters and others can be highly beneficial. at present, in many cases the effectiveness of renewable options is dependent on implementation strategies and cost recovery mechanism whereas if we consider the initial phase of the growth of renewable energy in India, it has been dependent on capital subsidy and grants which is not a positive indicator.(Pillai & Banerjee, 5/2/2009)

During the research work, various barriers and issues prevalent in the electricity board were learnt and that helps one to evaluate the parameters most susceptible to deviate during the implementation of integrated renewableenergy system for off-grid applications has been identified and discussed in details. Few of the factors are:

- Technological barriers- under this section various factors that were studied are –reason for lack of energy access in remote areas, why there is lack of database for resource assessment and how the low maturity level of renewable energy source and need of energy storage with renewable energy sources affects the profitability.
- Skilled manpower- is considered to be the biggest challenge for the industry and very little human resource can be counted in this category. The reason behind such a deficit can be that theexperts/ technicians involved have very low will power to work in the rural areas unless they get a substantially higher pay and special benefits.
- Lastly, the weak institutional framework of financial management was also one of the barrier for low return and slow growth.(Chauhan & Saini, 7/15/2015)

In the case study, the cost competitiveness is measured as net present value (NPV) whose value turns to be positive in the three years for 3MV plant and four years in 5.5 MV plant. Another important aspect of the study has revealed that in the projects there is least problem of rehabilitation of project and there is minimum threat to environment and to the Himalayan ecology. In addition to the study approach, it was identified that if the plant is upgraded and refurbished then there are lot of direct benefits like - extension in life of project and its related components, reliability and the technology used for enhancing the efficiency would be

more user friendly.(Rahi & Kumar, 9/30/2015)

To increase the economic appeal of small hydro power plants and to enhance their profitability when significant inflow flux and market fluctuations occur and to favour their further deployment, the three diverse design innovative management strategies/methods have been proposed to increase plant life time and operating range. It is believed that the three factors can significantly improve the effectiveness of CFD based design methods, thereby reducing the empirical aspects of the martial and error methods and increasing the running design space.(Ardizzon, Cavazzini, & Pavesi, 1/22/2014)

It has been observed by the author that one of the reason that is resulting is the time and cost over run is difficult terains where these projects are based. Another challenge that has been noticed is that locals living in these areas tend to demand good pay jobs with the project as it is there homeland, so they belive they must get priority in jobs but they fail to understand that they need technical and practical knowledge to execute job in the work site. The truth noticed is that at hydro power construction site more than the number of employees available to work it is more important to have the proper knowledgable skilled workforce. (Sharma & Thakur, 8/27/2015)

One curicial factor pointed by the author has been denial of access to hydro power; this prevents easy social inclusion of locals in that generating area. The various challenges faced have picked up the attention of industry folks, academic researchers and people who frame policies. The author has highlighted the important role played by the stakeholders in creating energy efficient business model.(Matos & Silvestre, 5/17/2012)

At the beginning, we have started with the conceptual idea of sustainable development that stresses on the need to address to preserve the economic, social and environmental factors for future generations. This concept seems to have important implications for businesses and more recently is identified to influence the organizations' added values, policies and practices.

The type of study undergone while drafting this paper can be used for auditing purposes with respect to their 2020 renewableenergy obligations. as during the study, the analysis of peers considering the RES development were considered and further the countries were grouped on the basis of similar productivity and efficiency. Further to the context, it was found that despite of larger countries' ability to produce output at a lower cost per unit, small countries such as

luxemburg and Ireland is also far behind with RES penetration, inspite of a fact that they belong to a category of the most technically efficient European economies with scale efficiency equal to unity. The reason behind the same can be that the small countries have a narrower scope for specialization and depend more on imported technology, this could be their main weakness that imposes the need of being technical efficient. But on the other hand, considering the reality it is a fact that the small countries enjoy a productivity advantage and a trade based volatility due to their openness, which result in growth and prosperity. Therefore, the empirical analysis adopted during the study implies that only large countries can derive benefit from the RES investments

Unavailability of human resource with required knowledgeand skills is often identified as one of the key reasons for poor dissemination of renewable energy technologies. One of the major reason for poor dissemination of renewable energy technologies is the deficit if skilled human resources (Menegaki, 6/12/2013)

As is a known fact, renewable energy requires human resource with requisite technical know-how to function at its optimal level. However, the current non availability of the trained human resource with mandatory knowledge and skill is one of the major reasons for poor dissemination of renewable energy

Sourcing skilled manpower

A Framework Document (RFD) signed between the Secretary Power & Minister Power for 2012-13 in which it was agreed to achieve Capacity building for additional 15956 MW. In which it was identified that to achieve the figures it requires the training of 16225 Persons at NPTI and 132,000 training weeks (Chawla, Sep-Oct. 2012)

During the study it was discovered that the availability of unskilled technical labour was in surplus where as the skilled labour supply is fewer. This is due to the following factors which are prevalent in the market:

- The new competitors have entered in to the power sector and they hunt for experienced employees and offer higher monetary benefits than what they are getting in present scenario.
- Another reason for shortage of skilled labour is that since many new private companies have entered in the industry and are looking for the experienced employees and lure them by offering higher position.

- In earlier days the labour was reluctant to change and believed that they lived in the fear of losing their job, that's why they used to stick to one place instead of moving on and learning new talent.

On the other hand, it is necessary to consider the professional profiles related to the energy efficiency policies that could generate jobs in the industry. (Tourkolias, Mirasgedis, & Damigos, 6/3/2009)

In addition to the discussion that for renewableenergy to create employment opportunities there should be complimentary conditions and to calculate the same skill requirements analysis is desirableby the project managers. another important contributing factor of the study is that it suggest that the till the time technical schools are set-up in the country, polytechnic schools in country can offer specially designed courses which will aimed to impart qualified knowledge that would lead to the optimum results.(Lambert & PereiraSilva, 6/27/2012)

As with any structural change the pace and the extent of the transition will depend significantlyon how well technical skills are aligned to new job requirements.The contribution of researchers will be required so that new ideas can be generated and introduced in the industry and the skilled workers would be the key source responsible for carrying out the idea into practice.The Researcher concludes that although there will be an enhancement in the employment, it will not necessarily be enough to offset the negative impacts that will be borne by the workers in the non-renewable energy sector.(Moreno & Jesu´s Lo´ pez, 10/31/2006)

The major challenge of this industry is that there is not a definite degree in renewable energies (although it could be postgraduate and specialization courses). Hence, the significance of establishing the required educational environment and the adequate employee skills are crucial to reach suitable competitiveness in this industry. The adequate skilled employees are expected to have sound understanding of organizational and resource management, interpersonal and communication and information technologies skills.

The researcher conducted qualitative interviews and suggested that occupational requirements in renewable energy jobs (e.g. international mobility and experience in the electricity sector) tend to leave out women. It was identified that there is a need to encourage education, training and skills development opportunities for women, who are otherwise facing lack of the qualifications, skills and expertise

necessary to take benefit from green jobs opportunities. Considering the researched data which indicates that women are still underrepresented among graduates in science, technology, engineering and mathematics and vocational training programmes are still considered to be male-oriented.(Koschel, 1/1/2013)

The way out from the problem can be the skill analysis and forecasting, which will aim at upgrading the senior qualifications and will motivate to adapt the current and future vocational skills of the workforce, there by contributing to close the current skills gap.(Gkatsou, Kounenou, Papanagiotou, Seremeti, & Georgakellos, 1/1/2014)

Secondly, women can be motivated by spreading awareness about social dialogue such as tackling organizational hurdles, in terms of working hours, child care services and the culture of organization.(García-Álvarez & Mariz-Pére, 8/1/2012)

To abridge, there is a clear association between MW installed and number of jobs, but the use of a single job /MW ratio is not practicable due to differences in the export /import capacity. The scarcity of specialist roles skilled workforce is not likely to be solved unless a series of educational, mobility and dissemination measures are put into practice.

Social Inclusion

The trust mediates the consequence of community identity on the willingness to participate in a local community energy project and Energy related social norms mediate the effect of community identity on the willingness to contribute in a local community energy project needed tobe supported. The findings show that trust and social norms fully mediate the relationship between community identity and willingness to participate community identity influences willingness of the people to participate in community energy project and this can be achieved through making alterations in trust, social norm and environmental concerns. (Kalkbrennera & Roosen, 09-12-2015). During the report the important role of community identity as an antecedent has also been highlighted this has resulted not only in highlighting the concept but also has facilitated in formulating effective planning policies and communication strategies. It is believed that the findings can contribute to initiate community energy projects and similar initiatives in countries other. although the variable involved might differ in their effect size, community identity, social norms, trust and environmental concern and it is assumed that they can be proved as building blocks for initiating new projects

in various areas.(Bauwens, Gotchev, & Holstenkamp, 09-12-2015)

The results derived suggest that there is an existence of synchronized actions among cooperatives. The coordinated actions emphasize on the economic and political content of the initiatives.To elaborate, on one hand, they represent strategic reactions of small participatory organizations to adapt to policy progressions and increasing competition in power markets.Whereas, on the other hand, they constitute a way of establishing networks in order to increase supply of power in energy markets.(Koirala, Koliou , & Friege , 30-11-2015)

Also to add to the above discussion, it is believed that the development of renewable energy cooperatives is a polycentric process, which involves the interaction of various parameters at different levels of decision-making. As proposed by Ostrom, whoemphasized on the need for citizens' self-organization and participation in the process of designing robust and democratic institutions. He added that if an elite or a dominant group establishes rules without the consent of localcommunities, they are not likely to serve the interest of all concern parties which is not aligned with the purpose of building strong, participative and inclusive renewable energy cooperatives.(Walkera & Wright, 28-11-2007)

The review suggests that the main challenges requires concealing of the bi-product of over riding culture, structure and practices from the centralized energy system. Further, the developments are expected as different actors attempt to align their incentives.These new developments will reshape operational roles and responsibilities, energy markets, behaviour of different actors, business models for energy services as well as corresponding institutional arrangements. Local communities will play a significant role in energy production, consumption as well as in distribution.(Cernea, 29 October, 2004)

The researcher suggests that renewableenergy projects can become more locally divisive and controversial if benefits are not generally shared among local people. There are many evidences which suggest that more direct and significant involvement of local residents in a project contributes to greater project approval and support.(Seyfang, Park , & Smith, 06-07-2013)There are various examples which reflect the positive impact on local peoples understanding of and support for renewable energy one of them being that local people themselves have done installation of micro generation technology at home.

Further, the facts stressed during the research states that considering the equity and the allocation costs and benefits have proved to be significant in local debates in regards to many development proposals and in this respect community projects are no different. Incase, inspite of labelling a project as community and then the local resident are left with a feeling that they are not benefitted out of it, leads to anger and opposition.(Wirth, 13-04-2014)

Considering a circumstance where during planning and executing in correct labour-recruitment is attempted for many dams (an error that enlarges boom towns, increases project costs, and decreases the options to reduce adverse impacts on local communities) is the under-employment and under-training of the area population and leads to short fall in skilled staff for dam and supplementary constructions.(Walkera & Wright, 28-11-2007) In such a situation local labour is substituted by over-importation of massive labour from outside areas, causing avoidable social and financial complications and also secretly reducing the long term social sustainability of dams, and under-financing. In the context, the Classic economic theory regards "cost externalization" as an unsound and unacceptable practice.Yet most dam-building projects practice externalization with no restraint and morality, flying in the face of economic theory and policy discourse.(Hatzl, Brudermann , & Reinsb, 25-02-2014)

The fundamental methodological principle of the risk-focused framework is fertile in that it encourages a mind-set always "on the alert" for identifying upcoming problems (potential risks), so that pre-emptiveaction may help arrest the adverse recurring events. This concept of moving ahead and efforts to prevent or reduce adverse possible social impacts in hydro electric projects attempts to avoid explode and "strike", which is any way, considered being better that trying to resolve issue later.(Rogers, Simmons, & IanConvery, 26-12-2011)

In the case on hand here suggests that institutional influences from the local social environment form the central explanatory variables for understanding the emergence and constitution of the power cooperatives. The paper intends to make importantcontributions to discussions about community energy. The initial is of a conceptual character consisting of the analysis of community energy- profit from using 'community' as an analytical concept. The findings here indicate the importance of community related institutional structures in understanding how community energy

projects are formed or why certain regions display a particular density of community energy. Further, the findings suggest that 'community spirit', a cooperative tradition, and the norms of locality and responsibility are central drivers behind the emergence and constitution of power cooperatives. Not only do these institutional comprises of community influence in the decision related to farmers, plant location and scale.(GordonWalker, 25-10-2008)

The survey conducted suggests that the local residents have more straight and considerable involvement in a project and if these peoples support the project then it contributes to greater project approval and support and there are numerous evidences that prove that this association could have a positive impact on local peoples understanding and support for renewable energy.(Wandersman, Florin, & Friedmann , 20-01-2016) Therefore, more strong level of assurance to the deeper meaning of community in community renewables can originate, by providing the locally based advice and support which is crucial for projects to be successfully developed by the people and for local people

Community-owned renewable energy is only one part of wider community renewables activity, which in itself comprises of only a small proportion of renewable energy generation overall. If we consider the case of UK, the growth rate has been dominated by large, developed and institution-financed projects. Therefore, it is felt that there is always pressure to engage society more widely in industry, as this can be proved beneficial keeping in view the future instability in energy markets. This can become important drivers of more locally controlled and owned models of energy generation, and might result in paradigm shift towards more determined policies of support.

The findings recorded after the analysis of the demographic variables indicate some cross-cultural similarities (including a surprising lack of race/ ethnic and education differences between participants and non participants).also to add there were striking cross-cultural similarities using the social psychological variables. The results of the analysis of the demographic variables (including the discriminant analysis) also suggest that the foundation of the community is directly proportionate to participation level.(Sinclair & Diduck, 20-02-2012) living in an area for along duration and with an intention to have family and children this can be seen as embedding an individual within a community, increasing

both the opportunities and incentives to participate. The assumption here is considered to be that the occupation, education, and race/ethnic status were not related to participation.

In developing countries, adopting an effective public participation strategy should not assume that people have the time, willingness, organization and resources to participate. In order to make the study more meaningful the major findings have been divided into three parts, which areas following:

- Socio-economic impact on community development - This portion covers various concerns which have apparent influence on the community development.
- Public consultations
- Local participation- Various internation allaws signed Policy, Rule and Regulations dictate the need to make public consultation and participation as an integral part of any environmental impact assessments or public affairs.(Kahssay & Mishra)

The study also reveals that majority of the poor people are given special privilege under some or the other government policy. The importance of local people have also been witnessed for the success off the project and the study suggests that the buyers of the produced electricity are already in the queue so there is almost very less chance of any type of financial risk.

Role of Training

The objective can be achieved in a scenario where power sector initiate change in its working environment.The companies can do so by hiring qualified HR managers from other sectors who can be asked to establish and incorporate best practices followed in other sectors. The suggested practices can include:

- Introducing Soft skills training
- Reducing hierarchical barriers and creating career development opportunities.
- Periodical trainings to the existing manpower to ensure up-to-date technical skills
- Counselling facility in order to boost motivation level which will result in increased productivity.(Kacan, 25-11-2014)

Deficient local and national technical staff and support organisations are proved to be a hindrance in developing and implementing rural energy programmes. The most ignored factors in sustaining energy programmes is the quality and flexibility of capacity, both human and

institutional, that provides the support structure for innovation and creativity. In addition for sustainable technology growth, a society must have management and technical infrastructure to upgrade and replenish its stock of skills and knowledge on a continuing basis. as a way out of the problem it is important for the human factor to accept the available technology and should create a self-sustaining organism for creating employment opportunities for local entrepreneurs and technicians in order to address immediately to technical inconvenience encountered due to lack of locally available capability. As a quick remedy, some villagers can be given basic training to carry out minor repairs and maintenance.(Kandpal & Broman, 29-03-2014)

During the research it was acknowledged that there are no specialized courses or reading material available for teaching or training purposes, not even at post graduate level. Another big limitation in promoting renewable energy education activities on a large scale is the lack of funds with most of the schools, colleges and universities in the developing countries.(Desha & Hargroves, 02-07-2014) Therefore, it is imperative to take the holistic approach considering all factors related to renewable energy education and then clear-cut strategy should be drafted. Moreover, to enable implementation of any such strategy, funds will have to be made available, in addition, if any programme related to increase employment opportunities in renewable energy education is intended to offer at secondary/ high school level the parameters should be checked appropriately before initiation of the program.

The results illustrates that the dimensions of civil accountability for a sustainable society and low-carbon lifestyle are considered most essentialas an energy educational goal.among the indicators, understanding and self-efficacy and identifying carbon-less technology and action plan are ranked first and second.The indicators of carrying out sustainable (green) consumption and civic engagement are ranked third and fourth.These dimensions of this literacy framework are aimed to align with the defined educational objective. According to the response from the teachers, the researcher was certain that the issue-based teaching approach could promote students abilities to apply the contextualized knowledge learned at school to deal with energy-related issues.This would help students to take further responsibility and would promote

appropriate actions to conserveenergy in daily life.(Garg & Kandpal, 1996)

During the research, following observations were made:

- Firstly, students exposed to project-oriented classrooms gained a higher level of proficiency with respect to energy-related knowledge and cognitive skills. The data can be used as a confirmation show casing the overall differences in pre/post gains, as well as relates the higher post scores achieved in every category of knowledge questions
- Secondly, the performance differences between project-oriented students and the rest of the student group were generally more pronounced for questions that related to practical energy knowledge

The study conducted further illustrates the complex relationship between knowledge, beliefs, attitudes, values, and behaviours. The results presented here substantiate previous findings which stated that self-efficacy is more strongly correlated to behaviour than knowledge. (Chen, Huang, & Liu, 03-01-2013) Considering another prospective factor responsible for influencing student behaviour can be the type of knowledge – practicalor informal "citizenship" understanding of energy, vs. technicalor formal "science" content knowledge.

Students who participated and shared their educational experiences, established the relevance of what they were learning in school and its relevance in their everyday lives and furthermore they were found sharing the important information with their families and the leanings can be identified by observing their attitudes and behaviours which reflected their real leanings.

During this study, learners stated what they were already aware and realized the limitations of their knowledge in respect to the acquaintance related to energy and the use of the same information in their everyday activities.The students mentioned that the lessons taught to them were practical, linked to everyday life and local conditions and they also had the opportunity to share their experiences with their peers.Furthermore, the students mentioned that the learning imparted were associated to general energy matters and more specifically on sustainable energy technologies and practices and emphasised that the few topics that were taught were those which they have already heard from the media. The research suggests that the energy awareness and provoked energy-

efficient activities can be inculcated if the module are repeated throughout the school year and are repeated during their later school lives. It is believed that this way we integrate the energy-efficient behaviour into the normal everyday behaviour, even though in absence of exogenous encouragement to energy saving.(Liarakou, Gavrilakis , & Flou, 01-04-2009)

During the research conducted to counter check the level of education related to energy renewable imparted at each level, it is observed that the greater endeavour are been made to explore, document and support the design of curriculum renewal strategies which focuses on sustainable development. The engineering education is available at limited areas and the teachers have been seen supporting the ready to use targeted resources. Where as in contrast, the post-graduation education has disjointed curriculum which has little significance in regards to the desired context. The research also reveals that the paramount method to push the education level in the industry is collaborated courses which will ensure practical learnings and new idea generation. Thus, the industry folks are aiming towards getting quality assured graduate attributes (DeWaters & Powers, 12-10-2015)

The projects that have been under discussion have displayed the potential for easy and free available information to highlight the knowledge related to hydro power industry and skill gaps pointed by industry folks.

Conclusion

During the course of the study, important constraints were identified such as sourcing of skilled manpower, social inclusion of locals and the role of training, which were not allowing the full utilisation of the renewable energy technologies. After going through extensive literature review and studying these factors it was seen that the knowledge needed for successful deployment of these projects was not being imparted. This was mainly due to the lack of structured courses and the lack of interest in people towards renewable energy. A more comprehensible approach towards making renewable energy popular was needed as well as inclusion of tailored courses into the curriculum has become a necessity.

Social inclusion was another major constraint for the Power Industry. It was seen that renewable energy projects become locally divisive and controversial if benefitsof these projects are not shared among local people. Direct and significant

involvement of local residents in a project would contribute to greater project approval and support. Social inclusion by keeping the locals informed of the benefits of the project as well as giving them direct employment would create a positive outlook towards these projects as well as root out any opposition. This would create apositiveimpact on local understanding of and support for renewable energy as well as adaptation of the same at their homes on a micro scale.

Role of training also plays a vital role in the above context. There is a lack of specialised courses at the graduation level when it comes to renewable energy technologies. Teaching the benefits of renewable energy as well as training and providing employment to the locals in the installation and maintenance of renewable energy technologies was the most straight forward way to tackle the above issue. Training locals would take care of unnecessary sourcing of manpower by providing skilled labours on site as well as increasing theconfidence of the locals towards these projects. Using these suggestions for any further development of renewableenergy projects would be hugely beneficial for the power industry.

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Contractual Factors Affecting Supercritical Technology Coal Based Power Capacity Addition in India

P. Chockalingam*, Dr. T Joji Rao**, Dr. R. Jayaraj***

**Director, Divideed Engineers Private Limited*
***Senior Associate Professor, CoMES, University of Petroleum and Energy Studies*
****Associate Professor, CoMES, University of Petroleum and Energy Studies*

Abstract:

India is steadily growing and this has resulted in increased electricity consumption. But the rate of electricity generation capacity added has not been able to meet the increased electricity demand leading to electricity shortages further leading to economic loss. This scenario highlighted the need for adding larger power generation capacity per unit at a faster pace meeting the environmental guidelines. Hence Supercritical technology coal based power generation capacity addition has become a preferred choice in India. Various measures have been taken by India to stimulate power generation capacity addition viz. Right to fair compensation and transparency in Land acquisition, rehabilitation and resettlement bill -2013, E is auctioning of coal Financial restructuring packages to state electricity boards, 2012 and other measures. This paper, through a detailed literature review, identified variables that affect the supercritical technology coal based power capacity addition in India and these variables were grouped into twelve themes which were subjected to Factor analysis. The outcome of the factor analysis indicates the significant factors grouped as contractual factors viz. Power purchase agreements, Fuel supply agreements, Contractor capability, Payment defaults, Imported coal and domestic coal pooling, Financial closure, Coal availability and Tariff are significant in affecting supercritical coal based power capacity addition in India. Formulation and Implementation of revised strategies addressing these contractual factors will facilitate timely addition of supercritical coal based power capacity in India.

Methodology: Factor analysis using Questionnaire

Major findings: Contractual factors that affect the supercritical coal based power capacity addition in India

Key words: Supercritical, Thermal, Generation, Coal

Indian Power sector overview:

Background and Significance:

Electricity is a key contributor to the development of any country and India is no exception. India has the potential to emerge as a major economy and has been growing at a higher rate compared to the other major countries even during periods of economic downturns (India Development update 2015,Report no.95979-IN,World Bank).

As per Tripta Thakura, S.G. Deshmukhb, S.C. Kaushika and Mukul Kulshresthac (2006), Indian power sector has gone through major transformations over the last few decades such as Abolishment of license in the power generation domain, Encouragement of private sector participation in power generation, Unbundling of the State Electricity Boards etc. This has made Indian power sector become an attractive destination for global power equipment manufacturers .Chinese, Korean, Japanese, American and European power equipment manufacturers are actively involved in building up the power generation capacity by setting up their manufacturing facility in India either directly or through Joint Ventures and through exports from their countries (Opportunities and Challenges in the BTG space, The Boston Consulting Group, 2012).

India has been adding the power generation capacity consistently from 1GW during 1947 to 307GW in 2016. Power sector of India consists both renewable and non-renewable sources and conscious efforts have been done to bridge the demand gap by all these sources. It may well be established from the Table 1 that among the various fuel sources of the installed power generation capacity in India namely Coal, Gas, Oil (Thermal), Hydro, Nuclear and Renewable Energy Sources (RES) and the coal based power generation with a contribution of 61% is the leading contributor to power generation in India.

Table 1:Fuelwise breakup

Fuel Source	Installed capacity (GW)	% Share
Coal	186	61
Gas	25	8
Diesel	1	0.3
Nuclear	6	2
Hydro	43	14
RES	46	15
Total	**307**	**100**

Source: Central Electricity Authority, India (2016)

India has planned to implement for Supercritical technology for the coal based power generation capacity added due to various advantages it offers voice, Reduced fuel consumption, Reduced water consumption, Reduced emission, Reduced land requirement, Increased unit capacities and High plant operating efficiencies. The Supercritical technology generation capacity addition target is given in Table 2. Indian coal based power generation capacity addition will be totally based on Supercritical technology except few captive smaller power generation capacity addition which may go for lesser efficient sub critical technology owing to economic reasons.

Table 2: Supercritical technology capacity addition target

Year	Overall target*	Coal based*	Supercritical (SC) *	SC as a % of coal based
2012-17	88537	69280	41568	60
2017-22	93400	63400	63400	100

**Values in MW Source: Planning Commission (2012)*

There has been under achievement of power generation capacity addition in India and delays in commissioning of coal based Supercritical technology power plants in India, which has led to electricity restriction and control measures and which has further resulted in business losses. India suffered a business loss of $68billion due to electricity shortages during 2013-14 (FICCI 2014). The problem is likely to be more pronounced as the demand for electricity is steadily on the rise.

The projected power generation capacity addition required in India is likely to be 436GW in the year 2020 and 746GW in the

year 2030 (Ministry of Power, India). The estimated demand projection for installed power generation capacity is given in Table 3. While the share of other fuel sources will be on the rise, The coal based power capacity addition will double from the installed capacity of 204MW (2014)to 419GW (2030). The new addition of coal based technology will be Supercritical technology based. Based on the track record of achieving addition of power generation capacities, meeting this demand will be a challenging task.

Table 3:Projections of Indian Installed power generation capacity (GW)

	2000	2014	2020	2030	2040
Installed capacity	113	289	436	746	1076
Coal	84	204	280	419	576

Source: India Energy Outlook, International Energy Agency, 2015

It may further be ascertained by the fact that the per capita consumption of electricity (kWh/year) of India is 1075USD during 2015-16 which is very low and this only confirms that electricity is not accessible to the entire population of India. It only indicates there is a huge latent demand for electricity that exists in India. Hence there is need for adding huge power generation capacities

Table 4:Per Capita Electricity consumption

Country	**Per capita consumption (kWh) ****
India	1075
China	3457
Brazil	2509
Russia	6602
US	12947
Canada	15558

***Per capita consumption figures for India is for 2015 and for the rest of the country, it is for 2012*

Source: Central Authority of India (2016) and CRISIL Insight (2015)

It is required that India adds the targeted supercritical power capacity addition, during 2012-17 and 2017-22 periods and in the future to avoid any further business losses. Hence there is need to identify the significant factors that affect the addition of coal based supercritical power capacity addition and take corrective action so that

the coal based supercritical power capacities are added as per target and on time.

Hence the focus of this study is to identify the factors that affect supercritical technology coal based power capacity addition in India, which may be useful in taking corrective actions so that the supercritical technology coal based power capacity addition happens as per plan in India.

Literature review:

As per Siddesh Pai and S. Gridharan (2013), Theory of constraints can be used to complete large capacity Ultra mega power plant (4000MW) using Supercritical technology with imported coal by an effective and efficient planning of activities taking material constraints into account. It is found that coal supply is the major constraint identified by using theory of constraints and suitable measures to mitigate fuel shortages and consequent delay in completion of the power plant is a must.

As per Xiaoli Liu and Xinmin Jiang (2008) Energy is a key factor that fuels the growth of any economy. With the increase in population and the economic growth of economies the need for energy has gone up. Many countries do not have adequate energy to meet the requirements. The Co-integration and vector error correction modeling along with generalized impulse response functions and variance decomposition tests conducted on six asian emerging economies (India, China, Indonesia, Philippines, Malaysia and Thailand) suggested that there is a direct relationship between energy consumption and GDP .This co relation between energy consumption and GDP is further corroborated by Shuddhasattwa Rafiq and Ruhul Sali (2009), and Maria van der Hoeven (2013).Hence addition of power generation capacity in line with the increasing GDP is mandatory to avoid business losses in emerging economies like India.

It is inferred from the analytical model developed by Stephane de la Rue du Can, Michael McNeil, and Jayant Sathaye (2009) studied the end user energy demand in India by 2020. The outcome of the analytical model suggested that per household residential electricity consumption will likely quadruple in the 20 years between 2000 and 2020.The growth in electricity demand implies that chronic outages are to

be expected unless efficiency improvement measures are implemented in the existing power plants and new power generation capacities are created. This quadruple consumption demand warrants reliable ,large unit capacity in a single location and uninterrupted round the year availability of electricity.This can be met by supercritical technology coal based power generation capacity addition.

The activity analysis model with social accounting matrix developed by Jyoti Prasad Painuly (2009) accounts for inter-sectoral influence and which allows for a two-way interaction between energy sectors (coal, oil, natural gas, and electricity) and other sectors of economy suggested that although available energy resources can meet the medium and long-term global energy demand, the world energy security faces lots of severe challenges in the aspects of demand and supply factors, infrastructure, geopolitics etc. This situation has forced the countries to develop new power generation capacity based on the available energy sources within their countries thereby reducing reliance on imported fuels. India, China, Indonesia is focusing on adding coal based power generation capacity as they have abundant coal reserves.

As per Jinke Li and Zongxue Li (2011) that by using the Granger causality analysis , ADF-Fisher and PP-Fisher unit root tests and the two-step EG test it can be inferred that there is unidirectional causality from GDP to coal consumption in China. It indicates that the continued economic growth has resulted in a continuous rise in coal consumption, which is fundamentally driven by GDP and therefore taking measures to conserve coal without compromising economic growth may be feasible. The unidirectional causality from coal consumption to GDP in India indicates that a change in coal consumption directly affects economic growth and coal constitutes a critical factor in sustaining the nation's economic growth and well-being. Economic growth is one of the most important factors influencing coal consumption. Hence, coal based power capacity addition in India is inevitable.

Based on the literature reports mentioned above a common theme emerges that economic growth is directly proportional to the energy consumption and countries are focusing building up of new power

generation capacity primarily on the basis of fuels available in house. It is inferred from the Central Electricity Authority, India report (2012) that in the case of India, the share of coal based power generation capacity is the highest while comparing with other fuels and creating additional coal based power generation capacity is vital for the country's economic growth. While the availability of Indian coal is a cause for concern, going for 100% imported coal decreases the viability owing to price increases and hence pooling of Indian and Imported coal is a viable option to ensure coal based supercritical power capacities are added on time in India.

Multiple literatures indicate that coal based power generation capacity addition is required to meet the India's economic growth. As per ,Suman Babbar John Schuste (1998), non-availability of power evacuation network affects the power generation capacity addition and this becomes a stumbling block during investment decisions leading to delays in adding new power generation capacities in India.

It is inferred from Jeetendra Kumar Tiwari and Rawani AM (2012) that the environmental regulations are frequently changed. The cost of environmental management is about 20% of revenues. Any change in regulation has huge cost impact. This affects the setting up of new thermal power plants as they could not do the long term environmental planning. The delays in according environmental clearances will result and time and cost overruns.

As per Anthony J Gonsalves (2009) as construction projects grow increasingly complex and costly, construction professionals need to be more cognizant of both the budget and time constraints. Improved management and scheduling of construction projects are imperative to the success of any project, particularly large-scale ones. The capability of vendors needs to be ascertained well.

It is inferred from Mohit Goyal, Hemant Dujari and Sarthak Misra (2012) that the major categories which contribute to delays in coal based power generation capacity addition include fuel supply constraints, Land acquisition issues, Delays in

environmental clearances and securing financing.

The inferences drawn from literatures are summarized and given in section 2.1. There is no study that has been carried out to identify the significant factors that affect coal based supercritical power generation capacity addition in India. This paper attempts to fill this gap.

Summary of Literature review:

The variables identified through the literature survey were categorized into 12 themes and the summary is given in Table 5.

Table 5: Summary of Literature review:

Sl	Themes	Select Author/s	Context	Inference
1	Electricity demand	Loganathan , Nanthakumar and Thirunaukarasu Subramaniam,2010, Xiaoli Liu and Xinmin Jiang,2008, Anurag K Srivatasava, Sukumar Kamalasadan,Daxa Patel, Sandhya Sanakar and Khalid S Al Olimat,2011, Shuddhasattwa Rafiq and Ruhul Sali,2009, Umesh Kumar Shukla,2010, J. Razmi and S.F. Ghaderi,Keyno,2008	Indian	Energy consumption is directly proportional to economic performance .There is need to augment the coal based power generation capacities in developing countries to meet the likely demand arising on account of economic growth
2	Coal	Ananth P. Chikkatur , Ambuj D. Sagar b, and T.L. Sankar,2009, Jinke Li and Zongxue Li ,2011, Siddesh Pai and S.Giridharan,2012, Mudit Kulshreshtha, and Jyoti K. Parikh,2001, Ujjwal Kumar a and V.K. Jain,2010, P. Chikkatur and A.D. Sagar,2007, Tai Wei Lim,2012	Indian	Literatures highlighted that availability of coal is critical and the need for coal price passing through to make coal based power projects viable which were bid on tariff as a base.
3	Environmental clearances	Jeetendra kumar Tiwari and Rawani AM,2012, Ritu Paliwal,2006,Subhodip Ghosh,2010, Koyel Mandal and Vivek Venkataramani,2013, Prashant Gupta, Rajat Gupta and	Indian	Delays on account of environmental clearances affect planned coal based supercritical power generation capacity addition in India .Cost of environment management solutions may affect the supercritical technology coal based power capacity addition

		Thomas Netzer,2009		
4	Power evacuation	Shyam Sundar Gupta,2008, Suman Babbar John Schuste,1998		Availability of power evacuation infrastructure helps the power generation capacity addition. Lack power evacuation infrastructure impacts investment decisions in power industry.
5	Execution	KPMG-PMI ,2012 Anthony J. Gonzales,2009	Global	Setting up of a single window clearance mechanism, setting up three tier project management office, modifying bidding criteria procedures, developing robust process for faster dispute resolution and institutionalizing training are some of the measures that can help reduce time and cost overruns at the time of execution of the project.
6	Securing finance	Sriram Siddhartha Potluri and Thillai Rajan,2009, Jyoti Prasad Painuly,2009, Thomas M. Minnich,2008, Salman Zaheer,2006, Mansoor Jamal Mallik,2013, Hamzah Abdul-Rahman, Roshana Takim and Wong Sze Min ,2009, J Cook,2000, Jim Gabriel,2012.,Asian development bank,2013, Central Electricity Authority,2012	Global	Securing finance for a power project is influenced by many variables including Land, PPA, Fuel linkage and Environmental clearances. Project finance in power projects and the role of project cash flow and a well designed financial model are the key to the successful project completion.
7	Land	Bill Mundy and Theodore Lane,2011, Paul Munro-Faure,2008, Sheetal Sharad, Shubham Jain and Rohit Inamdar,2013, G. Raghuram ,Samantha Bastian and Satyam Shivam Sundaram,2009, Rob Jenkins,2013, M.VijayaBaskar,2006	Indian	Land availability ,Cost ,Gestation period to acquire are key factors in land acquisition. Execution of resettlement and rehabilitation measures at times delay the project.
8	Manpower	Panagiotis Mitropoulos, Ph.D., P.E., A.M.ASCE; and Tudor Nichita,2010,	Global	There is a need for trained manpower to meet the power sector requirements. Cost of manpower in developing countries are on the rise.
9	Policy	Jyoti Parikh and Probal P. Ghosh ,2009, P R Shukla and Subhash Dhar,2009, Prabodh Bajpai and Sri Niwas Singh,2010, Central Electricity Authority,2012	Indian	Regulatory processes in India at times causes cost and time overruns in the thermal power sector. Dispute resolution in India is taking longer time.

10	Power Purchase agreements	James Nelson n, and PaulSimshauser,2013, Richard Meade and Seini O'Connor,2009, Erik J. Woodhouse,2005, Veronica Bonetti a, Stefano Caselli b, and Stefano Gatti,2010, Subhes C.Bhattacharyya,2010, Njeri Wamukonya,2003, Gary Bond and Laurence Carter,1995, A K David,P N Fernando,1995	Global	Power purchase agreement is a risk mitigation tool of power projects. Investors prefer projects with Power purchase agreements while doing the risk return profile of their options.
11	Private sector participation	Monomit Nandy and Sumantra Bhattacharya,2009, Maria van der Hoeven 2013, International Energy agency ,2007, Akintoye, A. S. & MacLeod, M. J.,1997		Regulatory measures have increased the challenges faced by private sector on account of in Indian thermal power context. Private sector share in Indian power projects are on the decline
12	Technology	Mrinal K. Ghose,2009, Stephane de la Rue du Can, Michael McNeil, and Jayant Sathaye ,2009		Technological options are developing and are available which can meet the regulatory norms. Technology options with higher unit capacity will help ,meeting the targeted coal based power generation addition

As per the literature review, the variables that affect the addition of coal based supercritical power generation capacity addition in India are grouped into themes such as Coal, Electricity demand, Environmental clearances, Power evacuation, Execution, Securing finance, Land, Manpower, Policy, Power purchase agreements (PPA), Private sector participation and Technology.

In order to identify the significant factors affecting the coal based supercritical technology power generation capacity addition in India, the, identified variables from literature review were grouped into twelve themes which were subjected to Factor analysis using Questionnaire survey as explained in section 3.

Methodology

Descriptive research which is conclusive in nature was used as it gathers quantifiable information that can be used for statistical inference on the target audience through data analysis. Closed-ended questions were used for inquiry to define and measure the significance of the subject being researched by a group of respondents and the population they represent. The quantitative

research methodology was chosen for analysis.

Sampling methodology

Target population

This survey covered any organization or any individual who has a stake in coal based power capacity addition in India. The target population included both Indians and global players.

Sampling frame

The stakeholders of coal based power capacity addition in India were identified as part of the sampling frame. The stakeholders include Private sector promoters, Domestic investors, Banks, State and Central Government power developers, NBFCs, Private equity investors, EPC companies, Power equipment manufacturers, Power plant consultants, Financial analysts ,Captive Users and Regulatory agencies

Sampling Technique

Proportionate stratified sampling was the method used.The population was divided into various strata based on the functions of the stakeholders.With proportionate stratification, the sample size of each stratum is proportionate to the population size of the stratum ensuring that each stratum has the same sampling fraction.The percentage of stakeholders in the sample size are given below:

Private sector promoters-20%

Domestic investors, Banks -15%

State and Central Government power developers-15%

NBFCs, -10%

Private equity investors -10%

EPC companies -10%

Power equipment manufacturers -10%

Others(Power plant consultants, Financial analysts, Captive users and Regulatory agencies)-10%

Sample size

The questionnaire was administered to 150 respondents who are the stakeholders and 120 responses were received (80%). Hence the sample size considered for this study was 120.

3.1.5 Questionnaire design

All the variables found in the literature review were included in the questionnaire in the form of 20 questions. The questions were set to a 5 point Likert scale ranging from Strongly disagree (5) to Strongly agree (1)

Factor analysis

Factor analysis using SPSS version 17 was applied on the 120 responses**.**

The extraction method used is principal component analysis. To ensure suitability for using factor analysis, this study used the Kaiser– Mayer–Olkin (KMO) test and Bartlett's test of sphericity. The KMO test is done to measure the sample adequacy in terms of the distribution of values for performing the factor analysis (Geourge D, SPSS for windows step by step: a simple guide and reference, 1999). The acceptable values should be greater than 0.5 (George D and Mallery P, 1999, Field A, 1996). Bartlett's test of sphericity is used to test the null hypothesis that the correlation matrix is an identity matrix. If the R-matrix is not an identity matrix, there are some relationships between the variables. Hence, if the Bartlett's test is significant, the results of factor analysis will be appropriate.

Cronbach alpha is used for testing the internal consistency of the data. A reliability coefficient of 0.70 or higher is considered "Acceptable " in most of the research studies.

Results and discussions *The results of the factor analysis are given in Table 6.*

Table 6: Descriptive Statistics

	Mean	Std. Deviation
Coal Availability	4.300	.5884
Coal Price	4.100	.7928
Imported coal & Domestic coal pooling	3.233	.8862
Land Availability	4.050	1.2151
Land Price	4.133	1.0284
Resettlement & Rehabilitation of land owners	4.125	.9218
Securing Finance	3.417	2.9946
Fuel Supply Agreements Project Finance	3.392	.9102
Pollution control	4.267	.9325
Clearance Procedures	3.333	1.0795
Lack of Concessions	3.117	.9717
Extension of construction period	3.667	1.0795
Power Evacuation & transmission constraints	3.283	1.0386
Technology Up gradation	3.450	.9153
Availability of manpower	3.692	1.1796
Financial Closure	3.058	1.1832
Payment Defaults	2.850	1.2275
Contractor Capability	2.783	1.2035
Tariff	2.833	1.1327
Power Purchase Agreements	2.617	1.1965

The mean value indicates the means of the variables used in the factor analysis. The standard deviation provides an indication of how far the responses to the questions deviate from the mean. The variable "Coal Availability" ranks the highest and the variable "Power purchase agreements" ranks the lowest in terms of means.

Correlation matrix:

The Pearson correlation test has been conducted to check the pattern of relationships of the variables. The

determinant of the correlation matrix for the data is 1.87E-019 (0.187) which is greater than the necessary value of 0.00001. Therefore, there is no multicollinearity problem in the data used.

Validity test:

Table 7:KMO and Bartlett's Test

	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.933
Bartlett's Test of	Approx. Chi-Square	4808.053
Sphericity	Df	190
	Sig.	.000

As per the results of the KMO test (Table: 7), the achieved value is 0.933 which is greater than 0.5 and confirms the adequacy of the sample. As per the results of Bartlett's test (Table 4), it is inferred that the Bartlett's test is significant at 1%.Hence the results of factor analysis are appropriate.

Extraction and after rotation is given in Table 8. Before the extraction 20 linear components re identified. The eigenvalues associated with each factor represent the variance explained by that particular linear component. The results show that the eigenvalue in terms of percentage of variance for factor 1 is 77.461%of the total variance and the factor 2 is 5.951% of the total variance. The rotation sums of squared loadings show the eigenvalues of the factors after rotation. Now the eigenvalues of factor 1 after extraction is 46.202% and for the factor 2 it is 37.209%.

Table 8: Variance Table

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.492	77.461	77.461	15.492	77.461	77.461
2	1.190	5.951	83.411	1.190	5.951	83.411
3	.890	4.449	87.860			
4	.778	3.891	91.752			
5	.489	2.447	94.199			
6	.279	1.396	95.595			
7	.221	1.103	96.698			
8	.141	.703	97.401			
9	.096	.480	97.880			
10	.079	.396	98.276			
11	.065	.326	98.602			
12	.057	.287	98.889			
13	.050	.248	99.137			
14	.042	.212	99.349			
15	.036	.178	99.527			
16	.031	.154	99.681			
17	.023	.117	99.797			
18	.018	.090	99.887			
19	.012	.062	99.949			
20	.010	.051	100.000			

Table 9 : Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.964	.983	120

Commonalities:

The commonalities which are the proportion of each variable's variance that can be explained by the principal components are given in Table 10.

The commonalities explain the common variance in the data structure. After the extraction of the factors, some are thrown away and this information is lost. Hence the amount of variance is explained by the retained factors in the communities after the extraction.

Table 10: commonalities

	Initial	Extraction
Coal Availability	1.000	.812
Coal Price	1.000	.877
Imported coal & Domestic coal pooling	1.000	.876
Land Availability	1.000	.840
Land Price	1.000	.916
Resettlement & Rehabilitation of land owners	1.000	.812
Securing Finance	1.000	.333
Fuel Supply Agreements for Project Finance	1.000	.940
Pollution control	1.000	.788
Clearance Procedures	1.000	.907
Lack of Concessions	1.000	.885
Extension of construction period	1.000	.868
Power Evacuation & transmission constraints	1.000	.895
Technological Up gradation	1.000	.844
Availability of manpower	1.000	.428
Financial Closure	1.000	.945
Payment Defaults	1.000	.940
Contractor Capability	1.000	.946
Tariff	1.000	.877
Power Purchase Agreements	1.000	.954

Extraction Method: Principal Component Analysis.

Component matrix:

The component matrix values are given in Table11 before the rotation. The component matrix values less than 0.4 are not useful for the inference and hence they are suppressed.

Table 11: Component Matrix

	Component	
	1	2
Financial Closure	.966	
Clearance Procedures	.948	
Tariff	.936	
Lack of Concessions	.935	
Coal Price	.934	
Power Evacuation & transmission constraints	.933	
Payment Defaults	.933	
Contractor Capability	.932	
Extension of construction period	.921	
Land Price	.900	
Fuel Supply Agreements for Project Finance	.897	
Resettlement & Rehabilitation of land owners	.896	
Coal Availability	.894	
Imported coal & Domestic coal pooling	.879	
Technology Up gradation	.877	
Land Availability	.873	
Pollution control	.867	
Power Purchase Agreements	.856	.470
Availability of manpower	.652	
Securing Finance		.432

Rotated component matrix:

The loadings given in the first stage of the factor analysis are rotated to get another set of loadings in order to have a better fit between observed variances and covariances. The rotated component matrix values are given in Table 12.

Table 12: Rotated Component Matrix[a]

	Component	
	1	2
Power Purchase Agreements	.953	
Fuel Supply Agreements for Project Finance	.916	
Contractor Capability	.883	.408
Payment Defaults	.875	.419
Imported coal & Domestic coal pooling	.872	
Financial Closure	.794	.560
Coal Availability	.746	.505
Tariff	.713	.607
Land Price	.459	.840
Land Availability	.472	.786
Technological Upgradation	.478	.784
Power Evacuation & transmission constraints	.597	.734
Pollution control	.525	.716
Extension of construction period	.600	.713
Clearance Procedures	.652	.694
Lack of Concessions	.635	.694
Coal Price	.653	.671
Resettlement & Rehabilitation of land owners	.611	.663
Securing Finance		.577
Availability of manpower	.457	.468

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

Table 12 represents the identified 20 variables into 2 factor groups which impact the addition of supercritical coal based power capacity addition in India.

Interpretation

The following section discusses the two factors identified through factor analysis, which impact the addition of supercritical coal based power capacity addition in India. They are categorized as Contractual factors and Regulatory and Operational factors.

Factor 1: Contractual factors

The factor "Contractual factor" indicates that the time taken to finalize contractual agreements, non-adherence to the commitments made in the contractual agreements, absence of time bound dispute resolution mechanisms impact the addition of supercritical coal based power capacity addition in India. It is found that the variables that contribute to Contractual factors include Power purchase agreements, Fuel supply agreements, Contractor capability, Payment defaults, Imported coal and domestic coal pooling, Financial closure, Coal availability and Tariff. Another learning from this study is that the contractual variables such as Contractor capability and Payment defaults affect impact the addition of supercritical coal based power capacity addition in India.

Factor 2: Regulations and Operational factors

The factor "Regulatory and operational factor" explains the challenges related to the difficulties in acquiring resources, the complex and time consuming procedures, Multiple agencies in accord approvals, lack of governmental support on issues related to social implications impact the addition of supercritical coal based power capacity addition in India. It is found from this study that the variables that contribute to regulatory factors include land price, Land availability, Resettlement and rehabilitation of land owners, Lack of concessions, Pollution control and Clearance procedures. This study indicates that Coal price and securing finance form part of operational factors that affect the addition of supercritical coal based power capacity

addition in India and Power evacuation and transmission constraints, and Extension of construction period is operational related factors.

Finding:

The outcome of Rotated component matrix (Table 12) indicates that the contractual factors are more significant than Regulations and Operational factors in affecting the addition of coal based Supercritical technology power capacity addition in India.

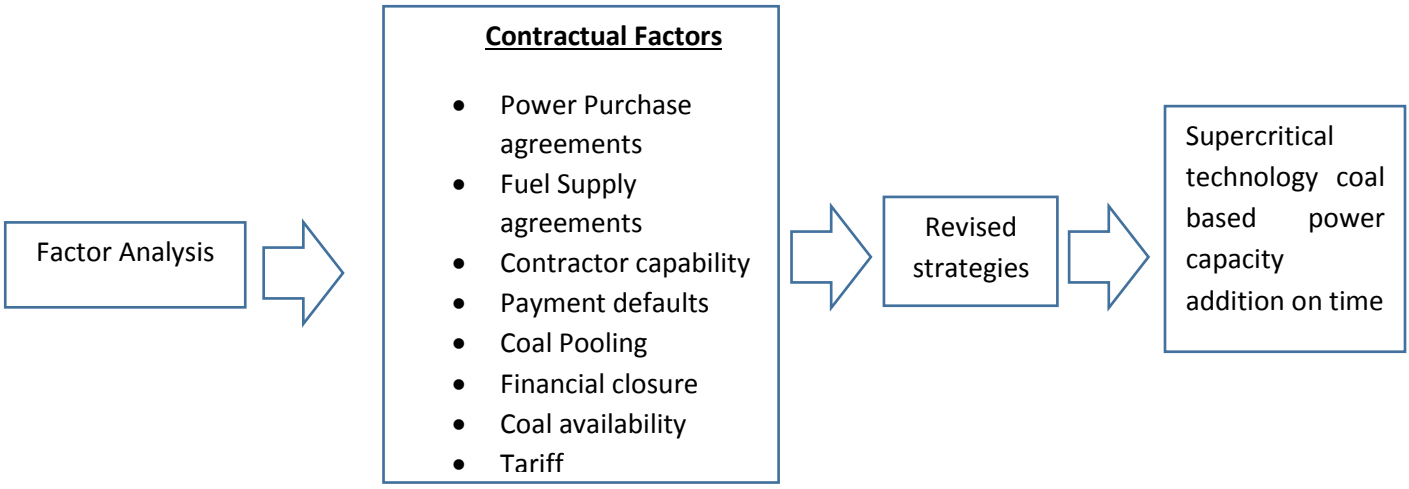

Figure 1

Recommendations:

It is clear that Supercritical power generation capacity addition can bridge the shortfall of electricity at a shorter span of time meeting emission guidelines. This study has found that "contractual factors" affect supercritical technology coal based power capacity addition in India significantly The measures to be taken to facilitate supercritical technology coal based power capacity addition in India are summarized below.

Indian Coal:

Domestic coal supplies to the power sector is increased by 10.7% in 2015 compared to a CAGR of 4.1% between 2009-2014, driven by speedier environmental clearances and land acquisition, leading to higher coal production. The government is also taking critical steps such as expediting the construction of three critical railway lines in

The recommendations of this study include the following:

Jahrkahnd, Chhattishgarh and Odisha. The reality is that the supplied Indian coal amounts to 451million ton against the requirement of 713million ton in 2015. Still the shortage of coal is significant. New technology options in mining, Continued and concerted efforts are necessary to address fuel availability issues. Rake availability also needs to improve in line with increasing production.

Imported coal:

The weak Indian rupee has neutralized the gains of reduced imports coal prices. The levelised tariffs approved under competitive bidding with imported coal are less than the required tariff of Rs.3.1 per unit. Quick resolution to the pending compensatory tariff suggested by the Appellate Tribunal of Electricity needs to be implemented. In addition suitable measures need to be taken to compensate the under recovery of fixed charge as well as to make the project more viable with imported coal.

Power Purchase agreements:

Discoms continue to be the weakest link in the power value chain due to their bad financial health.This risk has historically manifested through delayed payments to the generating companies.In the recent past it has also started to manifest in the form of lower energy demand and therefore a reluctance to commit long term power purchase agreements.This is a new risk to the generating company and it has to face the price volatility of short term merchant market which in turn forces the generating companies to run on lower plant load factors leading to losses. Also this nullifies one of the objectives of Flexible restructuring packages offered to the Discoms viz.Progressive reduction of short term power purchases. Hence, structural reforms are required now to improve the financial health of the distribution sector in India.

Dispute resolution:

The implementation of many of the coal based supercritical projects is delayed in India due to disputes and resulting in stoppage of work midway. It is better to devise a stage based dispute resolution process that encourages internal discussions and meetings aimed at resolving the dispute prior to commencing action (either litigation or arbitration).The contractor must be obliged to continue to execute the works pending resolution of the dispute. Dispute resolution mechanism to be modified to ensure that the litigation or arbitration to be

permitted after the commercial operation of the power plant. It is advisable to consolidate any other dispute which arises out of or in relation to the construction of the power plant. The power to consolidate to be with the Developer. This will help in minimizing the duration of dispute resolution.

Ultra Mega Power Projects (UMPP):

The recent tenders for Ultra Mega Power projects at Odisha and Tamil Nadu were faced with little participation due to lack of clarity on ownership.Modification of standard bidding documents taking into account this experience will facilitate aggressive bidding for Ultra Mega Power projects which are of 4000MW capacity in a single location.

Land:

The government has taken many positive steps towards land acquisition for power projects, including "The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Amendment) Bill, 2015". This is likely to reduce the incidence of disputes or litigation, but it is likely to increase the cost of acquisition. There is a need to relax the land transfer regulations for government owned lands to facilitate addition of supercritical coal based power capacity addition in India.

Clearances:

Speedy implementation of policy and regulation reforms is required at all stages from pre tendering, execution and financing. There is a need to define the performance standards of nodal agencies, create a transparent and accurate tracking mechanism as well as performance linked incentives and penalties.

Transmission network:

The transmission network is not adequate and strengthening the capacity of Power Grid Corporation Ltd by providing more investments in Power transmission, heavy load lines are likely to improve the transmission situation.

Conclusion

By the slew of measures taken by Government, Indian coal based supercritical power generation capacity addition is in the

right direction, but a lot more needs to be done to ensure that the actual capacity addition is as per the plan. There is a need for the Government to take additional steps to stimulate funding in the short term to ensure the planned investment goals in Indian power sector. With the coal supplies, improving now, the Government can look at extending loan tenures under of the current 5/25 scheme.

Further research may be carried out on the "contractual factors" post implementation of new strategies to find out their impact on the addition of supercritical technology coal based power capacity addition in India.

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Enterprise Wide Risk Management – A tool to maximize shareholder wealth

Dr. Ashish Tripathi*, Dr. Anil Kumar**

**Sr. Associate Professor, CoMES, University of Petroleum and Energy Studies*

***Professor, CoMES, University of Petroleum and Energy Studies*

Abstract

As outlined in the Finance literature the central goal of a finance manager is the maximization of the shareholder's wealth. This paper investigates the bearing which the various firm characteristics have on the impact of the introduction of ERM in the firm on the share price. It surmises that a firm which had a volatile past in terms of the fluctuations in its EPS can have significantly positive stock price reactions to the announcement of the introduction of ERM. In addition firms which have huge stockpiles of cash thus exacerbating the likely agency issues can benefit from ERM implementation. On the contrary there is the view that a firm should not spend precious resources on the costly execution of the ERM as the stockholders can mitigate the risks through the cheap mechanism of diversification of his investments in the stock market. However, in the end it can be concluded that the larger the issues like agency problems and market distortions the greater are the potential benefits (in terms of positive stock price reactions) that can accrue to a particular firm by taking the initiative of introducing the ERM framework.

Keywords

Risk, Diversification, Enterprise Wide Risk Management, Agency Problems

Introduction

ERM as defined in the management literature attempts to identify all the risks faced at the level of the firm to ensure that they are aligned with the risk tolerance levels. The levels of risk tolerance are decided in relation to the risk appetite which in turn follows from the strategic inclinations of the firm. In the traditional risk management process each individual

risk is identified and managed separately and independent of each other. In contrast, the ERM is a top down approach which is holistic in nature and also looks at the correlations between the risk factors of different departments. It is deemed by many that the adoption of the ERM results in direct benefits in terms of the better corporate governance which in turn should translate into increased shareholder wealth.

However there is the alternative view which takes the cost of implementation of the comprehensive ERM as a burden on the company finances, resulting in the destruction of shareholder value. It states that instead of the company trying to manage the risks through the elaborate ERM framework the owner shareholder can better manage the unsystematic/company-specific risk in a more cost effective way by diversifying his investments in the stock market (Sydow, Lindkvist and Defillippi, 2004). This view is actually derived from the modern portfolio theory. Since the investors are able to diversify in the market the implementation of ERM is a superfluous burden resulting it into becoming a negative NPV project. However, the assumption in this argument is that the markets function in a perfect manner and there are no frictions like transaction costs etc. No matter which view one takes, it is quite obvious that the ERM process would certainly have an impact on the shareholder wealth as reflected in the share price.

It can further be argued that, the ERM implementation results in a sustainable competitive advantage through improvement in the corporate governance of the firm. However, there are firm specific characteristics also which impact on the actual outcome of the ERM process. It is thus not possible to make a sweeping generalization about the desirability of the ERM for all the various kinds of companies. Depending on a firm's unique characteristics different forms and structures of the ERM framework can be implemented to derive maximum benefits from the ERM process (Bartov, 1993). It can thus be plausibly surmised that a firm which has a higher risk of loss or financial distress would benefit more from the implementation of the risk management initiatives as envisaged within the purview of ERM. A firm which has very volatile future earnings or high degree of leverage with small cash reserves to fall back upon can potentially benefit a lot from the ERM.

With the ERM implementation the risks in the future volatile earnings can be optimized so as capitalize on the earnings opportunities effectively while containing the risks within acceptable limits. Then there are certain firms which have significant uncertainties going forward into the future. There are uncertain earnings in the future and the as yet unrealized benefits of significant R&D investments. The current value however is linked to these unrealized benefits. Certain firms have plans for huge financial investments in the future in various growth options which might all unravel unfavorably in case of financial distress. This might result in a steep decline in the firm value. In case the final denouement results in firm liquidation it might cause asset disposal at a substantial discount to their fair values. In case of financial distress the firms in question would find it extremely difficult to raise cash through the financial markets to tide over the difficult conditions. In case the earnings have been widely fluctuating in the past the market deems the ERM implementation as a positive and reacts positively to the announcements of the appointment of risk officers (Olsson, 2008). Moreover, the larger the firm size, the more complex its operations and greater the exposure to the risk elements, the ERM implementation might result in tangible positive benefits. Since, ERM has an impact on the risk profile of the firm it can be reasonably concluded that the ERM implementation should impact the beta of the firm. If the cost exposure to the shareholders due to the unsystematic risks is huge, it does make economic sense to go for ERM execution.

Emergence of ERM

There is increased legislative pressure on the firms to improve their corporate governance mechanisms through explicit consideration and discussion of the identification, quantification and management of the major risks being undertaken as part of the ERM process. To buffet the norms of transparency and accountability it is being expected of the firms that they fully disclose material changes in their operational or financial conditions which might impact shareholder value. In order to be able to satisfy the above disclosure requirements satisfactorily, the firm is required to have in place a robust information retrieval and analysis mechanism. Bartov (1993) stipulates that the Basel II requirement of capital (which is applicable to the financial firms) brings into the ambit of ERM, risks arising out of business operations in addition to those that

are related to the credit portfolios and the market investments. Thus the financial firms in the West are actively engaging themselves in the ERM process so as to implement risk management initiatives across all the levels and verticals in the organizations. The rating agencies like S&P are evaluating the ERM initiatives of the financial institutions and in the process focusing on the methods being adopted by managers to optimally manage the risks being faced by their firms. In fact, they have made public announcements regarding their focus on the ERM implementation in the rating of the finance firms.

The hierarchical structure to be created in order to carry out the risk management in accordance with the ERM is a primary challenge for the firms. In order for the ERM to be successful this structure should be carefully crafted according to the needs of the firm in question. It is crucial to identify all the various types of risks that the firm might be exposed to. All the departments and the risks they are faced with have to be analyzed and investigated. Another crucial factor determining the success of the ERM is the involvement of and the ownership by all the employees of the organization. According to Olsson (2008) everyone should understand and appreciate the contribution of the ERM in creating value in the firm for all the stakeholders of the firm. In addition, the active involvement of the top management and its open declaration of support also go a long way in the successful implementation of the ERM in an organization. This is because of the wide scope of the ERM impacting everyone in the firm and requiring the full hearted support and involvement of every employee. They will align themselves closely with the process once they see the backing of the top management. An organization comprised of many diverse business units with different cultures with respect to risk appetite will come up with incongruous and markedly different risk management attitudes unless there is a unifying influence of the top management (Tufano, 1996). This unifying impact can bring about a consistency across the organization in the implementation of the ERM initiatives. It is very critical that the top management communicate effectively across the organization the urgency and the procedure for carrying out the risk management activities.

ERM and firm valuation

One way to demonstrate the top management commitment is through the appointment of a high level official in the capacity of the Chief Risk Officer. Thus, the appointment can be employed as a signal by the huge firms to communicate their seriousness about the entire risk management to the outside stakeholders. It is crucial for the risk management function to be viewed as strong and independent of the influences of the vested interests. Only if it is perceived such can the creation of the ERM authority structure result in shareholder wealth maximization. It can be plausibly hypothesized that the involvement of the senior executives in the ERM process leads to a wider acceptability of the same across the organization. A factor which can possibly affect the readiness of a firm to appoint Chief Risk Officer is the amount of leverage it carries on your books. The larger the leverage the more the riskiness of the firm, thus incentivizing the firm to try and create structures which would enable better risk management.

An information asymmetry can safely be assumed to exist between the owner shareholders and the managers regarding the risk to which the firm is exposed. Thus the managers are more aware of the risk profile of the firm. In their attempt to overcome this dilemma of the asymmetric information the firms execute the ERM framework. Thus, the creation of an ERM hierarchy should be positively viewed by the stock market (Bartov, 1993). It can be safely concluded that the announcement regarding ERM should definitely have a substantial valuation impact. However, this assumption of the ERM being a value creation activity runs counter to the logic behind the Markowitz's diversification logic. According to the modern portfolio theory as enunciated by Harry Markowitz in his seminal work, it is possible for the shareholders to eliminate the unsystematic risk inherent in a firm's stock by indulging even in naïve diversification which is essentially costless. Implicit in this argument is the fact that any money and time spent by the managers in managing firm specific risk is actually a waste and should result in destruction of firm value. Thus such an attempt at risk management should elicit a negative stock price reaction. Still there is doubt regarding the factors that prompt an organization to go for ERM and the appointment of a high level chief risk officer for overseeing of the risk management function.

It has been found that the firms with larger amount of financial leverage are more risky and as a result should benefit from proactive risk management initiatives. Thus for such firms the appointment of a CRO can be hypothesized to yield a positive stock market movement around the day of such an announcement. The assumptions under which the Markowitz assertion holds substance are the existence of perfect capital markets and no information asymmetry. In the case of the absence of the Markowitz assumptions the ERM activities might turn out to be value enhancing for the firm in question. The adoption of the ERM on a scale as witnessed in the real world is testimony to the creation of value by the appointment of a chief risk officer and the formation of an elaborate risk management authority framework. It can be anticipated that in the presence of the markets imperfections and agency costs, ERM can be value creating by mitigating the value destruction as a result of the above two factors.

Additionally the value of risk mitigation through ERM would be more pronounced in the case of firms which have a higher probability of lower tail events which can result in significant losses and firm distress. For such firms exposed to the risk of lower tail events with a significant chance the ERM project can be deemed to be a positive NPV one with substantial benefits to the shareholders. Aabo, Fraser and Simkins (2005) say that on the contrary a firm which is not susceptible to such risks can he deemed to consider such efforts at risk management as irrelevant from the point of shareholder value creation. The possibility of impending bankruptcy or possible liquidation raises the specter of lots of costs involving direct cash outlays like lawyers and courts fees etc. In the presence of such a possibility the firm might be constrained by not being able to pursue certain strategically crucial projects and also be impaired fatally due to loss of consumer confidence in the firm's viability. These costs justify management of risks in a proactive manner. There can be a downgrading in the firm's debt rating resulting in a higher cost of borrowing to the firm.

The impact of the possible bankruptcy, due to a lower tail event, on the other stakeholders ultimately finds its way in terms of a lower share valuation. As an example the internal stakeholders of high risk firms like employees and managers are exposed to a high degree of risk and demand

a higher compensation for the same. This results in larger cash outflows from the firm, thus impacting the shareholder valuations. Similarly, the suppliers might ask for a greater share of the pie to make up for increased uncertainty in receiving payments from the firm under distress. They would also be less forthcoming in entering long term contracts with the firm because of the higher ex ante risk of the firm. The greater the probability of the lower tail events the larger is the risk to the firm. This results in the derivation of value from the institution of the ERM process.

With the announcement of the appointment of the Chief Risk Officer (for the first time) the market can rationally conclude that some amount of resources, time and effort will be expended in managing the risk in the future (Tufano, 1996). These efforts if implemented effectively can be expected to lower the possibility of the lower tail events and in the process enhance shareholder value. However, the crucial element in the above expectation is the relationship between the magnitudes of the benefits resulting from the ERM as compared to the size of the costs incurred in implementing the ERM. If the costs incurred are larger than the benefits derived, the firm's shareholders might still finish up being at the losing end even with the implementation of the ostensibly beneficial risk management. The very creation of the position of Chief Risk Officer implies to some extent that the firm in question has started taking the ERM process seriously to some extent.

Firm characteristics, ERM and firm valuation

There are certain firm-specific characteristics which have a bearing on the probability of the lower tail events (involving losses) from occurring. As enunciated in the modern finance theory some of these variables are like firm size, variability in the earnings, reserves of cash, debt equity ratio or leverage and growth avenues. An expanding firm with extensive growth options has a greater uncertainty regarding future profits (Basel, 2003). It also has a greater degree of information asymmetry between the insiders and the outsiders. Due to the information asymmetry, during financial difficulty, the growth opportunities are grossly undervalued leading to dearth in investment funds. This phenomenon is called underinvestment in financial literature. Such a firm facing underinvestment due to

information asymmetry (especially in the situation of financial distress) will face the specter of a much higher cost of capital from all the sources of finance. This leads to the expectation of a positive impact of ERM measures on valuation of such firms.

A firm which has huge intangible assets like goodwill and patents is likely to again face under valuation of such intangibles, more so in situations of financial distress. The greater R&D expenditure creates a larger bank of intangible assets leading to a more pronounced positive impact of risk containment measures (Tufano, 1996). An indicator of the amount of intangible assets is the ratio of the market value to book value ratio of the firm. The greater the value of this ratio, larger is the contribution of intangible assets to the firm value. Such firms which have the intangibles contributing a major chunk of the assets can be expected to benefit more from the ERM implementation measures.

In case a firm has custody of a large cash reserve (which can be quantified as cash reserves/total liabilities), it has more financial muscle in terms of liquidity to fight off financial distress. If such a company faces certain liquidity issues in a situation of financial difficulty there are more chances of it coming out of the crisis relatively unscathed (Aabo, Fraser and Simkins, 2005). If the risk management practices instituted by the firm are able to ensure availability of sufficient financial resources for all the positive NPV projects such practices would in turn enhance shareholder wealth. On the contrary, huge cash reserves can sometimes create agency conflict wherein the managers are not subjected to the discipline imposed by the external sources of funds like the capital markets. Thus they can, in such a situation, invest in certain negative NPV or value destroying projects. In a condition wherein a firm is running low on cash, it will find it very difficult to emerge from a financial crisis. Such a situation will be magnified manifold times in case the firm in question is highly geared up.

A company which has ex-ante high standard deviation of earnings or revenues naturally has a larger probability of lower tail events. Negative possibilities like earning shocks, not meeting the analyst forecasts and violating debt related covenants are more likely in such a case. In such firms the managers try to reduce risk by taking measures which would reduce the potential

variability in the earnings of the firms. The outcome of such an initiative would be an appreciation in the share price which the potential shareholders would be willing to shell out. The execution and implementation of ERM measures in such firms can be anticipated to have positive share price reactions.

Another related variable is the extent of debt or leverage being employed by the firm in question. Large amount of debt increases the possibility of financial distress as there is a heavy commitment to pay fixed interest and principal repayment charges. In case the environment (both internal as well as external) is not conducive, resulting in a dip in earnings, the firm might go into financial distress. This has the negative consequence of the rating downgrades by the major rating firms in the economy. As a result the borrowing costs rise substantially for the firm. An additional pertinent point is that the rating firms give due consideration to the fact that the client firm has implemented ERM related measures or not (Basel, 2003). Thus, a secure firm achieves a better rating and as a result has reduced borrowing costs. The corollary that can be inferred from the above line of argument is that highly levered firms stand to gain much more through ERM implementation in terms of increased firm value.

In terms of size it seems quite natural that larger firms have the necessary financial strength to go through with the effective implementation of ERM measures (as it requires heavy investment in terms of training, personnel, software and hardware). However, the smaller firms can execute the ERM measures only at a very rudimentary level in a non-formal manner. The cost-benefit ratio enjoyed by the bigger firms (in the ERM implementation) would be much better than the smaller firms due to the economies of scale. Thus, the announcement of ERM measures can be hypothesized to have positive impacts on the share price of large firms.

ERM measures are ostensibly aimed at reducing the risk of the firm. They try to quantify all the risks that the firm as a whole might face and then tries to manage the same. In case the impact of the ERM measures is on both the idiosyncratic and the systematic risks, they can have a positive impact on the share price which in turn is a function of the systematic risk and not the unsystematic one. In other words it can be anticipated that the introduction of ERM

measures by the firms would cause reduction in the firm's beta and as the result the cost of capital (Stulz, 1996). The proper investigation of the impact of adoption of ERM measures on share price would entail fixing the first day on which the ERM adoption was announced. Such an analysis cannot be carried out on the days when certain changes to the already initiated ERM measures were announced. There is a greater chance of the implementation of ERM measures in the heavily regulated industries as there is an urgent demand from the regulator side for the same.

Conclusion

There is miniscule research on the positives and negatives of the ERM initiatives in the context of the Indian industry. As a consequence, although many organizations are adopting them, there are still many who have been hesitant in going ahead with the ERM initiatives. Research in the US has amply demonstrated that the ERM adoption might not result in a positive abnormal and significant stock price reaction across a wide swathe of firms in many different industries. However, it cannot be certainly claimed that there is absolutely no reaction in the stock price to the adoption of ERM measures. In situations where the ERM adoption can help in tackling the agency issues and the distortions in the markets the stock prices react significantly positively.

It is also significantly evident that in large firms where there is no exorbitant stockpile of cash the introduction of the ERM is viewed by the stock market positively. Firms in which the past had witnessed hugely volatile EPS also stand to benefit from the introduction of ERM (Smith and Stulz, 1985). The market rationally assesses the situations in which the ERM can reduce the costly lower tail outcomes and reacts accordingly. One potential problem which arises in the studies on ERM is the difficulty in assessing the extent of adoption of the ERM across different firms, although it is possible to exactly note the date on which it is announced. ERM might start delivering results over the long term in terms of better assessments of projects to invest in, etc. Event studies related to the announcement date are incapable of assessing such long term desirability of ERM. ERM might also contribute by delivering value to the stakeholders other than the stock market investors.

Adoption of ERM by organizations can ostensibly impact the amount of disclosures

related to the risks (to the various stakeholders) that the firms make in their annual statements. Managers have two opposing sets of incentives as far as ERM is considered. They would like to adopt ERM as the risks faced by the firm impact them directly. However they would benefit from increased risk and volatility in case their compensation is tied to share price. This is because equity behaves like a call option on the firm value. It is quite evident in the literature that option values are positively impacted by increased standard deviation/volatility of the underlying asset.

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Evaluating the indicators of sustainable ports development using AHP

Vikas S. Sengar*, Chandra Prakash Garg**, Dr. T. Bangar Raju***, Dr. N. Nath Dalei****

**Doctoral Research Fellow, CoMES, University of Petroleum and Energy Studies*
***Assistant Professor, CoMES, University of Petroleum and Energy Studies*
****Professor, CoMES, University of Petroleum and Energy Studies*
*****Assistant Professor (SS), CoMES, University of Petroleum and Energy Studies*

Abstract

From historic era till modern days, sea ports have been acting as commercial infrastructure for international trade and adding value to a nation. But escalation in port activities on land and increased vessel traffic has resulted negative impact on environment and ecology. Similarly creating social value is also gaining attention in port industry like others. Thus ports are forced to think beyond their traditional business ideology of growing in economic dimension only. Rather they are required to grow economically in balance with social progress and remain environmental friendly. This provides a scope to identify a sustainable framework and factors associated to it, with respect to a port. The presented study is attempt in the same direction and considers 14 factors to identify a sustainable framework for Indian sea ports. The study uses AHP analysis and identifies that for a port environment dimension should be prioritize over social and economic dimension to attain sustainability. Similarly economic dimension should be considered after social dimension while developing a sustainable framework. Additionally, the study also concludes that out of 14 sub factors used for study, "functional environmental management system" is most considered and "Port Infrastructure Development Scheme/fund" is least considered sub factor.

Key Words

Sea ports, Sustainable Port framework, Sustainable factors, Analytic hierarchy process.

Introduction

Today, Sea Ports are one of major economic driver in counties across the nation. They act as a key node maritime transport industry

and play a significant role in integrating transport chains (Cullinane, 2002; UNCTAD, 1996). Globally they account for 70% by value and 90% by volume in terms of international trade. In past Semi centennial, ports have acquired more importance as sea transportation has increased with globalization. Additionally, high volumes of cargo add to their importance as national trade gateways. As a business they add direct economic value to a nation but their business character helps in creating value synergies, thus they establish indirect relations with society. Since the demand (shipping companies, shippers) and supply (terminal handling operators) ends of ports have increased, societal pressures have identified their role in a port business model. Government regulations are further pushing ports to create fewer disturbances in environmental and social dimensions as well. Such a motivation realizes the importance of a strategic framework which includes environmental and social consideration with economic aspect of a port. Concurrently, sea ports need to tackle enhanced competition and pressure to increase services, modernize development, and enhance economic efficiency (AAPA, 1998; GreenPort, 2009a). In order to balance these competing needs, it has become imperative for port authorities to manage port operations in a sustainable manner. Identifying and absorbing a strategic sustainable framework can help a sea port to create a value under governmental objectives of environmental protection and social development.

The concept of port sustainability can be understood with the help of three major dimensions (the concept of triple bottom line): 1) An environmental dimension where port should put consideration on environment and ecological issues such as air quality, dredging operation and disposal of silt, noise pollution etc. with it performance and management. 2) A social dimension under which a port should look for stakeholder and community benefits. Other aspects under the dimension are the subjects of social benefits due to port activities such as direct and indirect employment, contribution to development of surrounding area etc.3) The third is an economic dimension which covers aspects of survival of port as an business. Examples under this dimension include efficiency of the use of the port area, Return on investment (ROI) etc. (UNCTAD, 2009). Thus the concept of sustainability in a port necessitates the simultaneous pursuit of

economic prosperity, environmental quality and social responsibility (ESPO, 2012; Cheon and Deakin, 2010)

Literature review

To strengthen the conceptual understanding of a sustainable port, authors first make attempt to identify and map different definitions of sustainable port and aspects of it. In the same context, as per Denktas-Sakar and Karatas-Cetin (2012) sustainable port operations refer to the 'business strategies and activities that meet the current and future needs of the port and its stakeholders while protecting and sustaining human and natural resources'. Considering the present study, authors identified more suitable definition of sustainable port being provided by Dekker's (2008) which is 'a port with an optimal balance between performance of business economics, utilizing the available capacity, limited use of space, minimal negative influence on the environment and a relation between port and hinterland' (Dekker, 2008 in Broesterhuizen et al. 2014).

To evaluate sustainability, John Elkington, during the mid-1990s tried to measure sustainability by comprising a new framework to outline performance in corporates of America.**1** The discovered framework was identified and named as the triple bottom line (TBL). Triple Bottom Line methodology surpassed the traditional accountancy of profits, ROI (return on investment) and market capitalization and included concerned environmental and social dimensions. This accounting system not only influenced the ideology of corporates but also provided new direction to research in the same context. The same methodology has influenced authors to either being concerned to one of the dimension of triple bottom line or the concept as combined. The same influence can be identified in existing literature review of factors associated with port sustainability. Comparing to other two dimensions a lot literature work in sea port sustainability has focused on environmental or ecological dimension. A group of authors have tried identifying environmental issues (Bateman, 1996, Berechman and Tseng, 2012, Dinwoodie et al., 2012 and Liao et al., 2010) and another group has considered environmental impacts (Darbra et al., 2004a and Darbra et al., 2004b, 2005; Gupta et al., 2005 and Wooldridge et al., 1999). In a segment of literature authors have also put weight on green ports and (Haezendonck et al., 2006 and Denktas-Sakar and Karatas-

Cetin, 2012) and management and operations of green ports (Acciaro et al., 2014).

Sustainability management in port has also been researched by a segment of authors. In the same context, environmental aspect of sustainability has been considered (Gouliemos, 2000; Peris-Mora et al., 2005, Le et al., 2014 and Villalba and Gemechu, 2011). Very few authors have considered both economic and environmental impacts simultaneously (Asgari et al., 2015). Additionally Yap and Lam (2013) considered all three dimensions in understanding relationship between the port's spatial expansion development and sustainability.

To identify factors and develop sustainability framework, authors have tried to identify factors associated with environmental, social and economic sustainability. (Darbra, Ronza, Stojanovic, Wooldridge, & Casal, 2005)(Puig, Wooldridge, & Darbra, 2014)(Acciaro et al., 2014) (Adisasmita, Harianto, Pallu, & Pallu, 2014)(Asgari, Hassani, Jones, & Nguye, 2015) (Roh, Thai, & Wong, 2016), (Schulte, Gonzalez-Ramirez, Ascencio, & Voss, 2016). The authors in the current study have tried to gather different factors in environmental and social dimensions from existing literature review and have considered a new set of economic factors for a sustainable sea port. Such a framework can contribute in existing literature for factors affecting port sustainability.

Table 1: Factors for Sustainable framework and supporting literature

Dimension	Factors	Notation	Authors
Environmental (ENV)	Functional Environmental Management System For Ports	ENV1	Asgari et al.(2015), Ginsberg and Bloom(2004), Gotschol et al.(2014), Kalafatis et al.(1999), Kirchoff and Koch(2011), Lai et al.(2011), Lamberti and Lettieri(2009), Lampe and Gazadat(1995), Rao(2002), Rao and Holt(2005), Saengsupavanich et al.(2009), Shang et al.(2010), Sharfman and Fernando(2008), Videras and Alberini(2000
	Education and Training Support regarding Port environment	ENV2	
	Management Support for Environmental friendly initiatives	ENV3	
	Clean Environment Performance Indicators for port operations	ENV4	
	Green Initiatives and Eco Services to Attract shipping lines	ENV5	
	Corporate Social Activities by Port	SOC1	Florida (1996)

Social	Port's Initiative for improving employees' working conditions and safety	SOC2	Gimenez et al. (2012) Marshall et al. (2005) Pullman et al. (2009)
	Employee welfare Schemes by Port	SOC3	
	Support for employees' training and education	SOC4	
Economic	Port's Capacity Utilization	ECO1	Expert panel analysis
	Advanced Technological and Financial Capability of Port	ECO2	
	Profitability (EBITDA/Assets) of port	ECO3	
	Port Infrastructure Development Scheme/fund	ECO4	
	Economic Incentive for attracting Business	ECO5	

Research Methodology

The motive behind the selection of this methodology is the identification, evaluation and prioritization of identified factors of sustainability of ports. The decision makers include experts (Domain specialist, consultants, ministry head, and senior executive) from the country. In this research, 14 factors (qualitative and quantitative) were recognized through literature and experts discussions (See Table1). This study utilizes Analytical Hierarchical Process to rank and evaluate the identified specific critical factors of sustainability in Indian Ports as shown in figure 1.

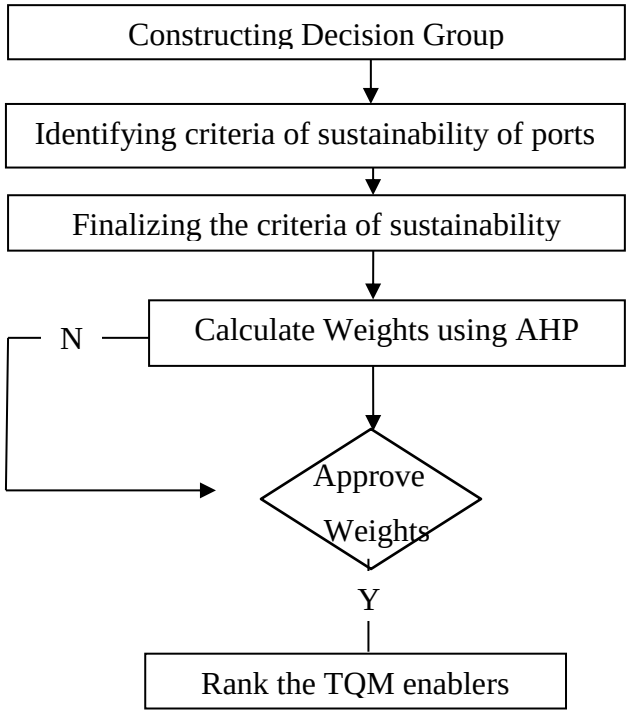

Figure 1. Flow chart for AHP analysis

AHP: Step-wise procedure

The AHP approach is based on three basic principles: firstly, building a hierarchical structure; secondly, judging comparatively activities or variables; and thirdly, synthesizing the priorities (Prakash & Barua, 2016a; Prakash and Barua, 2015). The use of AHP methodology has been reported in several decision making situations in wide-ranging fields such as sustainability in SC, Pharmaceutical, Airport & Airline Management (Garg, 2016; Vishwakarma et al., 2016; Luthra et al., 2017).

The AHP methodology follows these steps (Saaty, 1980; Prakash & Barua, 2016b):

Step 1: Defining the research problem. The research problem is to evaluate the sustainability criteria of ports. Thus, evaluation criteria of sustainability in the ports are identified and a hierarchy prioritization model is structured.

Step 2: Constructing a questionnaire to collect the data. In this step, industrial experts are asked to make pair-wise comparisons between sustainability dimensions of the ports and criteria under each dimension using a nine-point scale given by Saaty (2000).

Table 2: Relative importance scale used for the pairwise the comparison

Importance Intensity	Linguistic Variables
1	Equally Important
3	Moderately Important
5	Strongly Important
7	Very Strongly Important
9	Extremely Important
2,4,6,8	Intermediate Values
Reciprocals	Reciprocals for inverse comparison

Source: Satty (2000)

Step 3: Determining of normalized weights for sustainability dimensions of the ports. Based upon normalized weights, ranking for dimensions and criteria have been made.

Step 4: Evaluating the consistency of achieved solution. The consistency ratio (CR) is calculated to ensure the consistency of pair-wise comparisons. It was calculated using mathematical expressions given as CR = CI/RI (Garg, 2016; Luthra et al., 2017). The CR value is used to assess the consistency and reliability of the decision making group.

Where CI is Consistency Index and RI is random index, which is shown in below table.

Table 3: Random Index

N	1	2	3	4	5	6	7	8
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41

As a thumb rule, value of the CR ≤ 0.10, is acceptable, otherwise values need to be revised to get the consistent matrix.

Results and discussions

Table 4: Pairwise comparison matrix

Criteria	ENV	SOC	ECO	Weights	Ranking
ENV	1.0000	3.0000	7.0000	0.643389	1
SOC	0.3333	1.0000	5.0000	0.282839	2
ECO	0.1428	0.2000	1.0000	0.073772	3

Table 5: Obtained value from AHP

Highest eigen value (λ_{max})	3.0655
Consistency Index (CI)	0.0327
Random Index (RI)	0.58
Consistency Ratio (CR)	0.0564

Table 6: Pairwise comparison matrix w.r.t. ENV

Criteria	ENV1	ENV2	ENV3	ENV4	ENV5	Weights	Ranking
ENV1	1.0000	3.0000	3.0000	3.0000	5.0000	0.432398	1
ENV2	0.3333	1.0000	0.2000	3.0000	0.3333	0.128344	3
ENV3	0.1429	3.0000	1.0000	3.0000	3.0000	0.221859	2
ENV4	0.1111	0.3333	0.3333	1.0000	3.0000	0.100587	5
ENV5	0.2000	3.0000	0.3333	0.3333	1.0000	0.116811	4

Table 7: Pairwise comparison matrix w.r.t. SOC

Criteria	SOC1	SOC2	SOC3	SOC4	Weights	Ranking
SOC1	1.0000	5.0000	5.0000	9.0000	0.615444	1
SOC2	0.2000	1.0000	0.2000	3.0000	0.106557	3
SOC3	0.1429	3.0000	1.0000	7.0000	0.231835	2
SOC4	0.1111	0.3333	0.1429	1.0000	0.046164	4

Table 8: Pairwise comparison matrix w.r.t. ECO

Criteria	ECO1	ECO2	ECO3	ECO4	ECO5	Weights	Ranking
ECO1	1.0000	0.3300	3.0000	3.0000	0.3333	0.205505	3
ECO2	3.0000	1.0000	0.2000	3.0000	0.3333	0.287493	2
ECO3	0.1429	3.0000	1.0000	3.0000	3.0000	0.149464	4
ECO4	0.1111	0.3333	0.3333	1.0000	3.0000	0.067764	5
ECO5	3.0000	3.0000	0.3333	0.3333	1.0000	0.289775	1

Table 9: Final ranking for specific factors

Factors category	Relative preference weights	Relative Rank	Specific factors	Relative preference weights	Relative ranking	Global preference weights	Global ranking
ENV	0.643389	1	ENV1	0.432398	1	0.278200	1
			ENV2	0.128344	3	0.082575	4
			ENV3	0.221859	2	0.142742	3
			ENV4	0.100587	5	0.064717	7
			ENV5	0.116811	4	0.075155	5
SOC	0.282839	2	SOC1	0.615444	1	0.174072	2
			SOC2	0.106557	3	0.030138	8
			SOC3	0.231835	2	0.065572	6
			SOC4	0.046164	4	0.013057	12
ECO	0.073772	3	ECO1	0.205505	3	0.015161	11
			ECO2	0.287493	2	0.021209	10
			ECO3	0.149464	4	0.011026	13
			ECO4	0.067764	5	0.004999	14
			ECO5	0.289775	1	0.021377	9

Conclusion

With the help of Table 2 and Table 9, it can be concluded that a sustainable port can be evaluated in dimensions of environment and economic and social. The study identifies the ranking of these dimensions as Environmental, Social and Economic. Table 9 also determines the global ranking for sub factors for port sustainability. These rankings are identified by multiplying sub factor's relative weights with its respective dimension's weight. On the basis of these rankings it is concluded that "Functional Environmental Management System for Ports" weights 0.278200 as ranks 1 as factor of port sustainability. Similarly "Port Infrastructure Development Scheme/fund" is ranked last as it gets least weight (0.004999) among all the factors. Top five factors in global ranking are identified as "Functional Environmental Management System for Ports", "Corporate Social Activities by Port", "Management Support for Environmental friendly initiatives" "Education and Training Support regarding Port environment" and "Green Initiatives

and Eco Services to attract shipping lines". The present study finds that Environmental (ENV) dimension is ranked one and thus for ports to ensure sustainability, environmental dimension stand as one of the most vital aspects in today's port business scenario. The statement is supported as four out of five sub factors in ENV dimensions stand in global top five ranking. Second important dimension is identified SCO as three of its four sub factors namely "Corporate Social Activities by Port", "Employee welfare Schemes by Port" and "Port's Initiative for improving employees' working conditions and safety" stand in top ten of global rankings. ECO dimension is considered for sustainability t as like other businesses, port's business existence is directly dependent on its economic activities. Under this dimension highest ranked sub factor is identified as "Economic Incentive for attracting Business". Other factors like "Port's Capacity Utilization", "Advanced Technological and Financial Capability of Port", "Profitability" and "Port Infrastructure Development Scheme/fund" were also considered as factors for port's sustainability. The study identifies ECO dimension as third in ranking as four of its sub factors were standing in last five when global rankings were considered.

The study suggests that above factors are helpful in realizing a strategic framework for sustainability to a port business. Additionally, this study supports the triple bottom line concept of sustainability when it comes to a port business and thus considers factors under its three dimensions for developing such a framework. As per ranking it is evident that a ports sustainability framework must comprises of a functional environmental management system. Today certifications like ISO14000, ECOPORT etc. are already available in market which ensures the internal environmental management of a port and such functionality should be part of sustainability framework. With this the port governance should be committed to support environmental friendly initiatives such as green certification for shipping lines, award for most environment friendly customer, green supply chain and many more. Moreover the management and port staff should participate in spreading awareness about port's ecology and protective measures. On social front corporate social responsibility must be part of a port's sustainability framework. It means a port's business strategies must reflect policies, practices and initiatives it commits to in order to govern them with honesty and

transparency and should be able to establish a positive impact on its stakeholders and environment. Port staff training and welfare schemes should also be part of the discussed framework. With all this, to ensure its business existence, a port's sustainable framework should be developed considering economic factors as well. In the same context to ensure sustainability the case should also focus on profitability and survival in competitive industry. Thus the framework in discussion should comprise of strategies to attract more shipping lines; such as long term contracts with shipping lines or economic incentives for frequent tramp shippers. One more example can be quoted from Cochin port where the port has notified to provide incentive up to 85% depending on quantity of cargo and size of vessel. Other factors in economic dimension which should be considered are efficient port capacity utilization and considering new technology and financial instruments to absorb the same in order to remain competitive in market. For sustainable development of a port, strategic framework should consider the factors which are discussed in the section and are supported in Table 9.

Limitation of study

With respect to port industry the present study is an attempts to identify a strategic sustainable framework and factors associated to it, the knowledge used is limited to Indian context as the members of the expert panel belong to the same geography. Further the study is restricted to consideration of only 14 factors and thus it provides scope to future researches to consider more factors and further strengthen the framework.

Acknowledgement

The authors are grateful to the expert committee for sharing their knowledge for proceeding of the study.

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Falling Oil Prices and Its Effect on Employment in Oil & Gas Industry in gcc with Special Reference to UAE

G. Ramakrishnan*, Dr. Nikhil Kulshrestha**, Dr. A. Lakshmana Rao***, Dr. Santhosh Koyadan****

** PhD Scholar in Oil and Gas Management, University of Petroleum and Energy Studies Dehradun – India*

*** Associate Professor, CoMES, University of Petroleum and Energy Studies Dehradun – India*

**** Assistant Professor, CoMES,, University of Petroleum and Energy Studies Dehradun – India*

***** Talent Management Analyst,Zakum Development Company (ZADCO),Abu Dhabi - U.A.E*

Abstract

Purpose: The aim of this paper is to analyze the effect of falling oil prices and its effect on employment in Oil and Gas Industry in GCC with special reference to UAE.

Design/methodology/approach*:* First, we show a short review of the classical literature and the predominant paradigms through review of the available literature that has led to their subsequent evolution. Afterwards, we analyze the recent articles on falling oil prices from 2014 onwards and the views of various authors on its effect on employment opportunities i Oil & Gas Industry. Based on the views of various authors and facts, a SWOT analysis is made from the view point of Oil and Gas Industry in UAE for managing the employment crisis.

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Findings / Recommendations*:* By thoroughly studying the SWTO analysis, the Paper concludes that oil industry is suffering due to falling oil prices. UAE as a country can take this opportunity to remove unwanted, non performing employees and right size their organizational structure. The Expatriates and TCNs of the oil industry can try and find some jobs in non oil sectors of UAE as these sectors are booming due to forthcoming Expo 2020.

Research limitations/implications*:* Owing to the nature of the paper, it is a study conducted to open a new debate in connection with the Employment opportunities of Expats and TCNs in EPC Oil Industry and restricted to GCC countries and UAE in particular.

Key words: Oil Prices, Oil Crisis, Falling Oil Price, Crude price

Paper Type: Conceptual Paper

Introduction

The GCC countries are dependent on oil economy. Last three decades they saw a huge growth in their economy. Due to economic slowdown in China, entry of Iran into global oil supply market, production of shale oil in US and various other factors, the oil prices started to fall from end of year 2014. The price fall from around $100 per barrel to less than $30 has made the GCC countries to reschedule their expenditure. UAE has diversified its economic activities in to various non oil sectors such as real estate, tourism, aviation, manufacturing etc. The Oil economy is contributing to only 30% of its economy at present. Even then, the price fall of crude oil has affected their economy. UAE is taking lot of measures to reduce the cost of oil production by increasing efficiency, reducing manpower (which has resulted in huge job cuts), postponing expenses which are relatively less important etc. This paper is aimed at analyzing the effect of falling oil prices on the Oil Industry of UAE, the subsequent job cuts and other factors impacting the employment in Oil Industry. The paper also tries to find some solutions to these problems by using a SWOT analysis.

Review of Existing Literature on Oil Prices

There are very few literatures available that have highlighted the effect of oil prices on employment. Based on the review conducted on the existing literature, the following points gained attention that see the rise of oil prices from various perspectives.

Prakash Loungani, (1986), discusses the amount of labor reallocation during every oil price shock and its positive relation with unemployment. The paper points out that Oil prices have caused unemployment both in pre and post OPEC periods.

S.P.A Brown and John K. Hill, (1987) tried to quantify the long term consequences of lower oil prices and the effect on employment in all the 50 states of US. The study found that ten states stand to lose employment as a result of the oil-price decline. They are AIaska, Colorado, Kansas, Louisiana, New Mexico, North Dakota, 0k1ahoma, Texas, West Virginia, and Wyoming. For a 95 drop in o.il prices, their combined loss is 216 thousand jobs, or about 1.6 percent of their total employment. For the other forty

states and the district of Columbia, lower oil prices mean expanding employment. The study concludes that the sharp decline in oi1 prices that occurred late in 1985 and early in 1986 will serve to redistribute employment throughout the United States.

Knut Anton Mork, (1989), observed that there is a strong correlation between the oil price and the gross national product growth in US. But the study says that the observed oil price changes have always been on the increasing side and they have not studied the same during oil price decline.

David Margaroni, (1999), has highlighted the impact of higher oil prices on all other commodities' prices in the UK. He also states that the burden of increase of oil prices is at last shifted to the consumers as all other down line industries do not want to compromise on their margins.

Donald W. Jones, Paul N. Leiby and Inja K. Paik, (2004) observe that both oil-price and monetary shocks cause larger responses in job destruction than job creation in almost every industrial sector. If we consider the magnitude of effect, the oil price shock is two times the other monitory shocks. They also find that the response of employment to oil price shocks is sharply asymmetric, the response to positive shocks being ten times larger than that to negative shocks.

The paper says that the effect of increase in oil prices on employment was negative in the short run but it was positive in the long run due to substituting the labor in other sectors.

Yash P. Mehra and Jon D. Petersen, (2005) are of the opinion that increase in oil price is likely to reduce demand for some goods. But at the same time, it may raise the demand for some other goods. For example, demand for inputs is likely to fall in sectors that use energy but likely to increase in sectors that produce energy. If companies feel that it is a costly affair to reallocate capital or workmen from sectors that are affected due to oil price rise to sectors that gain, then aggregate employment and output will decline in the short run.

In their research paper, Olivier J. Blanchard and Jordi Gali, (2007) argue that much of the decline in output and employment was due to the rise in interest rates, resulting from the Fed's endogenous response to the higher in°ation induced by the oil shocks. Angel Estrada & Pablo Hernández de Cos (2012), observes that employment has a

correlation with oil prices from the importing country's point of view. According to them, Potential employment is usually estimated by applying an equilibrium unemployment rate (or NAIRU) to the population participating in the labor market. The NAIRU is the variable that balances the labor market. Consequently, to test if the real oil price has an impact on the NAIRU, it is necessary to know if it shifts the labor demand and/or supply curves. In its simpler version, labor demand depends positively on the level of production to be reached and negatively on the real labor cost of hiring a worker.

Assuming that firms have some market power, there appears a new determinant of labor demand: the markup of prices over marginal costs (m). In particular, if markups widen, the optimal decision of the firm is to raise selling prices and reduce production to increase profits. In this context, if markups increase when real oil prices are higher, employment demand will be lower for every wage and, therefore, the NAIRU will tend to increase.

Review of Business Articles from 2014

Since the available literature are few in number and most of them are directed towards rising oil prices, a review study was conducted on various business articles. The review was started from 2014 when the oil prices started to fall. The review is conducted year wise to provide a view on happenings in oil industry in a chronological sequence.

Business Articles in 2014

Andrew Critchlow (Dec, 2014), estimates that around 150,000 British workers along with their dependants are living in UAE. Due to the fall in oil prices, they all fear losing their jobs. “Firm limits need to be placed on public sector jobs and wages, and it should be clearly communicated to people that they should not expect to obtain a public sector job,” said the IMF in a recent note.

He opines that experts fear that the boom enjoyed by Expatriates in the previous decade in the region could soon be over unless oil prices rebound to levels above $80 per barrel in the near future. He states that irrespective of the GCC states imposing tax on the expats, the living in the region will become hard for the expatriates and third country nationals.

A Gulf Business Report by Morgan McKinlay states that there is a drop of 3% in the employment in UAE during fourth

quarter (Q4) of 2015 where as it was 4% up during Q4 of 2014.

Business Articles in 2015

A Gulf news articles pointed out that the falling oil prices will have little effect on UAE and Saudi Arabia especially for their National Oil Companies namely ADNOC and Saudi ARAMCO respectively. The article said that the oil companies around the world will reduce their investment by 20% in the coming year but it will not affect UAE and Saudi Arabia from investing.

The Gulf news article is supported by another article in Khleej Times (14.01.2015). The article titled "Here's Why a slump in Oil prices will not impact UAE" The article quoted Suhail bin Mohamed Faraj Fares Al Mazrouei, the UAE Minister of Energy, saying that the oil prices will have no impact in UAE's vibrant economy.

Khaleej times (14.01.2015) noted that Slump in world oil prices will have no impact on the UAE' s vibrant economy as stated by Suhail bin Mohamed Faraj Fares Al Mazrouei, the UAE Minister of Energy of UAE. The minister said that the country will focus on booting oil and gas production through Energy management, efficiency and rationalization.

Nadine El Dada, on October 07, 2015 posted an article on Times Real Estate Co founder Khurram in which his views about the effects of low oil prices on real estate business of Dubai was asked. Khurram is of the opinion that the major investors of Dubai real estate business are Indians, Pakistanis and British nationals. As the oil prices got lower, the people from these importing nations got more disposable income which helped Dubai real estate business.

Justas Gedvilas (13.11.2015), in his article says that UAE has not pressed the panic button due to reduction in oil prices. Justas Says " To conclude, the United Arab Emirates has one of the strongest positions in terms of its ability to sustain several years of declining oil revenues in the region, where crude oil production is already defined by lower production costs compared to global competitors".

According to the Guardian (30.12.2015), the oil producing countries have started feeling the effect of low oil prices because they always plan their spending budget based on an assumed crude oil price.

Business Articles in 2016

An article by Mathew West in BBC dated 18, January 2016 analyzes how low the oil

prices can go ad who will be the worst hit. He opined that oil prices which were then at $30 per barrel may even touch around $20. The main reason was due to economic slowdown in China resulting in reduction in demand and at the same time US shale oil production going up increasing the supply. So it is basically enormous supply Vs less demand.

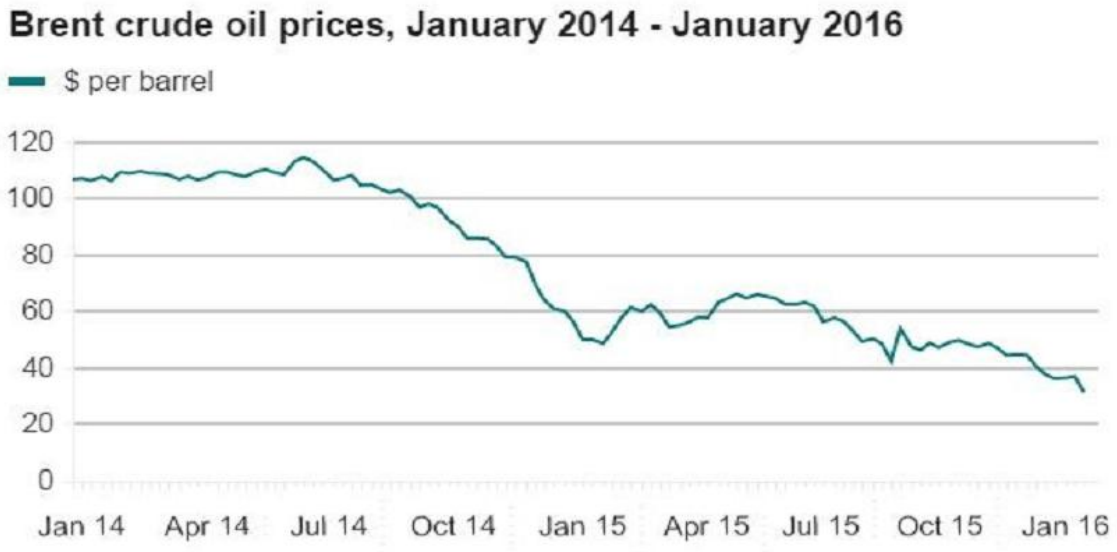

Fig 1:Source: Article by Mathew West in BBC dated 18, January 2016

An article titled "The Hidden Consequences of the Oil Crash", by Politico magazine dated January 21, 2016 states that Saudi Arabia has shed 200,000 jobs due to falling oil prices as they shut down thousands of rigs. In fact, similar conditions prevail in other GCC countries including the UAE since the fall of oil prices.

A MEED article said that ADNOC, the National Oil Company of UAE has planned to cut 5000 jobs by end of 2016.Times of India article (Daniel George, 22.Jan 2016) is titled "Indian expatriates hit hard as Gulf economies slip on free fall in crude prices". The article says that many Indian expatriates are sending their families back and others who were thinking of bringing their families have dropped the idea.

The free fall in crude prices have led to job cuts and resulted in companies not granting increments. There are no new projects while several projects have been cancelled across the region. The article cited Indian diplomats in Dubai, who said that a number of companies have either laid off staff or cut down on salaries in UAE.

The India Expatriates were in low morale as they were not able to meet their expenses due to increase in prices of all commodities including rent for their accommodation, children school fees etc.

The UAE and Saudi Economies were hit by lowering oil prices was confirmed by a PMI survey (Adam Bouyamourn 03.02.2016).

According to HSBC Global connection article dated 16th February 2016, key sectors of construction wholesale and retail posted weaker growth of activity in the UAE, although the travel and tourism firms saw a stronger expansion of business activity. The article states that sustained decline in oil prices has shaken the economy of the country.Adel Akbar Gafar (18.02.2016), in his article " Will the GCC be able to adjust to lower oil Prices?" describes how the GCC countries are planning to offset the revenue loss due to low oil prices. The article talks about introduction of VAT on citizens and residents from 2018 onwards, focus on non oil revenues and reduction on spending patterns. Higher oil prices enabled the GCC countries to spend handsomely on infrastructure, defense, education, public sector wages, and subsidies. If we consider a price forecast from 2016, the price of a barrel of oil has fallen more than 70 percent since June 2014. Meanwhile, the Organization of Petroleum Exporting Countries (OPEC) is forecasting that a $100 per barrel price for oil will not return until after 2040. The fall in oil prices wiped out $360 billion of GCC revenue in 2015 alone, forcing GCC capitals to reassess income sources and spending. This has made the GCC countries to rethink on employment especially in Oil industry and ultimately leading to huge job cuts.

Adel Akbar Gafar (18.02.2016) also talks about the efforts of Saudi and UAE Governments to reduce employing Expatriates and Third County Nationals by movements called Saudization and Emeratization respectively.Simeon Kerr (9th March, 2016) states that expenditure cuts and staff layoffs are increasing due to oil crises. Reports of large-scale job losses have spread in sectors from oil services to construction, both affected directly by low crude prices and the resultant slowdown in government spending. He says that the other sectors such as retail are also showing signs of stress where volumes have dropped by 30%. UAE officials have talked up Dubai’s diversified, service oriented economy, saying it can weather the oil downturn and rebound quickly. But Sultan al-Mansoori,

the economy minister, last month conceded that his target of 3 per cent annual growth would be "challenging" given depressed crude prices.

The Gulf Cooperation Council (GCC) Countries are mainly dependant on Oil Production for their Economy and they used this as a windfall during the past few years for their lavish spending. These countries have high foreign exchange reserves compared to other oil exporters such as Nigeria, Venezuela etc. (The Economist, 16.03.2016). It is of the Opinion that, now there is an era of lower prices and hence the rulers of these GCC countries have to change the structure of the economy to be sustainable in the area of lower prices. The receipts from sale of Oil account for more than 80% of their revenues.Since there is a huge reduction in their income, these Governments have resorted to various methods to handle the situation from drawing from their reserves, taking on debts and cutting down their expenditure.

The Economist (March 26, 2016) observes that Oman has told all State Owned Enterprises to remove the perks where as Qatari Companies such as Qatar Foundations have resorted to laying off their employees. The UAE cut the oil subsidies from year 2014 onwards.

Unfortunately for these GCC countries, they are in a war with Yemen which involves huge spending. All these countries are also in the process of improving their infrastructure such as Metro Rails, bridges, financial centers, malls etc for which they are spending huge amount in the form of materials, wages and salaries.

The Economist feels that the GCC countries have to concentrate on diversification in this period. The Gulf public sector have to stop becoming the main employer as the gulf citizens have got used to earn without doing much. These Governments are also thinking of taxing their expatriate employees.

UAE Accounts for 50% of OPEC's Oil reserves, Second largest Economy ($419 Billion) and third largest Oil producer (2.82 million barrels per day) in the GCC (Kalpesh, country focus, 2016). According the article, Abu Dhabi is having 95% of the oil wealth of the country and he balance 5% is spread among the other six emirates. This has forced them to diversify into other sectors for growth. Dubai, which is considered as the commercial capital of the country, has led this diversification activity

with investments in real estate, hospitality, transportation and infrastructure in order to aid balance economic development.

Dubai is concentrating on tourism to increase its revenue and as of now it is the 5th most visited city with 12 million visitors. In the years to came it may surpass Singapore and Paris.

But Suhail bin Mohammed Faraj Faris Al Mazrouei, Minister of Energy of the UAE says "The current slump in the world oil prices poses a real challenge to oil exporting countries but did not have any impact on the UAE' s economy, thanks to the economic diversification policy adopted by the country". He is of the opinion that low oil prices should create market opportunities in non-oil sectors for the purpose of diversifying the economy of the country (Emirates 24 x 7 dated 3rd April, 2016).

Criselda Diala-McBride (PM Magazine, 4.5.2016), in the article titled "Hiring in UAE hit by low oil prices and dwindling business confidence", states that there is a slowdown in the recruitment activity due to fall in oil prices and the number of permanent position on offer dropped by 9 percent. It also states that the number of available jobs dropped by 12% compared to previous year.

Hugo Erken, on his article dated May 30, 2016 has made a SWOT analysis from UAE point of view on the lowering oil prices. According to him Strong external position and attractive business climate are viewed as strength for UAE where as weak labour market and rigid political system is viewed as weakness. So it is evident that the labor market got a huge hit due to oil crash.

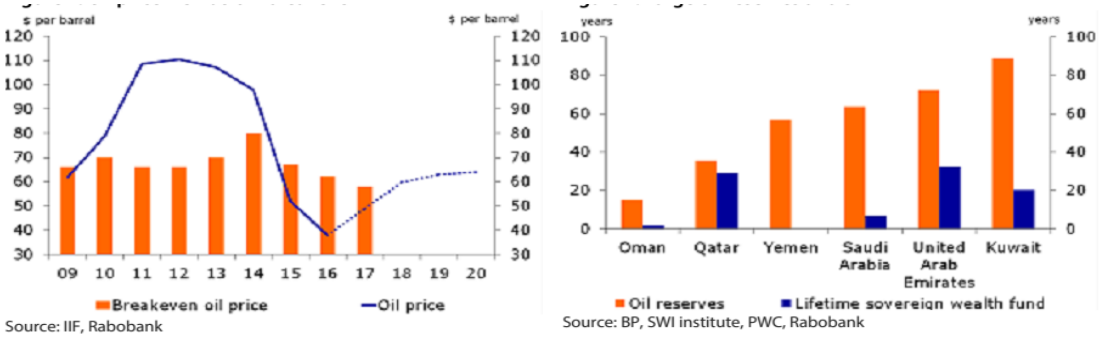

Fig 2:crude prices &years

The article has highlighted that the oil prices have fallen much lower than the breakeven level of their country operation.

Ravi Singh, CEO of Bluefin Consultancy , a Dubai -based management consul ting company, says the recruitment cycle in the UAE has stalled, and it is affecting various industries such as Oil & gas, Hospitality , tourism, retail , manufacturing, and construction. The downbeat trend is prevalent across the GCC region, and he expects this to remain the same in the next two years. The article goes on to say quoting Ravi Singh saying that there is a lot of insecurity in GCC due to oil crises. Many Organizations are not replacing the people because they are afraid on the future.

An article by world bank in 2016 observed that there is a huge slowdown in the growth of economy in UAE due to falling oil prices and due to this the Government is planning to slow down its mega projects in addition to introduction of VAT and Corporate tax on companies.

Slavka Atanasova in his article dated, 11th August, 2015, (arabianindustry.com) found that the job market in UAE took a toll due to fall in oil prices.

Grant Thornton, in their article titled "Oil Prices: the wider impact" describes the challenges faced by oil industry due to fall in oil prices. As a result of price reductions, not only the oil companies, but also their supply chain suffers a lot. According to them, even though oil companies suffer, the country as a whole may not suffer much as a result of diversification. The article state that Oil accounted for 90% of the country's economy during 1970 where as it is only 30-35% today. It means the country is becoming diversified in various sectors such as tourism, travel industry, real estate etc.

Discussion

By analyzing the above literature, we can find that the oil prices are not going back to $100 mark in the near future. Some of the authors say that the oil price may again reach $100 mark by year 2040. So, it is evident that the Oil Industry has to find some ways to tide over this situation. This can be achieved by finding ways and implementing the same on reducing the cost of production. The Oil countries also have to diversify in to non oil sectors to boost their economy. This in turn will help in retaining the manpower by redistributing the available human resources. This is one way of managing the employment crisis.

We find that salary rise in GCC is reducing every year as their oil income reduces. The following table shows that the reduction in GDP growth Salary rise in GCC including UAE.Studies also show that the number of jobs available in UAE is in the decreasing trend.

The following table shows that there is a clear correlation between the oil prices and employment

Salary Rise by Country
(Percentage rise in Base Salary)

Country	Saudi Arabia	Kuwait	Qatar	Oman	Bahrain	UAE
2014	7.5%	5.7%	6.5%	7.6%	5.9%	6.2%
2015	5.9%	5.4%	6.1%	6.1%	4.1%	5.6%
2016*	5.9%	4.6%	4.7%	4.4%	3.7%	5.3%

Economic Growth
(Percentage real GDP change)

Country	Saudi Arabia	Kuwait	Qatar	Oman	Bahrain	UAE
2014	3.6%	-1.6%	4.0%	2.9%	4.5%	4.6%
2015	3.3%	-1.3%	3.7%	3.0%	2.7%	3.3%
2016*	1.1%	1.2%	3.3%	1.6%	1.0%	2.1%

Fig 3:Source: Gulf Talent - Employment and Salary Trends in the Gulf - 2016

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Table 1: crude oil price and jobs

Period	**Crude Oil Price in US $**	**Source for Crude oil Prices**	**Number of jobs on offer in UAE**	**Source for Employment Monitor**
2nd Quarter 2014	108.59	https://www.quandl.com/data/OPEC/ORB-OPEC-Crude-Oil-Price?utm_medium=graph&utm_source=quandl	8057	http://www.emirates247.com/news/emirates/uae-employment-opportunities-up-by-21-2014-08-03-1.558237
3rd Quarter 2014	94.17		8002	http://gulfnews.com/business/sectors/markets/uae-s-job-market-slows-in-third-quarter-of-2015-1.1613756
4th Quarter 2014	52.00		8162	http://www.morganmckinley.ae/sites/morganmckinley.ae/files/article-attachments/UAE-Employment-Monitor-Q4-2014_Morgan-McKnley.pdf

1st Quarter 2015	51.06		8213	http://gulfnews.com/business/sectors/employment/what-will-turn-uae-job-market-around-1.1560277
2nd Quarter 2015	58.79		8109	http://gulfnews.com/business/sectors/employment/what-will-turn-uae-job-market-around-1.1560277
3rd Quarter 2015	43.58		7621	http://gulfnews.com/business/sectors/markets/uae-s-job-market-slows-in-third-quarter-of-2015-1.1613756
4th Quarter 2015	31.27		7899	http://gulfnews.com/business/sectors/employment/uae-job-vacancies-drop-in-first-quarter-of-the-year-1.1715987
1st Quarter 2016	34.33		7212	http://gulfnews.com/business/sectors/employment/uae-job-vacancies-drop-in-first-quarter-of-the-year-1.1715987
2nd Quarter 2016	46.27		Data is not available yet	

By going through the above table, the authors would like to formulate the following Hypothesis:

Hypothesis: Crude oil prices have got positive correlation with employment opportunities in countries where Oil and Gas Industry is the main source of revenue.

SWOT Analysis

A SWOT (Strength, Weakness, Opportunity and Threat) analysis is conducted below from UAE point of view. The analysis is done to find out what are the conducive factors available at current oil market, what their weakness is now, how UAE can

identify their opportunities and how to get rid of the threats.

Purpose of SWOT Analysis

The SWOT Analysis is conducted to find out the strength, Weakness, Opportunities and Threats in the UAE Employment Market. As we have seen above that there is a reduction in employment opportunities with reducing oil prices, it becomes important to find out the other opportunities where the employment opportunities can be increased. This will help the Expatriates and the TCNs to relocate themselves within UAE thereby avoiding to repatriate to their home countries.

Strength

Following are the strengths of UAE in this current oil market of falling prices:

- Only 30% of the Economy is Oil based and balance 70% economy is non oil based. So the country can survive by boosting its non oil economy.
- Dynamic leadership of the country is guiding the Apex Oil Company ADNOC to take quick decisions to handle the situations
- Enormous amount of wealth fund which can cater financial needs of the country for 32 years and oil reserves up to 75 years. So, even if they stop or reduce production to offset the price fall, the wealth fund can cater their needs.

Weakness

Following are the weaknesses of UAE in this current oil market of falling prices:

- Since 90% of the population consists of expatriates and TCNs, a move taken by oil industry to reduce manpower for overall reduction of cost of production of oil creates fear among remaining expatriates and TCNs if they also will lose their jobs.
- Difficulty of the employees of oil sector to easily find a job in non oil sector and get accustomed to that sector.

Opportunities

Following are the opportunities for UAE in this current oil market of falling prices:

- The oil industry can find out the non performing employees and remove them from the job citing the falling oil prices

as the reason. This will bring down the cost of production by increasing productivity as all performing employees are only on the rolls.

- The fall in prices of oil has increased the surplus for oil importing countries such as India, Pakistan, Briton etc. The people of these countries are now having more money to invest in various sectors in UAE, especially Dubai such as real estate, hotels, manufacturing units etc.

Threats

Following are the Threats for UAE in this current oil market of falling prices:

- Entry of Iran in the oil supply has increased the supply portion and it is very unlikely that the prices will go up in the near future
- China's economy has slowed down and there by the import of oil has reduced. China also is planning a pipeline project to bring oil from Russia. In such a situation, the demand for oil from Middle East will reduce.
- Non state actors like ISIS are selling oil at a very cheap price from the area under their control.
- All the above cited facts makes it almost impossible for the oil industry to increase their employment and also to retain their current employees.

Conclusion

By thoroughly studying the SWTO analysis, the paper concludes that oil industry is suffering due to falling oil prices. UAE as a country can take this opportunity to remove unwanted, non performing employees and right size their organizational structure. The Expatriates and TCNs of the oil industry can try and find some jobs in non oil sectors of UAE as these sectors are booming due to forthcoming Expo 2020.

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Human Resource Assessment for Indian Power Sector

Atul Agrawal*, Dr. Ruchi Tyagi**

**Senior Executive Chancery, Department of Power & Infrastructure Management, University of Petroleum & Energy Studies*

***Assistant Professor (SG), Department of Human Resource & Organization Behavior, University of Petroleum & Energy Studies*

Abstract

Indian power sector moves around the verticals of Power Generation, Power Transmission, Power Distribution and Power Trading. These activities are unbundled in most states in order to make each separated function more accountable. Power system in India powers the growth of economy hence its' annual growth at the consistent rate of 10% or more is prerequisite. Operational efficiency and competition index can be leveled up with the help of expertise of available human resource and policy makers. This paper analyses the present scenario of human resource availability for Indian power sector and convey the need to evolve HR strategies as per the need of the sector.

Keywords: *Power Sector, Skill, Human Resource, Training*

Introduction

Large numbers of skilled manpower like technicians, engineers and other semiskilled manpower is required in today's technological and capital intensive power sector. Technical manpower is required during the project construction and Operation and Maintenance (O&M) phase. Power projects are supposed to give optimum performance after commissioning if they are completed well in time and for timely competition of projects; managerial and technical competency is required due to technology intensive nature of the business.

A significant amount of demand and supply mismatch exists in the Indian power sector, hence there is an immediate need to build up more power plants to support more generation capacity. Installed capacity of existing power plants is also needs to be enhanced. These necessities require significant manpower requirement as per the need of sector. Large numbers of engineers

are produced in India every year but it is difficult to deploy them directly for such technology intensive industry. A proper training or experience is the need of sector. Central Electricity Authority organizes induction and training programs for technicians, supervisors, operator and engineers based on the requirements of respective technology area. This training and induction program ranges for the duration of one year or less. Although there are some very critical and import activities which needs to be performed by highly experienced manpower and it is difficult to boost such expertise in short period of time. In line with the same, capacity building exercises needs to be organized time to time to confirm the instant availability of manpower required in achieving the planned targets. Continuous and proper training to the present manpower must be provided to ensure up to date managerial and technical skill sets, productivity and higher motivation.

The total available manpower in the Indian electricity sector at the end of Tenth Five Year plan was near about 9.5 lakhs as per the report of Planning Commission's Working Group on Power for Eleventh Five Plan. The below are the requirements for additional manpower for the eleventh five year plan by assuming:

- Addition of generation capacity of 68869 MW in coming five years.
- Addition of 100,000 ckt. Kms of HV, EHV and UHV transmission lines in coming five years.
- Addition of 16 crore distribution consumers in coming five years.

The above described generation capacity addition target is revised to 78700 MW which further increases the requirement of manpower.

Table1: 11th Plan Additional Manpower Requirement (in thousands)

11th Plan Additional Manpower Requirement (in thousands)			
Area	**Technical**	**Non-Technical**	**Total**
Thermal Power	31.4	12.3	43.7
Hydro Power	25.3	7.1	32.5
Nuclear Power	3.9	1.6	5.5
Power System	202.1	60.6	262.7
Total	262.7	81.7	344.4

For the 12th five year plan, based on the earlier target of:

- generation capacity of 82200 MW,

- Transmission capacity of 63000 ckt. Kms and
- Approx 14 crore distribution consumer.

Table 2: 12th Plan Additional Manpower Requirement (in thousands)

12th Plan Additional Manpower Requirement (in thousands)			
Area	**Technical**	**Non-Technical**	**Total**
Thermal Power	26.9	10.0	36.9
Hydro Power	37.5	6.3	43.8
Nuclear Power	13.2	5.6	18.8
Power System	148.4	45.1	193.4
Total	226.0	67.0	293.0

The requisite manpower addition has been projected as in the below table. However, as per reviewed target, at least 100000 MW needs to be added in the 12thfive year plan and hence the requirement of manpower respectively increases.

Estimates which drawn by above tables, clears that at least 500000 skilled manpower, another 150000 Non-technical manpower needs to be introduced in Indian power sector during 11th & 12th five year plan period. Further, thousands of highly competent power managers and technical manpower are required in addition to above for the areas of monitoring & review, project finance, project planning and management etc.

Soft Skill Requirements

In last few years, numbers of diploma schools, engineering colleges, skill development schools, business schools, training centers have grown up in India. Huge enrollments are taking place in these centers but the qualitative inputs given are an area of concern. As per the result, industry is not getting what is actually required from new entrants hence demand and supply mismatch exists for required manpower.

- Soft Skills: In addition to power sector knowledge, soft skill set is also required. Human resource trainers should pay attention on this.
- Communication skills: Effective communication skills should be developed so that manpower can productively contribute to develop a harmonious environment within origination and also with customers.

- Continuous learning: A candidate should have willingness to learn continuously in the era of quick technological changes and modifications in organizational expansion plans.

- Problem solving approach**:** Capability to manage information, documentation support as per the need of official requirements of an organization, knowledge of new developments, identification of problems and suggest a quick solution is expected from an employee.

- Professionalism: A candidate should work in a professional manner. Ethical and social responsibilities, professional commitment, observing professional discipline of colleagues' and its effect on workplace in global and local context – are the significant particulars to consider in this regard.

- Teamwork: Teamwork is supposed to provide productive outcomes. One should have ability to do work in multicultural and multidisciplinary environment. Dynamic relationships & outcomes are promoted by the team leaders or managers in order to make a project successful.

- Self-Learning: Self updating trough the content and knowledge available at web is required. Changes happening in industry, changes in strategies of competitor are required to grab.

The National Training Policy (NTP), 2002

The policy laid out with the focus to improve training practices in Indian power sector. As per the mandate of NTP – every organization of power sector must have written training policy document which should have strategy to ensure the minimum one week training to each employee of that organization. Organizations are required to allocate sufficient funds in this regard. Minimum 1.5% of salary budgets need to be allocated initially which can be gradually increased to the level of 5%. The gradual increment in budget depends on the organizational requirement.

Periodical training need analysis by organizations is being recommended by NTP. The purpose is to evolve an annual need based intervention agenda for the

training which may focus on the following areas:

- Upgradation of skills through technical training
- Personality enhancement and development programs
- Issues pertaining to organizational development
- Information technology skill set

NTP also focuses on the educational upgradation plan. It provides opportunities through which leaves may be facilitated to an employee and financial assistance may be provided to acquire higher educational qualifications.

Concluding Remarks

Power system have phase wise series of operational requirements. The initial phase of project development and manufacturing is high technical intensive and requires specialized skill sets. As power sector is going through the phase of various reforms and restructuring and new dimensions are being evolved, a work force will be needed to understand and perform the business. Although we have highly qualified engineers and managers but they are not competent enough to immediately deploy in critical operations. National Training Policy, 2002 can provide a platform to such workforce to grab the inputs from training programs in order to be industry ready.

Acknowledgements

Corresponding Author would like to thank editors, reviewers and his family for their guidance and valuable suggestions.

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Indian auto industry: A review

Rakesh Naru*, Dr. Arvind Kumar Jain** Dr. Sunil Barthwal***

**Regional After Sales Manager, Jaguar Land Rover India*
***Associate professor, CoMES, University of Petroleum and Energy Studies*
**** Associate professor, CoMES, University of Petroleum and Energy Studies*

Abstract

As the capital income of an Indian is increasing, it is resulting in the expanding auto industry also. There was a time when a scooter or a car was out of reach for a common man. Time has changed every second person is using the product. The luxury is getting re-defined from a buyer which was part of the old money to a customer with new money. The recent research of buyer, says that Avg. age of 55% customers in luxury auto industry was 25-35 years. Though the study of JDP says that 43% of re-purchase depends on service quality, the paper wants to open a thought process that, "how to address the service delivery and quality requirements at different ages "as it varies with age also.

Introduction

The automobile (car industry) is approx. 120 years old in India, the first car that ran on the Indian Roads was in the year 1897, it was owned by Mr. Foster, however the first Indian to own a car in India was in the year 1901 and it was owned none but Jamshedji Tata. (Source – Wikipedia, Team-BHP report dated 24th Dec. 2008). The automotive industry in India emerged in the year 1940's, though till that time the cars were only imported in the India.

Automotive industry emerged in India in the year 1940's and Hindustan Motors was launched in the year 1942 with its long-time competitor launched in the year 1944, where they were building Dodge and Fiat products respectively. Below pic shows the Fiat showroom in Hyd. (Team-BHP report on Bombay Cycle)

Figure; 1

However, during the same period in the year 1945 M& M, started by two brother's

start producing Jeep, they start their production with Jeep CJ-3A utility vehicle. After Independence in the year 1947, the Indian Government launched the efforts in the direction of creating the automotive – component industry in India. By 1953, an import substitution program was launched and there were some restrictions on the import of fully built cars in India. (Team-BHP report dated 24th Dec. 2008) Also in the year 1952, the Govt. of India appointed the first Tariff commission; the purpose was to check the feasibility plan for indigenization of India automobile industry. In the year 1953, the commission submitted which recommended to categorizing the Indian car companies based on their manufacturing infrastructure.

It is clear that auto industry emerged in India with Independence and it started flourishing, as of now, there are more than 50 players in car segments with encouraging growth trend.

Performance of Auto Industry

Automobile industry in India is world's 10th largest industry with annual production of approx... 2 million units

The automobile industry in India was introduced in late 1890's, however, the manufacturing only took place after Independence in the year 1947, (SIAM).

The first manufacturing took place in the year 1950 by Hindustan Motors, with this it gave a start to the new era of manufacturing by companies like Telco (Now called as Tata Motors), Bajaj, and Ashok Leyland. In 80's with start of Maruti Udyog and most affordable car of that time, it gained market share by 50%. (Reported by SIAM)

The liberalization of 1991 opened gates of competition and growth for major international players and as of now, there are more than 50 automobile companies in India.

As of today, as per FDI (Department of Industrial Policy and Promotion (DIPP), Ministry of Commerce, Government of India), the world standing for the Indian automobile sector, as per the Confederation of the Indian industry is as follows:

- Largest three-wheeler market
- Second largest two-wheeler market
- Tenth largest passenger car market
- Fourth largest tractor market
- Fifth largest commercial vehicle market
- Fifth largest bus and truck segment

Performance of Auto Industry during 2015-16 Sources (SIAM)

Production

During April- March 2016, the auto industry produced a total of 23,960940 vehicles against 23,358047 in April-March 2015, with these figures during the period April- March 2016, industry registered a growth of 2.58% over the same period of last year. The total vehicles of 23,960,940 vehicles include passenger cars, commercial vehicles, three wheelers, two wheelers, and quadricycle. (Reported by SIAM).

Domestic Sales

During April-March 2016, the sale of passenger vehicles grew by 7.24% as compared to the sale in the same period. Within passenger vehicles, passenger cars grew by 7.87%, utility vehicles grew by 6.25%, and vans grew by 3.58% respectively over the same period of last year. (Reported by SIAM).

During the same period April- March 2016, commercial vehicles grew by 11.51% as compared to sales in the same period of last year. Within commercial vehicles (M&HCV'S) Medium and Heavy commercial vehicles grew by 29.91%, Light commercial vehicles grew by 0.3%, Three wheelers grew by 2.11%, however, the goods carrier register a negative growth of -3.62% in April- March 2016 with respect to April-march 2015.(Reported by SIAM).

Two wheelers showed a growth of 3.01% during March- April 2016, however within two wheelers max. Growth was shown by scooters and they grew by 11.79%, motorcycle and mopeds register a negative growth of -0.24% and -3.32% respectively in April- March 2016 over April- March 2015 (Reported by SIAM).

Exports

In April-March 2016, Exports register a growth of 1.91%, within this category, 5.24% growth was registered by passenger vehicles, commercial vehicles showed growth of 16.97%. Three wheelers reported negative growth of -0.78% and two wheelers reported growth of 0.97% respectively in April- March 2016 over April- March 2015. (Reported by SIAM) Year on year there is an increase in sales and it would continue with the growth of GDP and per capita income of Indian. The automobile industry has a huge scope, passenger vehicles every year are growing at 6-7%, which is huge. The trend in changing earlier, an Indian used to buy a car only once in his lifetime, now he wants to change the car every 3-4 years and with new young buyers adding to list it is becoming an important factor for driving growth.

Segmentation in Car Industry

The segmentation of car industry in done on the basis of length and price, source (FADA)

Table 1

SEGMENT	LENGHTH OF CAR/ MODEL TYPE	CAR MODEL
A1	LESS THAN 3400	NANO
A2	3400-4000M	ALTO,ZEN,
A3	4001-4500 M	MANZA,LOGON
A4	4501-5000M	COROLLA, OCTAVA
A5	5001-5500	ACCORD
A6	5501-6000	XJL, MERCEDES, BMW
B1	VANS	VANS
B2	MUV/MPV	SUMO, INNOVA
SUV	SUV	CRV, SAFARI

But if we see that this type of segmentation happens only in India as there are different tax slabs based on overall length of a car. Popular segments according to car industry (SIAM, FADA) are as below:-

1. Mini
2. Compact
3. Hatchback
4. Mid-size car
5. Sedan
6. Executive car
7. Premium car
8. Luxury car
9. Super luxury car
10. Van
11. Utility vehicle
12. MUV/MPV
13. Sports Car
14. Super Cars

Luxury Indian Industry: - Reported By Finical expert's

As a meaning, a luxury good is a product for which demand increases more than proportionally as the income rises, and is a contrast to a "necessity good", for which demand increases proportionally less than income. Luxury goods are often synonymous with superior goods and Veblen goods.

In another way, a luxury goods create a different market segment because of its demand, uniqueness, heritage and price. The three dominant trends in the global luxury goods market are consolidation, globalization, and diversification. (Source: -Raygain Technologies Ltd report). Consolidation involves the growth of big companies and ownership of brands across many segments of luxury products. Globalization is a result of the increased availability of these goods, additional luxury brands, and an increase in tourism (Mr. Salil Panchal Report on Indian Luxury Cars (Forbes India), Jan 2015)

An Assocham study stated that with the increasing brand awareness and growing

purchasing power of the upper class in tier II and III cities, (source:-Economic Times article by DS Rawat) Indian luxury market is expected to cross $18.3 billion by 2016 from the current $14.7 billion growing at a compounded annual growth rate (CAGR) of about 25%.

"The factors that have fuelled the luxury industry's growth are rising disposable incomes, brand awareness amongst the youth and purchasing power of the upper class in Tier II & III cities in India," said DS Rawat, secretary general, Assocham (source: -Economic Times article by DS Rawat).Areas such as five-star hotels and fine-dining, electronic gadgets, luxury personal care, and jewelry performed well in the year of 2015 and are expected to grow by 30-35% over the next three years. Big ticket spends such as on luxury cars mainly SUVs are likely to continue, growing upwards of 18-20% over the next three years, driven by consumption in smaller towns and cities. (Source: - Economic Times article by DS Rawat). DS Rawat has only tried to show the link of increase in income and respective increase in luxury goods. We can see the growth of the luxury market, approx. It is now 1.8-2.0% and is expected to rise to 3-4%, which is fairly a growth of more than 100%. The auto industry is also showing the growth of approximately 18% as compared to the aged trends. However in the Luxury industry the comparison and segmentation are done as per the pricing of a car which is driven by the company as below:-

Disclaimer

These prices are only indicative price and do not have any co-relation with the present price list of any company, these has been taken after visiting few retailers 6 months before to understand the product comparison as per the price and style. The profile of Indian consumers who wants to own luxury is changing from older elite cars to young trendy and aspirational class. That further means young affluent class will be a major force in Indian consumer behavior in coming years. As per the research, 53% of luxury buyers are in the age group of 25-34, only 15% of luxury buyers are above 45+. (Mr. Salil Panchal-Jan 2015, Forbes India, “Indian Luxury cars) Table 2. With this type of buyers, all of the efforts are being put by every manufacturing to address the service needs of the customers in the age group of 25-34 as they are redefying the expectation level of customers and hence play a major role in market share of any organization. (Mr. Salil Panchal-Jan 2015, Forbes India, “ Indian Luxury cars)

Table 2;Price Position Chart (FY 16-17)

Product	JLR Name-plate	Ex-showroom Price INR Lacs (ex-Delhi)	BMW Name Plate	Ex-showroom Price INR Lacs (ex-Delhi)	Mercedes Name Plates	Ex-showroom Price INR Lacs (ex-Delhi)	Audi Name Plate	Ex-showroom Price INR Lacs (ex-Delhi)
XE	MY17 XE 2.0 L P Pure	39.90	320i Petrol Prestige	36.90	C 220 CDI Style	39.63	A4 1.4 TFSI Prem+	38.10
	MY17 XE 2.0 L P Prestige	43.69	320i Petrol Lux Line	42.70	C 220 CDI Avant	42.40	A4 1.4 TFSI Tech	41.20
	MY17 XE 2.0 L P Portfolio	47.99	320d Petrol M Sport	45.90	C 200 P Avant	41.40	A4 1.4 TFSI Tech	41.20
XE X260	MY17 2.0L D Pure	49.50	520d Prestige Plus	50.50	-	-	-	-
	MY17 2.0L D Prestige	55.90	520d Luxury Line	54.00	E 250 CDI E Edition	53.24	A6 2.0D Matix	51.80
	MY17 2.0L D Portfolio	62.10	520 D M Sport	54.00	E 250 CDI E Edition	53.24	A6 2.0D Matix	51.80
	MY17 2.0L P Prestige	55.65	520i Luxury Line	54.00	E 200 CGI E Edition	50.97	A6 1.8 TFSI Matix	52.75
	MY17 2.0L P Portfolio	61.85	530 D M Sport	62.00	E 350CDI E Edition	63.56	A6 1.8 TFSI Matix	52.75
XJ	MY16 XJ 3.0L D P.Lux	99.99	-	-	-	-	-	-
	MY16 XJ 2.0L P Portfolio	101.26	-	-	-	-	-	-
	MY16 XJ 3.0D Portfolio	107.72	730 LD DPE	114.00	New S 350 CDIL	113.50	A8 3.0 TDI Prem	114.07
	MY16 XJ 3.0D Portfolio	107.72	730 LD M Sport	122.90	New S 350 CDIL	113.50	A8 3.0 TDI Prem	114.07
F-Type	MY17 F-Type 3.0L ST2 Coupe	144.16	Porsche Cayman 3.4S	105.08	-	-	-	-
	MY17 F-Type 3.0L ST2 Coupe	144.16	911 Porsche Cayman 3.0l	142.00	-	-	-	-
Dis Sport	MY16 Disco Sprt S 2.2 L TD4 5st	47.59	X3 2.0 D X drive	47.50	GLE 250 CDI	60.63	Q5 2.0 TDI Prem	48.44
	MY16 Disco Sprt HSE 2.2 L TD4 5st	55.30	X3 2.0 D X line	53.90	GLE 250 CDI	60.63	Q5 2.0 TDI Prem+	51.54
	MY16 Disco Sprt HSE 2.0 L Gtdi 5st	56.50	-	-	GLC 300 Petrol	51.90	-	-

Customer delight

A customer exceeding his or her expectations and thus creating a positive emotional reaction is called as Customer delight. This reaction happening due to emotional part leads to word of mouth. Customer delight helps to distinguish the company and its products and services from the competition and directly affects sales, market share, and profitability of a company. Earlier Customer satisfaction.

Indian Consumer Profile

It has been seen as a Key Performance Indicator. (JDP report 2016) Customer satisfaction is a measurement of whether expectations of a customer are met (compared to expectations being exceeded) In other words extent to which the expectations are met. It is the relationship between customer expectation and service delivery to that particular customer, it cannot be generic. However, it has been found during various studies, that mere customer satisfaction does not create brand loyalty nor does it encourage positive word of mouth. (JDP report 2016 and FADA). Customer delight is created by product, accompanied by standard services with right interaction from people at the front line. The sources and the study of JDP say that interaction is the greatest source of opportunities to create delight as it can be personalized and tailored to the specific needs and wishes of the customer. (JDP report 2016 and FADA), In premium car industry personalized service delivery during various steps of handover and takeover with the customer is key to customer delight. During contacts with touch points in the company, more than just customer service can be delivered.

As already stated that the buying age for luxury products (cars) for 55% of its sale is just 25-35 years, it clearly indicates the impact of service delivery and its enablers on the customer with respect to its age.

The front line people can surprise by showing a sincere personal interest in the customer's need and requirements, offer small attentions that might please or find a solution specific to particular needs. Those front-line employees are able to develop a relationship between the customer and the brand. Elements in creating motivated staff are: recruiting the right people, motivating them continuously and leading them in a clear way. (JDP report 2016 and FADA).

Purpose of customer delight

There are three objectives when implementing Customer Delight: First, make customers loyal; finding new customers costs 4 to 9 times more time and Money than reselling to an existing client.

It is thus commercially intelligent to retain as many customers as possible. A second objective is to have customers that are more profitable. Average delighted customers spend more with less hassle as compared to customers who are not satisfied. The last objective of Customer Delight is to have clients talk positively about your product, brand or shop, the so-called Word of Mouth. In a world of well-informed customers, 92% of customers consider word of mouth as the most reliable source of information. Delighted clients are a valuable source of advertisement for any company. A study says that out of 10 satisfied customers, only one would say to others why he is satisfied, on the contrast, 6 out 10 customers spread –ive word of mouth if they are dissatisfied with product or company. Hence it is very important that a max. customers should be satisfied by product or services being offered. Source: -Al-Wayan, A., Pleshko, L. P., & Baqer, S. M. (2008). An investigation of the relationships among consumer satisfaction, loyalty, and market share in Kuwaiti loan services. Journal Of Financial Services Marketing, 13(2), 95-106. doi:10.1057/fsm.2008.9)

In order to consistently deliver Customer Delight at all customer touch points throughout the company, a customer-centric-corporate culture is key. With this corporate culture all processes, systems, people, and leadership are aligned to deliver Customer Delight; everyone in the organization shares the same set of values, attitudes, and practices. Developing the culture is an ongoing process, a continuous exercise of innovation and improvement, involving every single employee of the company. An absolutely necessary step is linking Customer Delight behavior to the core values of the brand. Core values are operating principles that guide an organization's internal conduct as well as its relationship with customers, partners, and shareholders.

Once core values are clearly outlined it is critical to incorporate them into everything you do, from hiring to employee appraisals and decision making (Caruana, A., Money, A.H. & Berthon, P.R. (2000). I also felt that many times core values in companies become a part of the book or a policy document only if it is not being communicated or adopted in a way it should be. So it is also important that our core values of brand change as per the change in customer profile with time. It is also been seen that customer behavior changes with new technology and somehow I also feel that core values should address these changes time to time.

But it is also the truth that Customers are becoming ever more demanding, and in most markets, they have more options to choose from than ever before. At the same time perceived 'switching barriers', the inconveniences of changing supplier, are being reduced.(Caruana, A., Money, A.H. & Berthon, P.R. (2000).

Different markets show very different customer loyalty profiles. The Leadership Factor's experience has shown that, for example, in some manufacturing sectors customers may have very little choice over which supplier to use. This can lead to complacency and the feeling that customer loyalty is irrelevant since they have no option but to come back. Such reasoning is flawed on two counts. 1) Customer loyalty goes beyond mere retention to a range of attitudes and behaviors, something which will be covered in more detail later. 2) Customers do come back when they have no other choice, but they will be vulnerable if any competitor arrives on the scene. Companies that are in a virtual monopoly situation can be vulnerable to this way of thinking.

The best example of the same is when scooters were sold in India and suddenly the 4-stroke motorcycle manufacturing company then named as Hero Honda and now Hero motorcycle not only introduced the new segment but also wiped the old segment.

The difference between markets is due to a combination of factors - the amount of competition, the sophistication of the customers and the perceived switching barriers. If all competitors were equally easy to use then we would expect an almost perfect correlation between customer satisfaction and loyalty.
As per JDP study the factors that affect the customer loyalty of areas below:-

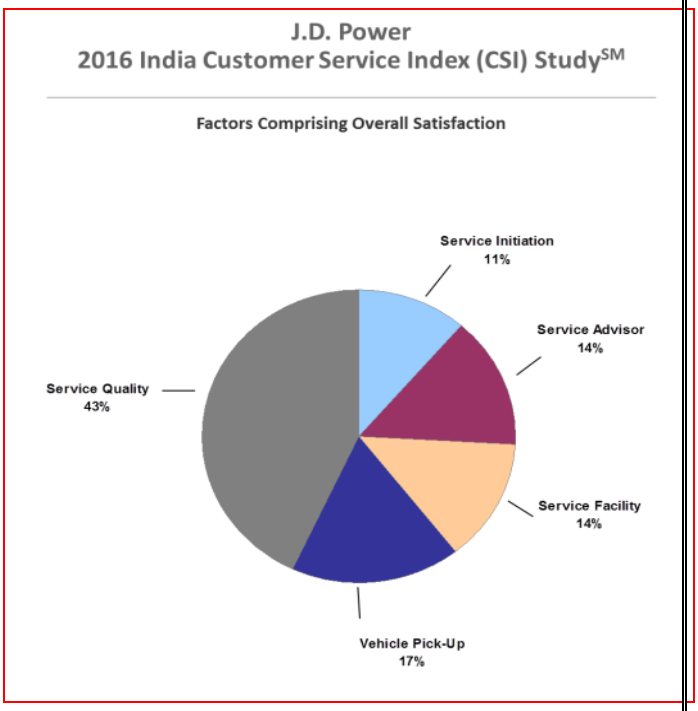

Figure 2

Conclusion

Indian automotive industry is growing with rapid growth, if we see a history of car industry from the year 1897, the growth in beyond measurement, and every player is present in India, the luxury

industry which is now 1-2% of total industry and is expected to 3-4% of total industry by 2025, which is 300% increase from buyer. This is growth would happen as result of new money with new buyer adding to the league of rich people in India, with a lot of expectation and views and understanding of segment in a better way. Thus it becomes very important to match their expectation with our delivery especially with age group of 25-35years which drives the growth in the luxury industry.

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Inland waterways transportation, the ignored sector for Indian government; lessons from China government.

Aditya Gupta[*], Prof. (Dr.) Neeraj Anand[**], Saurabh Tiwari[***]

[*] *Business Head ,Drive India Enterprise Solutions Ltd,*

[**]*Professor and Associate Dean, Research, CoMES, University of Petroleum and Energy Studies*

[***] *Assistant Professor (SG), CoMES, University of Petroleum Energy Studies*

Abstract

Inland Waterways (IWT) possess several advantages over competitive modes like Rail and Road in terms of being least capital intensive, lowest cost of running and maintenance and being environment friendlily. In spite of carrying a rich history of movement by rivers and possessing navigable waters in excess of 14000KM, the share of IWT in India's total transportation is not even 0.5%. In contrast the share of IWT in China is more than 14% and constantly growing.

The Chinese Government has realised the advantages of this mode and constantly supporting this sector through policies, programs, projects and funds. This papers outlines the progress made in India and China in the IWT sector and what the various initiatives which have been taken by Chinese Government which are worth considering and emulating for Indian Government.

Introduction

"Transportation is the centre of the world! It is the glue of our daily lives. When it goes well, we don't see it. When it goes wrong, it negatively colours our day, makes us feel angry and impotent, curtails our possibilities" (Robin Chase).

Robust transportation system is essential for economic progress of any country. Transportation sector comprises of network of Railways, Roads, Airways, Coastal shipping, Inland Waterways and Pipelines or combination of these. Inland Waterways Transport (IWT) is the transportation of freight over rivers, canals, backwaters, and creeks. Among all modes of transportation, it is the most appropriate mode of transportation due to following reasons:

- IWT is fuel efficient:

It is estimated that one litre fuel can transport 24 tonne/km freight by road, 85 tonne/km by rail and 105 tonne/km by waterways (IWAI Website).

- IWT is environment friendly: It uses the least fuel to move the cargo. The order of the ratios between water, railway and road transportation is within the ranges of 1:2:5 in cost and 1:1.5:4 in energy consumption respectively (UNESCAP Report).

- IWT is least Capital Intensive: Estimates show that developing and building an inland waterway costs about 5-10 per cent to that of 4-lane highway/railway. No Land acquisition and allied infrastructure required (IWAI Website).

- IWT is sustainable: Infrastructural development of the waterways helps to prevent floods, and provides water reserves and the accompanying fauna and flora. Hydroelectric stations can be installed along rivers and canals (website - 32cup.com).

- IWT carries least External Costs: IWT carries least impact on communities, low noise, least pollution, accidents and congestion.

- IWT is safe: There are only rarely accidents on the waterways. The shippers are very well trained and have to abide to very strict safety requirements (website - 32cup.com).

- IWT is cost effective: An average sized ship can carry as much as 40 railway carriages or 60 trucks, and uses the infrastructure more efficiently (and thus cheaply) than the other methods (website - 32cup.com).

- IWT is much more than meets the eye: the waterways can be used for tourism, recreation and cultural and aesthetic purposes as well (website - 32cup.com).

IWT is natural, safest, energy efficient and the most environments friendly mode of transport. This mode is extensively used for transportation in many countries. IWT contributes about 8.5% of total cargo movement in USA, about 14% in China, 24% in Belgium, 38% in Netherlands and 13% in Germany (KPMG Report, 2014).

However, in India IWT never got the attention it was due. All our focus since Independence has been to develop Rail and Road sector. Due to continuous neglect, the share of IWT in total freight transportation in India is paltry 0.5%. It has been estimated that diversion of one billion tonne-km of cargo to the IWT mode will reduce transport fuel costs by 5 million USD and the overall transport costs by 9 million USD (Sriraman, 2010). A 14% share of IWT, equal to that of China, in total transportation could reduce India's transportation bill by at least Rs 15,000 crores.

The aim of this paper is to analyse how Indian Government has erred in the development of this sector and what are the various lessons which can be learnt from China Government.

Brief Literature review

Inland Waterways Authority of India (IWAI) (IWAI Website) website provides various details of IWT progress in India so far. It lists the various operational waterways in India. The key barriers in the development of IWT in India have been identified by Dr. S Sriraman in his study. Narayan Rangaraj and G. Raghuram argue about where and how much Government should invest in IWT. They identify the key stakeholders in IWT and role of various Government agencies and instruments available with them. Qualitative and quantitative comparison in terms of cost between IWT and present modes of transport such as railways and roadways is studied by Amit Mishra, Alipt Saxena, V.B. Khanapuri.

An overview of the global IWT scenario, especially of Europe, US and China, amongst others, has been brought out by K. G. S. Sarma. Vijaya Singh brings out that India should have an integrated transport plan for the major mechanised transport modes. There should not be unhealthy competition between the modes and they should supplement and not compete with each other. KPMG report on water transportation in India (KPMG Report, 2014) indicates the share of IWT in various countries. It lists the major projects on Indian IWT and reasons for its stunted growth.

Shulin Duan & Zhanhua Wu [11] discusses the development of IWT in China in recent years and role of central and state Governments. A report by Consulate-General of the Kingdom of The Netherlands on Inland waterway transport in the Pearl River basin [12] indicates the role of responsibility of provincial and local authorities in the development of inland waterway transport in the Pearl

River region A Study through a comparative overview of the experiences in the IWT industry in USA, the EU and China was conducted by Paul Amos, & FEI Weijun(Paul Amos, World bank, 2009). It identifies the governance system of IWT in China and how does it contrast with EU and US. It highlights the key policy steps taken by China Govt. Guibin Xu[14] identifies the key developments in the area of multimodal transportation in China using IWT.

Research Methodology

An analysis was made of published literature and statistics on Inland Water Transport in India and China to understand the historical development, the existing status of the movement, barriers to development and the policy initiatives by both Governments. Interviews have been conducted with various players in the IWT sector, namely officials of IWAI, Shippers, Barge owners and operators and Industry experts. The interviews brought insights on the challenges faced by Inland Waterways Industry and how China has been able to promote and progress in this sector.

The Indian Progress

India has a very rich history of river transportation. Archaeologists have found evidence of dock being built during Harrapan civilization which was more than 2000BC old. For centuries Ganga and its tributaries have been extensively used to carry cargo within the country and for trade to outside world. Even during the period of British rule the Brahmaputra and Barak-Surma rivers were used extensively for transport and trade between northeast India and the port of Calcutta (IWAI Website). However, in the post independent era Road, Rail and Air took precedence and IWT was completely ignored (Aditya Gupta, 2016). It took Government almost 40 years after independence to set up Inland Waterways Authority of India (IWAI), the premium agency for Inland waterways under Ministry of Shipping (Aditya Gupta, 2016). IWAI has declared five National Waterways (IWAI Website):

- The Ganga-Bhagirathi-Hooghly river system from Haldia to Allahabad (1620 km) – (NW-1)

- The river Brahmaputra from Dhubri to Sadiya (891 km) – (NW-2)

- The West Coast Canal (WCC) from Kollam to Kottapuram including Champakara and
- Udyogamandal canals (205 km) – (NW-3)

- The Kakinada-Puducherry Canal (KPC) including rivers Godavari and Krishna (1095 km) – (NW-4)

- The East Coast Canal (ECC) integrated with rivers Brahmani and Mahanadi delta system (623 km) – (NW-5)
- The total navigable length in India is 14,500 km, out of which about 5200 km of the river and 4000 km of canals can be used by mechanized crafts (IWAI Website). Out of which 4,332 km have been declared as National Waterways (IWAI Website).

The figure 1 shows the map of IWT network in India. Source : IWAI.IWT in India has been used to carry steel, iron ore, coal, cement, food grains, fertilizers, Plant and machinery and other bulky and heavy items.

In spite of some action happening on IWT in last 30 years still the adoption of IWT in India is much less than desired. This is due to variety of factors (Sriraman, 2010):

- Navigation comes fourth in Government. priority after drinking water, irrigation and hydel power (Sriraman, 2010)

- Lack of coordination among central government, state government and various other agencies involved (Sriraman, 2010)

- Poor participation of private sector into this mode (Sriraman, 2010).

- Insufficient depths throughout the stretch. Excessive siltation (Sriraman, 2010)

- Non availability of adequate navigational aids restricting hours of operation (Sriraman, 2010)

- Non availability of low draft high technology vessels (Sriraman, 2010).

- Non availability of permanent terminals. Infrastructure at terminals (Sriraman, 2010).

Figure 1; Map of IWT network in India.

- Non availability of cargo/industry along the water front (Sriraman, 2010).

- Non availability of return cargo (Sriraman, 2010).

- Lack of connectivity with other modes to create first mile and last mile transportation and an intermodal transport system.

The China Progress

China's IWT network is the largest in the world in terms of length and cargo carried (Paul Amos, World Bank, 2009). China also a very rich history of transportation over rivers. China builds Grand Canal some 2500 years ago. It is the first such structures build by mankind. It connected the five main rivers of China and played a crucial role in development of China as a country.

Modern China has almost 126,000 KM of navigable rivers, streams, lakes, and canals, more than any country in the

world. The main navigable rivers are the Heilong Jiang; Yangtze River; Xiang River, Pearl River; Huangpu River; Lijiang River; and Xi Jiang.

Major navigable rivers

Yangtze:

Yangtze River, flows from the inner Western part of the country to the Eastern coast, where it meets the sea. The Yangtze River along with its tributaries accounts for more than half of China's total waterway system and has a navigable length of about 60,000 km (UNESCAP Report).

Of the total available length almost five per cent carries draft in excess of 2m and is suitable for navigation by vessels of 1,000 dead weightt or more. Yangtze alone accounts for more than two thirds of the cargo carried over IWT in China.

Pearl River:

The Pearl River with its total trunk length of 2167 km stands one amongst the four biggest rivers in China. It is next to Yangtze River and there are almost 988 rivers with total length of 36000 km in Pearl River basin. Out of this 13000 KMs is navigable, the 5000 km stretch links inward to southwest side via barges leading its outward to South China Sea (UNESCAP Report). Since it is connected all over the world through eight ports it forms an important coastal port system in the world which consists of Hongkong, Gunagzhou and Shenzhen (James Wang, 2013).

Heilongjiang River:

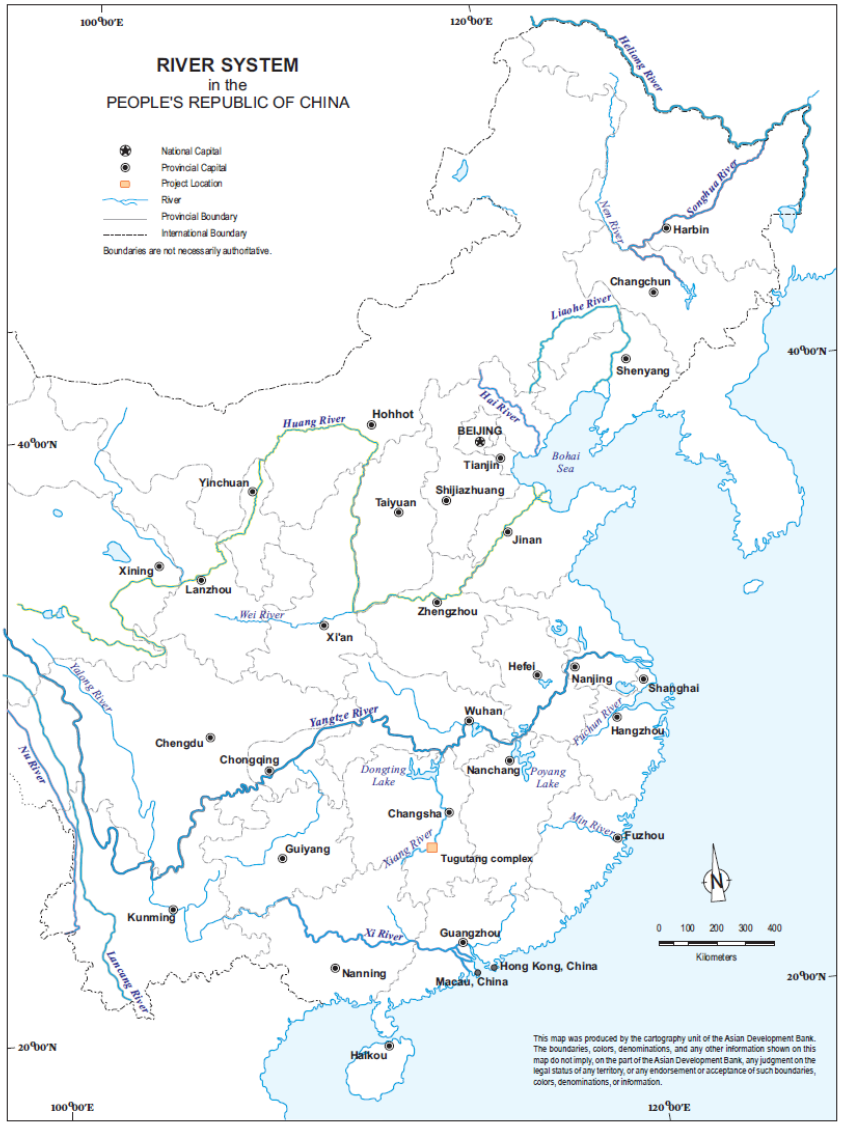
The Heilongjiang River water system has a navigable length of 4800 KM and is composed of system of four rivers namely, the Heilongjiang River, the Sooghuajiang River, the Nenjiang River, the Usuri River and some small tributaries (UNESCAP Report). The river is frozen in winter, so, the navigation period is only about 200 days in the year. (James Wang, 2013).

Grand Canal:

In addition to the major rivers, there is the ancient Beijing-Hangzhou Grand Canal, with a navigable length currently standing at 1,747 km, but which is expanding annually as a result of channel regulation works. All others river flow from West to

East. The advantage with this canal is that it flows from North to South and with its connections with major rivers form a myriad of interconnectivity.

China is concentrating its IWT infrastructure development thrust on 5 key areas namely, Yangtze River, Yangtze River Delta, Pearl River, Pearl River Delta and Beijing-Hangzhou Grand Canal (UNESCAP Report).



Source: Asian Development Bank.

Figure 2; map showing the major river systems in China

Figure 3; The Pearl, Yangtze, Yellow and Songhua river systems.

Terminals and Barges

China has a vast terminal network on IWT spanning over 2000 inland ports. Out of these 85 are key ports, with 52 of them capable of handling vessels of capacity of Ten thousand dead weight and more. Seven ports out of these have annual cargo throughput of more than 10 Million MT. The IWT network has array of ship locks and ship-lifts with Three Gorges Dam on Yangtze river being largest of them (UNESCAP Report).

China has the largest barge fleet in the world running close to two hundred thousand barges. Barges of all sizes ply on IWT. Yangtze River with large draft carries barges of 1000 DWT and more. The other rivers and tributaries carry barges of typical sizes of 50 dead weght, 100 dead weight and 500 dead weight (UNESCAP Report).

Commodities carried over IWT

The major commodities of freight movement are coal, petroleum, ores, iron and steel, building materials, lumber, grains, cotton, fertilizers, insecticides and general cargoes (Paul Amos, World Bank, 2009). With containerised terminals being developed, IWT is now being extensively used for Export and Import containerised movement from port to hinterland.

The China India contrast.

The China's IWT network has been experiencing fast growth with more than 7-9% yearly growth in volumes carried (Paul Amos, World bank, 2009). The India network has been growing at a much smaller pace and even posted a negative growth in some years due to mining ban in Goa. The table 1 provides a snapshot of

comparison between IWT in India and China

Table 1; Comparison of IMT in China and in India.

	China	**India**
Waterways Length in KMs	Navigable Length - 126,300 KM Designated Waterways - 61,000; Commercially Significant - 24,000	Navigable Length - 14,500 KM Designated Waterways -4,400; Commercially Significant - 2,900
Cargo Moved in Billion Ton KM (Year 2012)	1120	4.77
IWT share of Total National Freight (Year 2014)	14.00%	<0.5%
Containers handled at inland ports	> 10 million TEU handled/year	Negligible
No. of vessels in IWT system (Year 2007)	183000	13000
Length of Waterways capable of handling > 1000 DWT vessels (Draft > 2m)	8700 KM	2223 KM
Main Commodity Types Using IWT	Coal & coke 17% Oil & oil products 8% Metallic & non-met. ores 19% (Year 2006) Building materials 34%# Steel 7% Containers 6% Others 9%	Coal, cement, bauxite, iron ore pellets, stone, HR steel, project cargo and related raw material, Sulphur, rock phosphate, cement, lime stone & clinker (Year 2011-12)

The China Government initiatives

There are numerous initiatives taken by Chinese Government which is leading to such high share of IWT in the total transportation. Some of these initiatives are worth considering for Indian Govt.

- Multi Layered Governance structure*:*

In China a three level civil administration is in charge of the IWT management (Paul Amos, World Bank, 2009). At the top level the Ministry of Transport (MoT) develops sectorial policies and infrastructure planning (Paul Amos, World Bank, 2009). On a next level the River Administration (Example Yangtze and Pearl River Administration) is responsible for the implementation of IWT projects on the country's main inland waterway transport link along the Yangtze and Pearl River (Paul Amos, World Bank, 2009). On

the third level the provinces themselves implement IWT projects. The provincial Governments are responsible for development, operation, maintenance, administration and regulation of inland waterways in their province. In China, the MOT at centre, River Administration and Provincial governments are all aligned for various IWT projects. There is a clear division of roles and responsibilities. In contrast in India we are following a single tier system. Ministry of Shipping through IWAI is only responsible for developing and managing all National waterways. States Govt hardly carries any priority for navigation and prefers to use water for its own requirement like power generation, irrigation, drinking etc. There is hardly any involvement of State Govt in implementing Waterway Infrastructure Projects.

- Alignment among Government departments*:*

In China, Regulation on Administration of Waterways ensures coordination among various departments while implementing IWT projects. Other administration departments like hydroelectricity, irrigation, flood control, fisheries, water supply forestry and others are informed and on boarded. In 2005, MOT agreed with seven provinces and two municipalities along the Yangtze River to jointly construct the Yangtze River 'golden waterway' to promote the economic development in Yangtze River area (Paul Amos, World Bank, 2009). The Yangtze River IWT Co-ordination and Steering Commission were established (Paul Amos, World Bank, 2009).

Under the auspices of the Commission, an overall promotion plan for the Yangtze River waterway construction during the 11th Five Year period (2006-2010) was approved and implemented (Paul Amos, World Bank, 2009). In India, navigation enjoys the last priority in river water usage after drinking, irrigation and hydroelectricity. Navigation was never taken into consideration while building of dams and bridges in India. In many of the state governments there is no separate department for IWT or it is a sub function of Irrigation.

- Standardisation of Waterways:

State promulgated "Inland Navigation Standard of People's Republic of China" after an extensive investigation and study (Paul Amos, World Bank, 2009). The waterways have been classified as shown in table 2:The intent of creating classification in China was to continuously monitor and improve the waterway system. To move lower class Waterways to higher

class Waterways. Targets were taken to increase Class III+ from 8,687km to 14,300km and increase Class V+ from 24,000 to 36,000 km. The classification also indicated to China administration as to where they stand in comparison with advanced countries like US and EU in terms of Waterway quality and depth. In India too we came up with formal classification system of Waterways. However this classification always remained on paper and was never used to truly classify our rivers and drive improvements.

Table 2; Class of waterways and its capacity.

Class of Waterways	Tonnage Capacity	Depth of Waterway in meters
I	3000	3.5 - 4.0
II	2000	2.6 - 3.8
III	1000	2.0 - 2.4
IV	500	1.6 - 1.9
V	300	1.3 - 1.6
VI	100	1.0 - 1.2
VII	50	0.7 - 1.0

- *Time bound plans for waterways improvement:*

China Govt has been successfully creating time bound plans to improve IWT infrastructure and implement them. They came up with 3 phase plan to improve navigation at Yangtze River. In 2007, China adopted the National Inland Waterways and Ports Plan to 2020 (NIWPP2020) (Paul Amos, World Bank, 2009). NIWPP2020 was jointly agreed by MOT and the National Development and Reform Commission (NDRC) (Paul Amos, World Bank, 2009).

It was developed through detailed economic and engineering feasibility studies in 2005, and set out prioritized plans for upgrading of navigation standards and major port facilities of those waterways designated as being of national importance (Paul Amos, World Bank, 2009). The Plan was to substantially increase the length of waterway after investment and have navigation standards comparable with the busier waterways in the USA and the EU (Paul Amos, World Bank, 2009). There are time bound plans for the Government to improve the class of waterways. It has been decided to improve Class III inland waterway system by 65% (in terms of km), from 8,687 to 14,300 km,

and the Class V by 50% (from 24,000 to 36,000 km) by 2020.

- . *Priority in Development*:

China Government clearly established priority in development of navigation on Rivers. They recognised that Yangtze was a key river for them and focused all their energies and funds in developing cargo on this river. The shipping development on Yangtze River started in 1980s in three phases. The three phases are: (i) Recovery Phase (1980-1990), (ii) Stable Development Phase (1990-2000), and (iii) the Rapid Phase (2000-present) (Workshop on IWT, 2013). Firstly, they developed the Yangtze River, secondly, the Side Rivers of the Yangtze, and thirdly, the smaller rivers and their side rivers (Workshop on IWT, 2013).

In India too, The National Waterway 1 was declared almost three decades in mid 80s. However if we compare the cargo carried on the 2 rivers, the total volumes on Ganga are almost negligible as compared to that carried on Yangtze. India has not been even able to develop the previously five declared National Waterways and we have declared 106 more National Waterways in April 2016. This will further divide the attention and we will scarcely be able to develop any of the waterways to its full potential.

- *Allocation and source of Funds:*

The allocation of funds for this sector is meagre in India as compared to China. While China is investing in Billions of Dollars we are still stuck at millions and that too remain underutilised at the end of the period. China changed their funding pattern from year 2000. In the past funding for IWT infrastructure construction was funded mainly through government support (Paul Amos, World Bank, 2009). As this was turning out to be insufficient, the China government came up with innovative ways of funding (Paul Amos, World Bank, 2009). Government established an IWT Construction Fund by collecting surcharges from waterways freight, port construction, and passenger movement (Paul Amos, World Bank, 2009). Provincial governments would raise their own funds for IWT through user charges and cross-subsidy from land transport modes (Paul Amos, World Bank, 2009).

Before 2001, both national and provincial governments were the most important source of IWT infrastructure financing and more than 75 per cent of investment was financed by governments (Paul Amos,

World Bank, 2009). After 2002, the percentage began to decrease, to only 54 per cent by 2006(Paul Amos, World Bank, 2009). The share of various sources of funding in 2006 were National Budget(0.1%), Domestic loans (39.0%), International Loans(3.4%), MOT port construction fees(2.6%), MOT Inland waterway Fund(18%), Enterprises and Institutions (2.3%) and Provincial Budgets(33.6%) (Paul Amos, World Bank, 2009). As compared to this, in India, the central budget is still the only source of funding for Waterway development and maintenance. Even State Governments have limited allocation to IWT and look for support from Centre in terms of CSS schemes. The domestic loans are almost negligible as the lenders do not find commercial viability in the projects.

Setting up industries on river fronts:

China has been very successfully in setting up Industry hubs close to Yangtze and Pearl River. There are many steel mills which are located on Yangtze River bank which uses barges for transportation of material whereas Pearl River is mainly engaged in transporting import and export containers to hinterland. There has been a conscious effort to set up industries along the river fronts. In India, river navigation was never considered during planning for industrialization. There are almost no industrial clusters which are located very close to river Banks and are able to exploit the potential of IWT.

*Speed on implementing projects***:**

In China large projects are planned and implemented at great speed. Three Gorges project is a perfect example. The project is reduced transport cost by river barge by 37 per cent. The phase wise development of Yangtze River is yet another example. In contrast even Indian Shipping Minister Mr Gadkari admitted "Inland water ways authority of India has not been working professionally and lacks speed".

Intermodals:

In China there is a clear policy to improve the interface between IWT and other modes especially sea-ports and rail (Paul Amos, World Bank, 2009). China's inland ports handle nearly 10 million TEUs per year. 27 inland ports on Yangtze River possess container handling capability out of which 12 ports are dedicated container terminals. The Three Gorges Dam has further facilitated growth in container movements. In Pearl River Basin we have one of the world best river-port connectivity. In India the container traffic on IWT is almost negligible. Plans have

now been made to create intermodal terminals at Allahabad, Varanasi, Gazipur in UP, Sahibganj in Jharkhand and Haldia in West Bengal as which will have rail and road connectivity. The connectivity of IWT with sea ports still remains matter of concern in India.

Private participation:

Chinese Govt has been very successful in involving private sector in IWT. Though waterways building and management remains state subject, inland shipping, terminal construction and operations, barge owning and management and MTO operations are almost in private hands. In India, the private sector participation in this sector has been meagre due to lack of commercial viability. Goa Waterways is a prime example. This waterway thrived without any Govt assistance due to availability of cargo and draft.

Barge standardization programme:

In 2006 MOT issued Inland Waterway Vessel Standardizationguidelinesto pursue vessel standardisation (Paul Amos, World Bank, 2009). A scrapping/subsidy scheme to replace old vessels by new vessels was offered. The old vessels were causing congestion, had low average tonnage and carried environmental and safety concerns thereby rendering IWT less competitive (Paul Amos, World Bank, 2009). The old vessels were encouraged to be scrapped and replaced with more modern standard vessels through financial assistance (Paul Amos, World Bank, 2009).

Cooperation with foreign partners:

China has been partnering with the Netherlands, the European Commission, and projects are being developed with international financing institutions such as the World Bank and the Asian Developments Bank. The Overseas Joint Foundation, foreign governments and foreign traders are encouraged to invest in the construction and operation of ports and waterways.

China Government came up with Regulations and Policies to encourage Joint Venture in various IWT related activities. India has recently partnered with World Bank for a project. However other foreign institutions are hired more as consultants than partners in development.

Investment on Support system:

Navigational aids play an important role in river navigation, hence lot of projects are implemented in China relating to support

systems like GPS, VTS, RIS and digital charts in main river areas (Paul Amos, World Bank, 2009).They have also implemented IT platform on their terminals to increase the efficiency of their working. They have used the RIS with some innovations and changes such as the use of RFID chips on the smaller rivers and canals instead of expensive AIS transponders (Workshop on IWT, 2013).

Conclusions

IWT is considered to offer many merits, both on the community level and on the business level. Advantages on the community level can be found in the field of being fuel efficient, lower capital costs, lower emissions, higher safety levels, safer transport of dangerous goods, and lesser road congestion. Several countries like US, Germany, Netherlands, Belgium, and Bangladesh have recognized the advantages of IWT and transport lot of their freight on this mode. The Chinese Government too recognizes the IWT as a promising mode for cargo transportation and has adopted a clear game plan to plough its benefits. This strategy has translated into numerous support programs and incentives. The current Indian Government has recognised the importance of this sector. The minister has indicated allocation of Rs 1 lakh crore for this sector.

However the need of the hour for Indian Government is to implement the learning from China in terms of building a long term vision, assigning it the same priority as Rail and Roads, identify and implement projects with speed, attract and encourage private participation, allocate much larger funds and improve the depth and quality of waterways with adequate navigational support.

'I am the river, sit and listen to my wisdom" (Ian Menard). It is high time that we as a country truly sit and listen to this wisdom.

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IoT in Indian PSU Oil Outlets – Contributing Factors

Sudip Das[*], Dr. Shailendra Kumar Pokhriyal[**] and Dr. Geo Jos Fernandez[***]

[*]*Client Solution Manager, Infosys*

[**]*Professor and Associate dean, CoMES, University of Petroleum and Energy Studies*

[***]*Assistant Professor (SG) University of Petroleum and Energy Studies*

Abstract

IoT is bringing about a revolution in the Oil and Gas industry. Currently less than 1% of physical objects are connected to the internet and the opportunity to make them connected is huge. Internet of Thing (IoT) ranks third in terms of the estimated potential economic impact of 12 technologies (Mckinsey). As per Cisco's report 'A New Reality for Oil and Gas' (Robert Moriarty, 2015), there is a 3.7% increase in consumer demand at Retail Oil Outlets due to adoption of IoT. Literature Review has revealed that currently there is a substantial financial opportunity, loss without the adoption of IoT in the Indian PSU Oil Outlets. This paper has done a literature review and survey to calculate the Opportunity Loss and also identify the 26 variables which contribute to increase in employee productivity and operational efficiency through IoT in Indian PSU Oil Outlets. Factor analysis was used to group these 26 identified variables under 9 factors/building blocks based on their co-relations. The 9 building blocks were *Customer focus, Increase in operational profit, Differentiation, Value to Customer, Adoption of latest technology, Enabling IoT ecosystem, Connected objects, Better usage of customer data and Partnership with IT Service Provider*. These 9 building blocks can be leveraged by the Indian Public Sector Downstream Oil Companies for implementation of Internet of Things (IoT) at their Retail Oil Outlets.

Keywords – Internet of Things, Operational Efficiency, Employee Productivity, Connected Objects, Automation

Introduction

The Oil and Gas industry has to face numerous challenges such as lower prices of crude oil, lower production rates, volatility of demand and supply, growing upstream capital expenditure, economic downturn,

competition for resources, rising costs, environmental legislations, burgeoning population, geopolitical changes, taxation, safety policies and aging workforce. Global warming, along with other environmental and health concerns present significant obstacles in accessing natural resources such as crude oil, coal and gas.

IoT ranks third in terms of the estimated potential economic impact of 12 technologies (as identified by Mckinsey). Currently less than 1% of physical objects are connected to the internet and the opportunity to make them connected is huge which can bring about operational efficiencies and simplified business processes. IoT enables "Things" to generate data themselves. IoT enables objects to connect to the Internet and therefore have embedded intelligence. The huge amount of data generated when analyzed can provide valuable insights and patterns. Internet of Things (IoT) is going to impact almost every sphere of the Oil and Gas operations. The new IoT ecosystem will enable the decision makers to make real time decisions, increase the asset uptime for Upstream and Downstream operations, reduce the compliance related costs and improved innovations.

Key findings of a Forrester survey on IoT in 2015 are as follows:

- Pressure to leverage data and deliver better customer experiences spurs IoT adoption or plans at 50% of global enterprises
- Businesses need clear leadership support to navigate the risks and complexities of IoT deployments — but 75% don't have it yet
- Many firms are missing out on the potential for IoT to transform business models
- IoT-empowered customer experiences deliver top- and bottom-line business improvements (Forrester, 2015)

IoT is increasingly helping industries across various sectors to effectively utilize their business assets in innovative ways. Businesses are being transformed through IoT and helping users to improve decision making. The huge amount of data generated through IoT enables to predict valuable insights. The business benefits that accrue through IoT include:

- Improved efficiency, safety and productivity: IoT enables business users to make real time decisions by leveraging insights using sensors. The operating costs can be reduced

significantly and efficiency can be enhanced with minimal manual intervention. Increased use of wearable devices has led to a safer and collaborative working environment. IoT has led to the automation of many business functions, enabled remote monitoring of equipment and minimized manual intervention.

- Reduced operating cost: Industries can benefit from increased asset utilization, streamlining of business processes and increased streams of revenue through new business models.

According to IDC, estimates for worldwide IoT revenue by region in 2020 will be as follows:

1. $ 2.6 trillion – Asia Pacific
2. $ 2.1 trillion – Western Europe
3. $ 1.9 trillion – North America
4. $ 217.1 billion – Central & Eastern Europe
5. $ 114.4 billion – Middle East & Africa
6. $ 76.3 billion – Latin America

IoT adoption in Retail Oil Outlets causes consumer demand to increase by 3.7% (Robert Moriarty, 2015).

Opportunity loss without IoT in Indian Public Sector Retail Oil Outlets

The literature review revealed that there is an *Opportunity Loss of Rs 1569 crores* for 2014-15 without the adoption of IoT in the PSU Retail Oil Outlets. The calculation of Opportunity Loss is as follows:

Product	**Consumption in 2014-15 (Tonnes)**	***3.7(%) Increase in demand due to IoT (Tonnes)**	**Barrels**	**Opportunity loss for 2014-15 ($)**	**Rupees**
Petrol	18,587,000.00	687,719.00	5,866,243	54,516,952	
Diesel	68,700,000.00	2,541,900.00	18,962,574	176,225,521	
Total	87,287,000.00	3,229,619.00	24,828,817	230,742,473	**15,690,488,184 =1569 crores**

Table 2

Total Consumption of Petrol and Diesel in 2014-15 in the Public Sector (Tonnes)	Total Consumption of Petrol and Diesel in 2014-15 in the Public Sector (Barrels)	Average Gross Refining Margin (GRM) of Public Sector Refineries ($/barrel) for 2014-15	Total Refining margin of Petrol and Diesel for Indian Public Sector Refineries ($)	Rupees
87,287,000.00	671,049,110.00	9.29	6236283062.27	424,067,248,234 = 42,406 crores

Table 3

Gross Refining Margin (GRM) of Refineries ($/barrel) for 2014-15	
IOCL	10.77
BPCL	8.55
HPCL	8.56
Average	**9.29**

* As per Cisco's report 'A New Reality for Oil and Gas' (Robert Moriarty, 2015), there is a 3.7% increase in consumer demand at Retail Oil Outlets due to adoption of IoT

- Exchange rate: 1 USD = Rs 68
- 1 metric ton = 8.53 barrels (Petrol)
- 1 metric ton = 7.46 barrets (Diesel)

Source: http://www.eia.gov/cfapps/ipdbproject/docs/unitswithpetro.cfm

Sources: Indian Petroleum & Natural Gas Statistics by Ministry of Petroleum & Natural Gas Petroleum Planning and Analysis Cell

Research Problem

People, Processes, Data, and Things are not connected through Internet of Things (IoT) in Indian Public Sector Retail Oil Outlets resulting in Financial Opportunity Loss.

Research Gap

The entire literature was unable to provide IoT enabling factors for enhancing employee productivity and operational efficiency in Indian Public Sector Retail Oil Outlets.

Research Question

What are the IoT enabling factors which will help increase employee productivity and operational efficiency in Indian Public Sector Retail Oil outlets?

Research Objective

To identify IoT enabling factors responsible for increased operational efficiency and

employee productivity in Indian Public Sector Retail Oil Outlets.

Research Methodology

The mode of inquiry used was 'survey' employing predominantly closed ended questions therefore the quantitative research methodology was used for analysis.

Sampling Procedures

Target Population

The target population for the survey was employees and ex-employees of Bharat Petroleum Corporation Limited (BPCL), Indian Oil Corporation Limited (IOCL) and Hindustan Petroleum Corporation Limited (HPCL).

Sampling frame

The Sampling frame for the survey was the employees and ex-employees of BPCL, IOCL and HPCL who were involved in the downstream business.

Sampling unit

The sampling element was defined as those who are/were involved in the Downstream Retail Oil Outlet business in BPCL, IOCL and HPCL.

Sampling technique

Non Probabilistic Judgmental Sampling was used during the data collection process.

Sample size

The sample size of 402 respondents was considered for this research work. This number was determined through Yamane formula $n = \frac{N}{1 + N * (e)^2}$

Where

n - Sample size;

N – Population size;

e - Acceptable sampling error.

The population size (N) was taken as 150,000 and the acceptable sampling error (e) was taken as 5%

Instrument design

Based on the published reports, case studies, research papers, annual reports etc. the key IoT enabling variables for increased operational efficiency and employee productivity in Global Retail Oil outlets were identified. A semi-structured interview was conducted to finalize the list of variables by subjecting it to 15 respondents for designing the questionnaire. The enclosed questionnaire was sent to the 1st respondent and based on his/her input, the questionnaire was modified. Thereafter it was sent to the 2nd respondent and the same process was followed till the saturation of the variables occurred. The questionnaire was handed over predominantly in person.

The following three variables were eliminated based on the responses of the respondents.

- Sensor and hardware producers
- Mass Market
- Market Share

The finalized list of IoT enabling variables is given below:

- **Data security –** IoT enables secure payment through Smartphones
- **Faster decision making –** IoT enables decisions to be taken faster through analysis of the data
- **Customer insights –** IoT provides customer insights through predictive analytics
- **Security risks –** Customer data and security risks need to be addressed effectively for effective IoT implementation
- **Customer experience –** Refueling experience significantly increases at Retail Oil Outlets through IoT
- **Connecting Customers' mobile phones to petrol pumps** – IoT provides information on the nearest Oil Outlet, shortest route to the Outlet, track the chain of past transactions, payment modes and offers smart discount offers to customers
- **Increased in-store sales from formerly fuel-only customers –** Personalized offers bring more customers to Convenience stores who used to formerly only refuel at the pump
- **Convenience –** Apart from cashless transaction, IoT can help a customer can identify closest parking spot, alerts the driver when the vehicle runs low on fuel and navigates the driver to the nearest Retail Service Station
- **Customer expectation –** IoT can provide value, flexibility, simplicity and options to customer
- **Customer Relationship –** IoT can help provide value based on relationships with various stakeholders
- **Brand value – B**rand value significantly increases as a result of IoT adoption
- **Workforce at Outlets –** IoT adoption significantly reduces the work force at Retail outlets
- **Marketing –** Communicating the value of the IoT adoption to prospective customers will enhance sales
- **Return on Investment –** IoT helps generate superior returns and increases the return on R&D investments
- **Automation of manual processes –** Many of the manual processes could be automated through IoT
- **Cost Optimization** - IoT holds the key to cutting costs in Retail Oil Outlets
- **Efficient new method for performing existing tasks** – IoT enables the existing tasks to be executed faster and provides new ways of delivering services
- **Cashless transaction** – It involves scanning a QR code at the pump, selecting how much fuel to be

refilled without having to pay through wallet

- **Process Optimization –** IoT enables optimization of processes at Retail Oil Outlets
- **Generation of New revenue stream –**IoT enables to sell new products and services at Retail Oil Outlets thereby enabling fuel retailers to gain new revenue streams Example: Usage based insurance policies
- **Competitive Advantage –** IoT presents a new means for the business to build competitive advantage.
- **Application Service Provider –** Service Providers need to be engaged with for interpretation and analysis of generated data
- **Wearables –** Wearable watches increase collaboration with workers
- **Sensors –** They collect information about physical assets to monitor status or behavior. They can monitor inventory on real time basis.
- **Asset optimization -** Sensors can track assets and equipment on a real time basis; this can help the business to run preventive maintenance
- **Business value –** Connected devices can unlock tremendous business value for Retail Oil Outlet business through cloud storage.

Pilot testing

Based on the list of the finalization of the variables, a questionnaire was prepared and pre-tested with 30 respondents for checking its reliability.

Administering of Questionnaire to the wider stakeholders

The questionnaire was then administered to a total of 402 respondents. The respondents were asked to respond on a 1-7 likert scale. The responses to the questionnaire were sought through email and also through in person.

Factor Analysis

The responses of the 402 stakeholders were taken on a 7-point Likert scale and subjected to Factor analysis. The sampling adequacy was checked using the Kaise-Meyer-Olkin (KMO) test. The KMO score was 0.715 which is adequate to proceed with Factor Analysis.

Table 4: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling		
Adequacy.		.715
Bartlett's Test of Sphericity	Approx. Chi-Square	3791.459
	df	325
	Sig.	.000


9 Factors identified from factor analysis
Customer Focus
Increase in Operating Profit
Differentiation
Value to Customer
Adoption of latest technology
Enabling IoT Ecosystem
Connected Objects
Better usage of customer data
Partnership with IT Service Provider
Increasing efficiency and productivity through IoT in Indian Public Sector Retail Oil Outlets

Figure 1

Data Analysis

Factor analysis was used to group the 26 variables identified under 9 factors based on their co-relations. The 9 factors obtained from statistical analysis are given below:

Variables grouped as different factors

(Factor 1) Customer focus

- Customer experience
- Customer Expectation
- Customer Relationship
- Brand value
- Workforce at Outlets
- Marketing
- Process Optimization

(Factor 2) Increase in operational profit

- Return on Investment
- Automation of manual processes
- Cost Optimization

(Factor 3) Differentiation

- Generation of new revenue stream
- Competitive advantage

(Factor 4) Value to Customer

- Faster decision making
- Business value

(Factor 5) Adoption of latest technology

- Efficient new methods for performing existing tasks
- Cashless transaction

(Factor 6) Enabling IoT ecosystem

- Security risks
- Connecting Customers' mobile phones to petrol pumps
- Increased in-store sales from formerly fuel-only customers
- Asset Optimization

(Factor 7) Connected Objects

- Wearables
- Sensors

(Factor 8) Better usage of Customer data

- Customer Insights

(Factor 9) Partnership with IT Service Provider

- Convenience
- Application Service Provider

Conclusions and Recommendations

Consumers expect the features of convenience, reliability and safety from products and services.

Customer Focus

Apart from cashless transaction, IoT can help a customer can identify closest parking spot, alerts the driver when the vehicle runs low on fuel and navigates the driver to the nearest Retail Service Station. IoT can help create more sustained value through moving from a one-time transaction focus to a continuous, relationship focus with customers, suppliers, workers and assets. IoT provides information on the nearest Oil Outlet and provides the shortest route to the Retail Oil Outlet on the Customer's Smartphone mobile app.

Increase in Operating Profit

IoT can enable to sell new products and services at Retail Oil Outlets thereby enabling fuel retailers to gain new revenue streams. IoT can help generate higher profits at Convenience stores through optimizing the inventory and merchandise, pricing and promotion. The Smart pump can ascertain the mileage of vehicles which in turn enables an insurance company to measure mileage and determines premium payments.

Differentiation

Automation and Innovation need to be vigorously embraced by the PSU Downstream companies where they seem to be lacking as compared to the Integrated Oil and Gas majors.

Value to Customer

Improved refueling experience, business outcomes, smarter discount offers at convenience stores, cashless transactions using Smartphones are some of the attributes that the IoT can provide to customers at Retail Oil Outlets.

Adoption of latest technology

Predictive Analytics coupled with Cloud enabled solutions can correlate the profiles of consumers with the respective fuel purchases at Retail Pumps along with any in-store purchases. Through analysis of the data, attractive discount offers can then be provided on the user's smartphone. IoT can also enable to provide dashboards on the customer's smartphone relating to the inventory of fuel, consumption rate, when to replenish fuel, monitors tyre pressure and provides signals when to refill the tyres.

Enabling IoT Ecosystem

The refueling experience significantly increases at Retail Oil Outlets through IoT enabled ecosystem. Personalized offers can bring more customers to Convenience stores, who used to formerly only refuel at the pump. Indian Public Sector fuel retailers can boost sales of their convenience stores through connected marketing.

Connected Objects

Sensors collect information about physical assets to monitor status or behavior. They can monitor inventory of lubricants and fuel stored at underground tanks on a real time basis. IoT enabled sensors can be used to monitor power use, tailor the operation of equipment to business hours, provides information on customer traffic and even weather conditions at the Retail Oil Outlets. Wearable watches can increase collaboration with workers at the pumps.

Better use of customer data

Connecting the unconnected objects results in the huge generation of data. IoT provides customer insights through predictive analytics such as tracking the chain of past transactions and payment modes. Predictive Analytics tools help generate actionable Customer insights through the churning of Customer data. These insights should be used to provide smarter discount offers to customers at convenience stores associated with PSU Retail Oil Outlets.

Partnership with IT Service Provider

The PSU Downstream companies need to leverage the partnership with their respective Application Service Providers' for effective implementation of IoT at their Retail Oil Outlets for interpretation and analysis of generating data, it will also automate their business processes.

Implications of the Study

Identified were *Customer focus, Increase in Operational Profit, Differentiation, Value to Customer, Adoption of Latest Technology, Enabling IoT Ecosystem, Connected Objects, Better Usage of Customer Data and Partnership with IT Service Provider*. These 9 factors can be leveraged by the Indian Public Sector Downstream Oil Companies for implementation of IoT at their Retail Oil Outlets.

Appendix A. Abbreviations

BPCL – Bharat Petroleum Corporation Limited

GRM - Gross Refining Margin

HPCL – Hindustan Petroleum Corporation Limited

IOCL – Indian Oil Corporation Limited

IoT – Internet of Things

IT – Information Technology

KMO - Kaise-Meyer-Olkin

PSU – Public Sector Unit

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Marketing in current times: Challenges and Opportunities for companies making consumer products and providing consumer services in India

Dr. Prateek Kanchan*

**Professor & Director, B. K. School of Business Management, Gujarat University*

Abstract

Current time portrays a lot of challenges to marketers of all types in all industries. Organizations operating within India, whether Indian companies or foreign companies operating in India are a part of this market and they all are passing through these challenges with varying degrees of success in their endeavors. It does not matter whether a company is operating since India's independence or has been operating since any year after 1947. The pressures and challenges for all companies are there and customers/consumers are not giving any special consideration to an old company as compared to a company which has recently started. It is for everyone to see the level of aggressive marketing resorted to by companies old or new or very new also. No industry is aloof from this phenomenon. It may be more in some industries as compared to other industries, but all industries are a part of this ever dynamic marketing action resorted to by companies making consumer products and providing consumer services in India.

Keywords: Marketers, challenges, products, services.

Introduction

Marketing has all along faced challenges ever since competition has intensified. In fact, it will not be an exaggeration to say that competition breeds marketing. However, the reverse is also true as more and more marketing generates competition within and across industries as well as geographies. In India, ever since liberalization was given a major boost in 1991 by the then Central Government of late Prime Minister, Mr P.V. Narsimha Rao (1991-1996) as well as during subsequent governments till the end of the 20th century as well as the current times, of the 21st century, marketing and competition are major activities for the players in all industries. Providers of all products and services are constantly engaged in the marketing of their offerings which has strong connection

with the competitive space of which they are a part. This competitive space constantly expands and with this expansion all marketers within this space keep on changing/modifying their competitive activities.

Challenges and Opportunities for companies in marketing their offerings

Challenges and opportunities are considered as counter to one another, but in marketing, these are considered complementary by dynamic organizations and marketers working with them. It all depends upon how creative and ambitious the company and its marketers are which in turn will always be the foundation of converting any challenge into an opportunity in the existing or potential market. The focus of this article/paper is to see and interpret the challenge/s which had and can become opportunity/ies in the past as well as future these can be traced from the four Ps of marketing which is the very essence of this discipline.

Product:

The challenge with the product is its life and the changed expectations of the people from it. At times, expectations of people from a product as well as a service change/increase through their own motivation and at some other times companies motivate these expectations. Sometimes, these expectations change due to peer influence or influence of other societal players. Numerous examples are there in this direction. I will share some example in these cases, although there may be numerous examples in each category.

Expectations of people change for the product/service through their own motivation.

When consumers are using a product/service for a long time, they start expecting more of the same and with this there perception of the provider company also undergoes a sea change. Whether it is a mundane household item or a luxury car or even a star cruise across the world, this tendency of consumers performs its role regularly and without fail. All the companies in all categories, be they Fast Moving Consumer Goods (FMCG) companies, Consumer Durable companies, Consumer service providers etc. have been experiencing this since time immemorial. When a company comes out with a car, it may be meant for a particular number of people to be seated, but the users may use the same car for a number of people and they expect the company to help them out in the new model even if it requires more price to be paid. This changed expectation of customers can be accessed through consumer research done from

time to time. Maruti Suzuki started with small cars and was all for its promotion since early 1980s. However, from that time till the current times (2016), it is strongly known also for big cars as well as small cars. The same can be said for many packaged food items. Ready to cook food in packages started getting promoted by companies as a change from routine foods in the beginning. Later on, consumers started buying them in bulk to take advantage of their long shelf life and started using them as organized food items regularly as breakfast, lunch, and dinner. This all added the responsibility of companies to produce more to meet enhanced demands and promote their offerings differently with more creativity.

Instant noodles are a classic example here. Initially started as a snack to be had off and on, it gradually became a staple diet for many households across the country resulting in its demand multiplying in a big way. Numerous brands came and tried their luck in the ever increasing market of Instant Noodles. Maggie from Nestle happens to be the most prominent here. However, it faced a serious problem in early 2015 over a debatable and controversial content in it, thereby resulting in a countrywide ban after the harmful contents were verified by some certified laboratories in the country. Eventually, it made a comeback in late 2015 after overcoming the controversy considerably. It is a dynamic phenomenon which is only increasing and expanding with time. These are some examples from some industries. There are numerous examples from different industries.

Expectations of people change for the product/service through company motivation.

It is not always that consumers motivate companies through their behavior. At times, companies do a lot of things which makes consumers try something out of curiosity, or for a change. It dawns upon companies that this trial by an individual or a group of individuals could get researched leading to a modification in product/service design, usage, communication, etc. When micro-wave technology came up with some select functions of cooking getting served by it, slowly but steadily, consumers across all strata of society started accepting it. It made people plan their lives in such a manner that cooking started appearing attractive to people instead of a cumbersome, time-consuming task as early. Not just a micro - wave oven, but appliances like Oven Toaster Griller (OTG), Hand blender, Induction cook top, Chimneys etc revolutionized India kitchen to a great extent and currently kitchen has become a good

activity area for lots of people in many families, thereby generating a lot of demand for many things used in the kitchen. In turn, it makes a lot of business sense for companies making such products to advertise and promote them for further development of business. Real estate companies have adopted a robust marketing practice right from the point of legal approvals till selling their houses or commercial properties to their buyers.

In the 21st century, buyers of houses or commercial properties are motivated by the promoters themselves to expect the best deal with the most agreeable price. Till the end of the 20th century, whether it was a metro city, state capital or any other prominent city of India, property was bought majorly to reside comfortably in it or to run one's own commercial activity from it. Not many of the buyers bought it with reselling as the major purpose, although some might have done it. Now, the advertisements and promotion of the real estate developers are put in such a manner that a buyer takes himself or herself as a business person negotiating a property to resell after a particular point of time, thereby reaping a good dividend out of it. This has motivated real estate developers come up with houses and commercial establishments which have re-sale value for a long term.

Expectations of people change for the product/service through the motivation of peers, society etc.

All of us as consumers are a part of a vast expanse of social network which includes family, friends, colleagues, etc., which is very dynamic in the context of its regular impact on our decision making with respect to buying or not buying products and services from time to time. These multiples sets of people to which we belong simultaneously constantly change our expectations about and from products and service which we use. We do give varying importance at times to the opinions of such peers while buying a car, or a kitchen appliance, or a tour package, an insurance policy, etc.

It is so important that if a single person in our peer group has had an experience, positive or negative about any product or service used by him or her, it translates considerably in all of us depending upon the respect which he or she commands in our group. It motivates companies providing various products and services to find such opinion leaders from among people at various social and geographic levels in various markets and make them influence their respective circle positively from time to time.

For negative word of mouth, companies have nothing to offer except an open apology through various media channels.

Price:

This P of marketing is very important for companies to face as well as ward off challenges to marketing their offerings across markets. The biggest challenge with the price is its justification over time. On the one hand, if the price remains constant for a long time without any clarification, as compared to the continuously reducing prices of the competition, consumers/customers may interpret it as arrogance on the part of the company although the company may be justified in continuing with the same price on the grounds of quality, service etc.

On the other hand, if the company continuously reduces the price whether the competition does it or not, and gives a tough fight on the basis of reduced cost due to increased demand, consumers/customers may perceive differently and start doubting the quality of the company's offering. If the company increases the price for better service, quality, etc. and does not explain it to the market, regardless of the competitive action, then also consumers/customers will have complaint. So, every company faces this dilemma about handling possible consumer/customer reactions/outcomes, whether price increases, decreases or even if it remains constant. So what is the way out? It is important for the company to explain in less and simple words, any action which it takes vi's-à-this price of its offerings while taking action. In other words, the action related to the price must be accompanied by a smart, short, and a crisp educative advertising campaign justifying the price increase, decrease, or same price without offending the feeling of the consumers/customers.

We come across FMCG products, consumer durables, kitchen appliances and home furnishings etc., which highlight price changes as a tool to come closer to different types of consumers/customers who get impressed with different price changes from time to time. Every time, the company has to justify the increase, decrease, or the constancy of the price. Otherwise, it backfires in a very bad way. Moreover, interpretations derived by consumers/customers spread like a strong word of mouth, which is good if it is positive, but can be very harmful, if negative. The company has to make sure that positive word of mouth is generated and not a negative one. It will be

covered more in the head of 'promotion' further.

Place:

In the current dynamic world of marketing, the location of the product or service offered for selling, whether offline or online, matters very much. The multiple points of sale on the one hand offer choice to consumers, and on the other hand, sometimes lead to confusing the consumers about the best point of purchase. Whether it is a colony Kirana store or a department store in a community center or, a big supermarket on a high street, or a completely on-line store linking the consumer/customer with all possible brands on earth, place of actual selling has become very dynamic, and convenient. However, it also makes consumers/customers confused at times as to which is the best place to buy. Companies use all placement options as consumers/customers find the same brands available at all options. It becomes necessary on the part of companies to make the consumer/customer feel satisfied when he or she purchases from any outlet at any given point of time. As different outlets offer same products with different price, consumer/customer satisfaction is not easy.

However, there is no option for the companies than to satisfy their audiences regularly.

Promotion: This P of the marketing mix talks about the most optimum mix of integrated marketing communications tools in order to make the product or service offered or to be offered known, liked, preferred, accepted, and as well adopted across the targeted audience. It goes much beyond advertising, and includes tools like sales promotion, publicity and public relations, internet promotion, interactive media, corporate advertising, etc. It depends upon various factors related to the company as a whole as well as the brand to be promoted as to which tool or mix of tools to be used and for how much time after which the mix needs change on the basis of market feedback which should be constantly taken.

All types of products and services use promotion in varied forms and types in order to create, maintain and increase their presence in the market. However, not all are very successful in this activity. What differentiates the successful and not so successful promotions is the dynamic mixing of the promotion tools and the timing of its implementation keeping in mind the market dynamics. At times, if the goings get tough, howsoever genuine the brand and its promotion might be, it helps in promoting less or taking a break from it and coming back with renewed vigor later on.

Maggie noodles from Nestle did the same in 2015 in India, while facing a crisis due to a suspected harmful ingredient in it. In other words, promotion just does not mean shouting from the rooftops whether it is required or not. Moreover, in the current times, of excessive competition across categories and geographies, smart promotion is required and not just same high sounding promotion throughout the year, year after year.

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Multilateral Perspectives of Offering Incentives to Demand Response Programs

Rajeev Ramalloor Alasseri*, Ashish Tripathi**, T. Joji Rao*** and K. J Sreekanth****

**Kuwait Institute for Scientific Research*

*** Senior Associated professor CoMES, University of Petroleum and Energy Studies*

****Senior Associated professor CoMES, University of Petroleum and Energy Studies*

*****Kuwait Institute for Scientific Research*

Abstract

Peak load management can be tackled by many means, and incentive-based demand response program (IBDRP) is rather the latest and relatively a novel method of demand response (DR) to achieve this. Peak load management has been made comparatively easy by the latest technologies used by DR/IBDRP and, hence gaining reputation among the community. The main attraction for enrolment in IBDRP is the expected financial incentives as a reward towards the curtailment in the power consumption. Improper calculation of the incentives results in the dropping out of participants from the programs. This paper examines the possible factors affecting the estimation of incentives by bearing in mind both consumers and implementers. From the referred literature, establishing an unassailable and unblemished customer baseline is identified as the imperative factor determining the incentives paid to the consumers. Any error in the calculation of it may lead to financial losses to both implementer and consumer.

Keywords

Incentive-based demand response program, customer baseline, demand response

Introduction

From the grid perspective, reducing demand is equivalent to increasing the electricity production. Demand Side Management (DSM) plays a very significant role in reducing the electricity use and one of its major part, demand response (DR) is getting a lot of acceptance in many applications and locations. With the available DR programs, run by different independent system operator (ISO) and regional transmission organizations (RTO) in the United States of

America (USA),the potential peak reduction of a massive 28798 MW and 28934 MW was estimated for 2013 and 2014, respectively, and this contributes to a reduction of 6.1 and 6.2% of peak power reduction, respectively, for these years[1].

Federal Energy Regulation Commission (FERC) definesDR programsas "changes in electric use by demand-side resources from their normal consumption patterns in response to changes in the price of electricity, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized" [2, pp. 28].The FERC also classified DR into two major groups and subgroups, which areshown in Fig. 1.

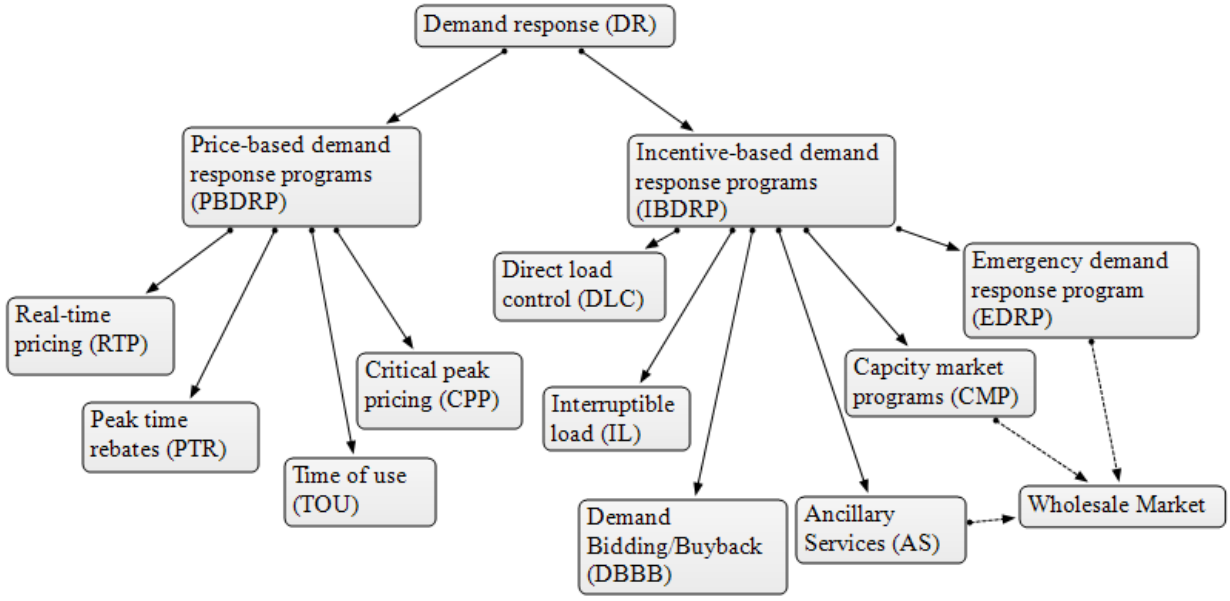

*Figure1. FERC's view of DR***.**

DR is mainly classified into price-based demand response program (PBDRP) and incentive-based demand response programs (IBDRP). In IBDRP, the price of electricity varies with time to match with theelectricity consumption of consumers and the costs they apply on the utility system. Both utility provider and consumer agree on the tariff based on a written contract. Some of the programs under the PBDRP are real-time pricing (RTP), peak time rebates (PTR), time of use (TOU), and critical peak pricing (CPP).

In the IBDRP, consumers receive reward for reducing their electricity consumption upon

request or by allowing implementers to control their electrical load. Some of the commonly used IBDRP are direct load control (DLC), interruptible load (IL), demand bidding/buyback (DBBB), ancillary services (AS), capacity market programs (CMP), emergency demand response programs (EDRP), etc. Among these, AS, CM, and EDRP are operated in wholesale markets, while others are operated in retail markets.

Background

The implementation of DR gives a lot of benefits to both the implementers and the consumers. For the implementer or supplier, the successful implementation of any DR program delays the need for building new power plants or transmission lines [3,4]. Peak load reduction can be achieved by effective implementation of DR programs, by shifting the loads from peak hours to nonpeak hours or by compromising the comfort of the consumers. This will reduce the running hours of inefficient power plants. Some of the DR programs are also used as a reserve capacity for contingencies in the grid. As an example, by increasing the DLC implementation, PJM, a north eastern grid in the USA, covers 20% of its contingency reserve. In addition to improving the grid stability, DR programs can also be used as a tool to optimize the grid connectivity of renewable energy sources such as solar and wind energy [3,4].Other than the ones mentioned above, combating climate change, promoting awareness, generating new jobs and expertise, and reducing the relianceon hydrocarbons are some of the other benefits [5].

Many countries and agencies in the world dealing with power production are interested and engaged in different DR programs. One of the examples is from the USA. Fig.2 shows the increase in the participation of consumers in both PBDRP and IBDRP from 2012 to 2013. From Fig. 2, it is evident that consumers are more attracted to IBDRP, than PBDRP.

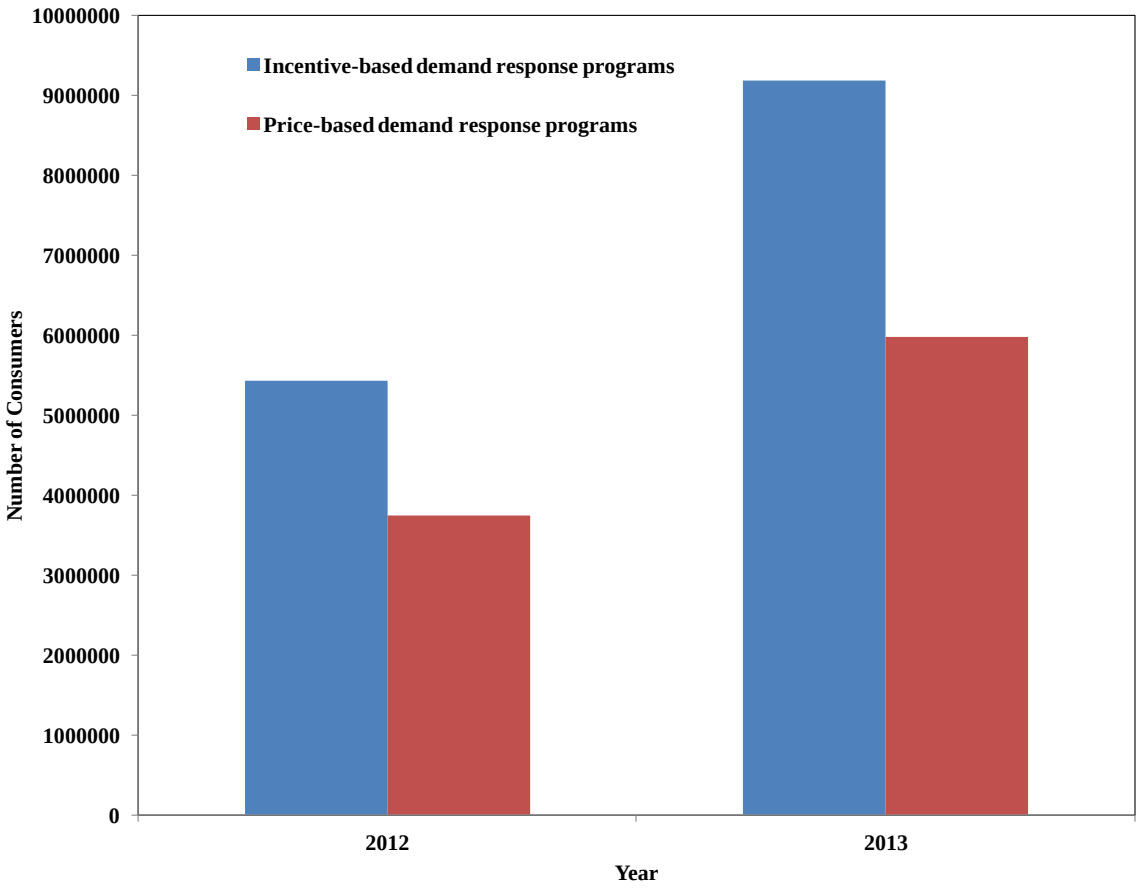

Figure 2. Yearly increase in the enrolment for DR programs in the USA[1].

In IBDRP, different types of incentives are given to participants to alter their electricity consumption. This consumption could be either increasing or decreasing in nature, depending on occasion and situation. The designing of such incentives is not an easy task as it may affect the structure of the system. Compared to high electricity consuming consumers, those who use less electricity will voluntarily participate in the IBDRP to get maximum benefit [6]. However, this may result in some consumers paying less while others paying higher and could be one of the major barriers of implementation.

In addition to receiving incentives, participation in DR programs may reduce the monthly electricity bills of the consumers. These savings come from the reduction in consumption during the peak hours. This will indirectly reduce the expenses required to maintain the electrical equipment in their facility. In some cases, by shifting the operation of loads to nonpeak hours, some consumers are able to increase

their daily consumption without paying extra money [8].

Incentives paid to consumers are highly dependent on the programs they are enrolled in. As an example, IBDRP with an emergency nature like EDRP pays more incentives than other programs, due to the high requirement from the generation side [9].

Even though consumers are more attracted to IBDRP, many dissatisfied consumers are leaving the programs too. Based on the literature referred, it is learned that consumer satisfaction is highly related to the incentives they receive. It is also learned that the main reason behind the dropouts is related to the insufficient incentives.

Objective

Objective of this work is to expose the major factors influencing the consumer participation in the IBDRP and role of incentives for the same, both in the consumer and in the implementer's perspectives.

Consumer perspective

From the referred literature, some of the factors related to the user participation in the IBDRP are identified, which are shown in Fig. 3.All consumers, those who are participating in the IBDRP programs, need to make some compromises, which will be rewarded in the form of incentives.

Methodology

Document analysis was conducted in detail to meet the specified objective. Different keywords such as DSM, DR, IBDRP, PBDRP, incentives, consumer satisfaction, etc. were used to search associated documents in various channels of information. A total of 62 documents were referred, which included government reports, company reports, research articles, research thesis, and journal and conference papers etc. After scrutinising the documents, relevant and irrelevant documents were identified and separated. Later, twenty five selected documents were analysed in detail and emerges with the following results, which is presented in the following sections.

Results and discussion

Here, results pertaining to factors influencing consumer participation in consumers' as well as implementers' point of view are explained exhaustively.

However, there are also some threats associated with receiving these incentives. Some of these threats are detailed below.

One of the mandatory requirements for implementing the DR programs is the installation of smart meters. Smart meters are connected to computer networks, using the communication system, to collect data instantaneously. With a proper recording facility, these data can be stored for long durations and can be retrieved easily whenever required[10]. With traditional meters, gathering instantaneous and historic data is not possible. Without this, establishing some of the most important parameters, such as customer baseline (CBL), which is used for calculating the savings, cannot be carried out. Therefore, the implementing agency should take necessary steps for educating consumers about the importance of smart meters. If the cost of smart meters needs to be borne by the consumer, they should get a fast payback. This also creates a confusion among the consumers, regarding their participation in the program, which is considered here as a threat. If the payback period is going to be longer, participants may not be having any interest in joining the DR program. Also, the extra cost of the meters will be a burden on a financially weak community [5]. In many cases, consumers show resistance in changing their traditional meters to smart meters due to the threat related to privacy issues. Since the data of electricity usage data are connected through computer network, hackers can easily identify the occupancy of users in their respective houses by hacking the information. Implementers should take necessary steps to avoid such threats and win the trust of consumers. As the incentives paid to the consumers are directly related to the calculation of CBL, the accurate calculation of CBL is very vital for the consumers. The importance of CBL from both the implementer's and the consumer's perspective are detailed in section 5.3 (customer baseline).

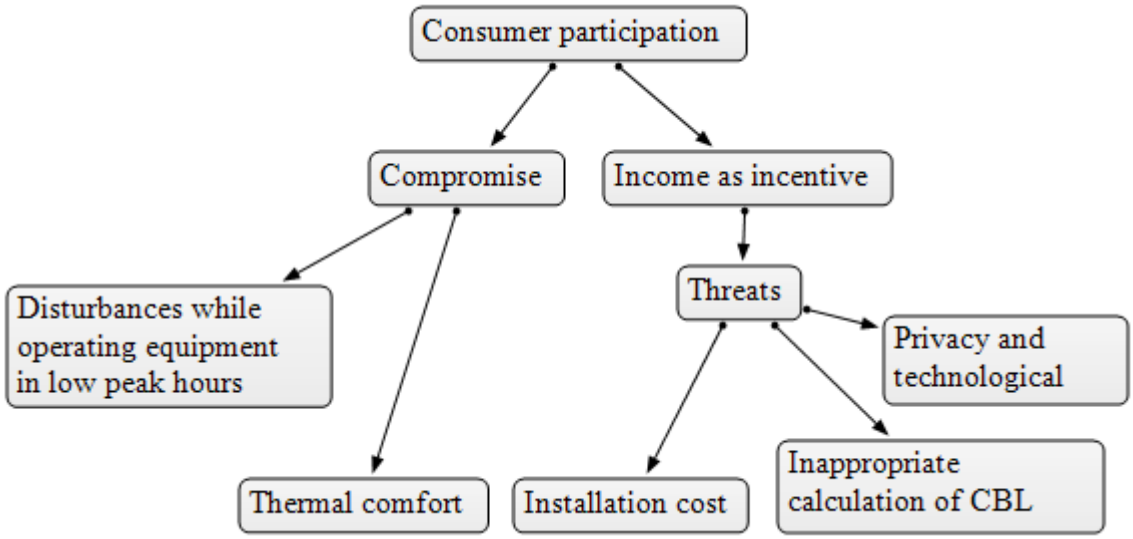

Fig. 3. Factors related to consumer participation

As mentioned earlier, to receive incentives, consumers have to make some compromises in their quality of life. Some of these compromises are identified and given subsequently.

In some classical IBDRP such as the DLC and the IL, implementers automatically cut down the load of the users irrespective of their activities. Air-conditioning (AC) units are considered to be a potential load for such programs. Generally, switching off the AC unit for 15 minutes during the peak power period will not have much effect on the indoor comfort [3,11]. However, a lot of parameters, such as ambient temperature, number of people in the affected area, type of activity, etc. will influence the comfort of the inmates. Even though these create a lot of inconveniences to the users, consumers are left without any choice due to the contractual obligations. In most of the cases, the cost lost for not using electricity is much higher than the incentives they receive [9]. This could lead to the nonrenewal of the IBDRP.

From the referred literature, it is learned that in some cases, when the demand decreases abruptly for a short period of time, the generation companies want to avoid the shutting down of some of their units. To match with the demand, utility companies encourage the consumers to consume more electricity. Normally this will happen during the nonpeak hours. Shift able appliances, such as washing machines and dishwashers can only be operated during this time, which will

disturb the users. Implementers should compromise in comfort is worth the financial incentives they receive, even

Implementer's perspective

Some of the factors related to implementing the IBDRP in the implementer's view is shown in Fig. 4. Here, a detailed cost benefit analysis needs to be carried out to see the feasibility of the program, prior to its implementation. We have categorized the major costs into capital, administrative and incentive payments. Places where proper infrastructure development has not taken place, a huge capital investment needs to be made prior to the implementation. This includes the replacement of traditional meters by smart ones, two-way communication (preferably internet based) between control centre and the buildings, control devices and control systems, etc. [12,13].

Administration costs are operational expenses to run the programs successfully. These include maintenance costs, expenses towards data collection and transfer, cost of

make sure that the consumers feel that the though it is not the real practise and case in demanding situations.

marketing and awareness, evaluation, measurement and verification (EM&V), etc. It is highly important to ensure effectiveness while conducting these programs by using continuous measurement and verification processes. Cost towards E&MV may be higher for the newly implemented programs for the first few years compared to an established program[7].

Nowadays, many channels are available to market any product. Some of the proven effective channels are television, newspaper, community events, radio, door-to-door canvassing, word of mouth, media events, direct mail and telemarketing [12,14,15]. These campaigns should be developed by considering the types of load, weather, demographics of the consumers, etc. As telemarketing and direct mails address the consumers directly, they can have more impact on consumers[15].

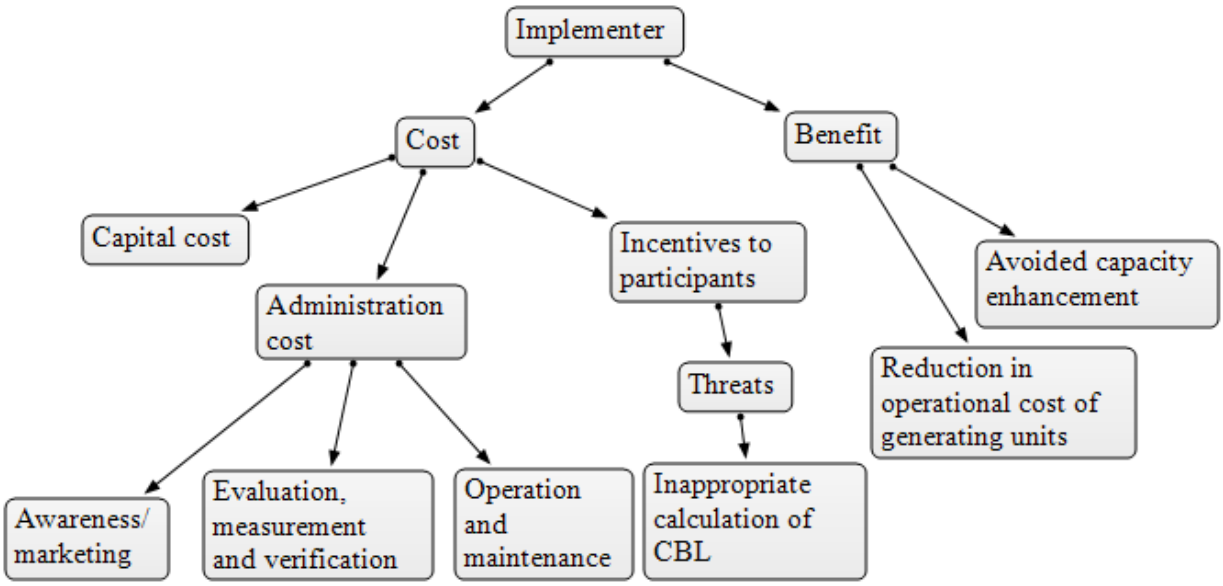

Fig. 4. Factors related to implementation of IBDRP in the implementer's view.

Incentives have a vital role in the DR program and the success of any DR program depends highly on the incentives that consumers receive in turn for their participation [16].A lot of methods are adopted for offering incentives to the participants. Financial incentives are offered mainly in the form of monthly credit, onetime payment, yearly bill credit, etc. [14–17]. One of the nonfinancial incentives is the delivery of free hardware to participants for controlling their loads. As the savings are estimated based on the CBL, inappropriate calculation of it may lead to an extra cost for the implementer. Section 5.3 (customer baseline) explains the problems faced while calculating the CBL and its importance to implementers and consumers.

A detailed calculation of the expected financial benefits from implementing the IBDRP needs to be carried out in all the programs. The main savings are listed under the avoided costs associated with the construction of new power plants and transmission networks. Depending on the country and the type of the power generation technology, this cost will change. The other major saving is from non-operation of less efficient generation units. This saving includes the direct savings of extra fuel required to produce the same amount of electricity, compared to an efficient unit. As the non-operation of such generators will result in the less maintenance of units, this saving also needs to be explored.

Customer baseline

CBL is important for calculating the reduction made by the consumers during electricity consumption. CBL is the base power consumption of any facility, prior to the DR implementation. The power difference between the DR event day and the CBL is calculated to find out the impact of DR on the load [18]. As there is no direct way to monitor load reduction, base load need to be established done carefully as the money paid to the participants depends upon this. Any error in this calculation may lead to overpayment or underpayment to consumers. In most cases, overpaid consumers will continue their participation, while underpaid may leave the program [3,19]. Many ISO/ RTOs adopt different methodologies to calculate the CBL (Table 1).

Table 1. Different methodologies for the calculation of CBL.

Sl. No.	ISO/RTO	Methodology	References
1	PJM	Hourly average of the four highest load days of a similar type from the last 45 days	[20]
2	CAISO	Average of the load during the last 10 eligible days	[21]
3	NYISO	Peak load hour within the last 30 days that corresponds to the event hours	[22]
4	ISONE	Load profile of the last 10 similar days	[23]
5	ERCOT	Statistical Regression Model, Middle 8-of-10 Preceding Like Days Model, and Matching Day Pair Model	[24]

Form the consumer's perspective, having a higher CBL value is always beneficial. There is a high chance that some consumers may increase their consumption pattern for the period, when the CBL is calculated. By doing so, consumers can get more incentives by curtailing their load, as the difference will be calculated by the exaggerated CBL. At the same time, establishing the CBL correctly is highly important to the implementers too. It is the prime task of the implementers to make sure that the CBL is not inflated. Generalizing the CBL is very difficult as each consumerhas his own consumption pattern and this cannot be compared with the theoretical values. By performing proper EM&V, implementers can make sure that the CBL is authentic. However, continuous EM&V may create inconvenience for the consumers and they may feel that their credibility is being questioned repeatedly. Some of the points to be considered for the verification purposes are given subsequently[7,25].

The CBL is supposed to be the actual consumption of a user in normal conditions. The implementer should have the capability to ensure the appropriateness of the CBL value if the DR program is not available. By seeing the size of the house, equipment load and users, the implementer should have the ability to judge whether the given CBL makes any sense or not. This capacity will be developed by the continuous analysis of the past data, comparison with similar buildings, etc. Even though smart meters and communication devices are installed and in service, implementers should ensure that the system is functional to provide power data during both baseline period and DR events. It is also important to make sure that the calculated CBL can be used as a reference for different DR programs in which users are eligible to shift whenever they feel. It will be practically very difficult to calculate the CBL for a facility whenever users change their DR programs.

Conclusion

In the present study, it is proposed to have an innovative and novel methodology to assess the possibilities of various DR programs, by adhering to the theoretical standards and approximatemethods such as the IBDRP.

By understanding the potential of the energy savings of the DR programs, more utility companies are planning to implement such programs, especially the IBDRP. The calculation and distribution of incentives effectively isone of the prime factors affecting the success of such programs. The inappropriate calculation of incentives is a threat for both implementers and participants. These threats can be eliminated to an extent by calculating the CBL in a fool proof manner. Even though CBL can be verified by continuous E&MV, the repetition of such activities makes consumers restless, and they feel that they are not trustable. This could be a major setback to the implementers. Different models are available in the market to optimize the incentives offered to the consumers. Such models can be used for finding the most appropriate incentive rates for the participants. In addition, by using encrypted data transfer between smart meters and data centres, implementers can reduce the privacy-related issues of data transfer. Also, by launching effective marketing/awareness campaigns, more participants can be enrolled into the

IBDRP. A separate program awareness may be conducted forenvironmentallyconscious consumers, to increase their participation, if it is really needed.At present, it is very much cost-effective to introduce the IBDRP to an electricity market where proper infrastructure is available. In the case of the lack of infrastructure, proper financial support from government is needed to upgrade the infrastructure.

The approach used in this study can have many directions, and hence this study can be extended to new areas, such as comparing the centralized DR or IDBRP programs with decentralised ones, in terms of both the interaction between consumers and suppliers and its expenses. Hence, a more realistic and optimised distribution, which encourages a large and substantial participation from all the stakeholders, can be ensured.

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Riding the Oil Tides:
Strategies for Oil and Gas Companies

Kallakuri Ravikanth*, Dr. P C Bahuguna**, Dr. Ginni Chawla***

**Training Specialist Dolphin Energy*
***Associate Professor, University of Petroleum and Energy Studies*
****Assistant Professor, University of Petroleum and Energy Studies*

Abstract

Energy from the Oil and Gas undoubtedly ruling the World's energy landscape as the ever growing population needs cheaper access to energy and fossil fuels remain the Primary fuel for many emerging economies. In this paper we will examine two main things the organizations need to be focused on, namely The People and The Process, so that they can ride these price tides, maintain competitiveness and have sustainable development in the long run. Oil and Gas industries are reinventing themselves how to survive in the low price environment from the last few years. Different ways of cost optimization measures are undertaken by the industry to reduce operating costs, saving capital, deferring new investments or abandoning less profitable ventures etc. By studying the recent trends across the industry and the allied literature, all of the initiatives can be consolidated in to two main verticals and structural changes can be made addressing these two. The Oil price variations invariably depend on the Global financial cycles, Geo-Political conflicts between the countries and speculative trade. Most of the National Oil and Gas companies are State controlled and their Government's has a say on their day to day affairs, politicizing their decisions rather markets determining the real price depending on the classic Supply-Demand model. One of the first moves from the industry during the low price environment is to reduce the head count or Human Resources. For sure it reduces their budget and related costs build will be detrimental in the long term. This is due to the time taken by the new workers and the cheaper contractual workers to get accustomed and attain the skill levels required for the job. This can improve the bottom lines and the new approach will continue to strive across the organizations. Industrial Internet of Thing's (IIOT), Process data analytics and Operations

integration across the human resources can be used. Process improvements should be made by using data analytics and sharing the data at multiple verticals to get effective solutions and reduce the downtime of the processes.

Introduction

Modern energy is fundamental to our standards of living and for meeting people's energy needs companies continue to expand in the most efficiency way. The energy industry is one of the huge industries and is continuously growing. Energy is connecting different regions through the energy trade. Meeting the energy demand is an ongoing challenge for the industry, the scale of supplies required to meet the needs of more than 7 billion people each day is huge and requires significant investment and stability of prices. The share of crude oil represents one-third of the world's energy consumption and is about 95 million barrels a day[1]. Lower oil prices have reduced growth, opened up large budget and trade deficits and increased financial stability risks to the organizations during this turbulent time.

Organizations across the world are scrambling their resources to address the issues pertaining to their day to day affairs and are reinventing themselves on a constant basis as to be more efficient through less usage of energy. Organizations are doing this by increasing productivity, shutting down or closing business operations which are not profitable, deferring investment decisions which are not sustainable in the long run and reducing man power (human resources) across the organizations. As with the saying, "knowledge is divine," the organizational knowledge is deposited and held within the documented practices, internal procedures, policies, strategic plans, etc.

The objective of this paper is to study different aspects of optimizing the operations across organizations by addressing two core areas, namely People and Processes. Both of these are discussed in the context of the oil and gas industry. The present situation across industry is reviewed, followed by the decisions taken by operating companies to curb costs in the state of rising oil prices and consequently the effects of such practices on organizations is studied.

Review of Literature

Energy is Fundamental

Energy is vital in our everyday lives and is virtually needed in every aspect of modern life. Energy derived from Oil and Gas plays

an important role in the development of economies throughout the world economic growth, new energy sources and technological developments are creating new jobs for the growing population and sustainable development.

Crude oil and its derivatives continue to be world's leading fuels, driven by energy demands from growing middle class population in developing countries. The Natural gas and other hydrocarbon liquids/derivative prices varies in tandem with the Crude oil price and hedged together. Natural gas usage across various sectors is growing rapidly due to its ease of use and transportation, and relatively fewer emissions compared to oil and other fossil fuels. 40% of the growth in global energy demand during 2014-2040 is projected from the natural gas, being the cleanest among the Other fossil fuels[1]. China and India will alone account for half of the growth in global energy demand by 2040,with remaining 30% coming from a group of 10 Key growth countries, namely, Brazil, Mexico, South Africa, Nigeria, Egypt, Turkey, Saudi Arabia, Iran, Thailand and Indonesia[1]. The world oil & gas markets are now shifting to Asia from the traditional Western & European markets. Asia, in particular India and China will lead the world in terms of population size, its pace of growth in the standards of living and energy usage. As the countries continue to expand, they need energy to sustain the growth, fuel higher levels of productivity, boost investment climate, improve living standards of the rising population and eradicate poverty.

Historical Crude Oil Prices (USD)

We can see in the chart below that from the year 1970 to 2015, Oil prices reacted to a variety of Geo-Political, Social and Economic events across the world. The prices slumped from their highs many times, notably in 1986, 1998, 2003, 2008 and 2015, each time have the own reasons to recover back to a certain extent. Under the effects of global financial meltdown (2007-2008) and in the middle of global financial crisis, oil prices peaked at $145.85 and on 12 January 2016, crude oil dropped to as low as $30 for the first time since December 2003. Emerging economies across the world are largely affected due to the ballooning oil import bills, decreasing domestic growth, budget deficits and drastically reduced state spending.

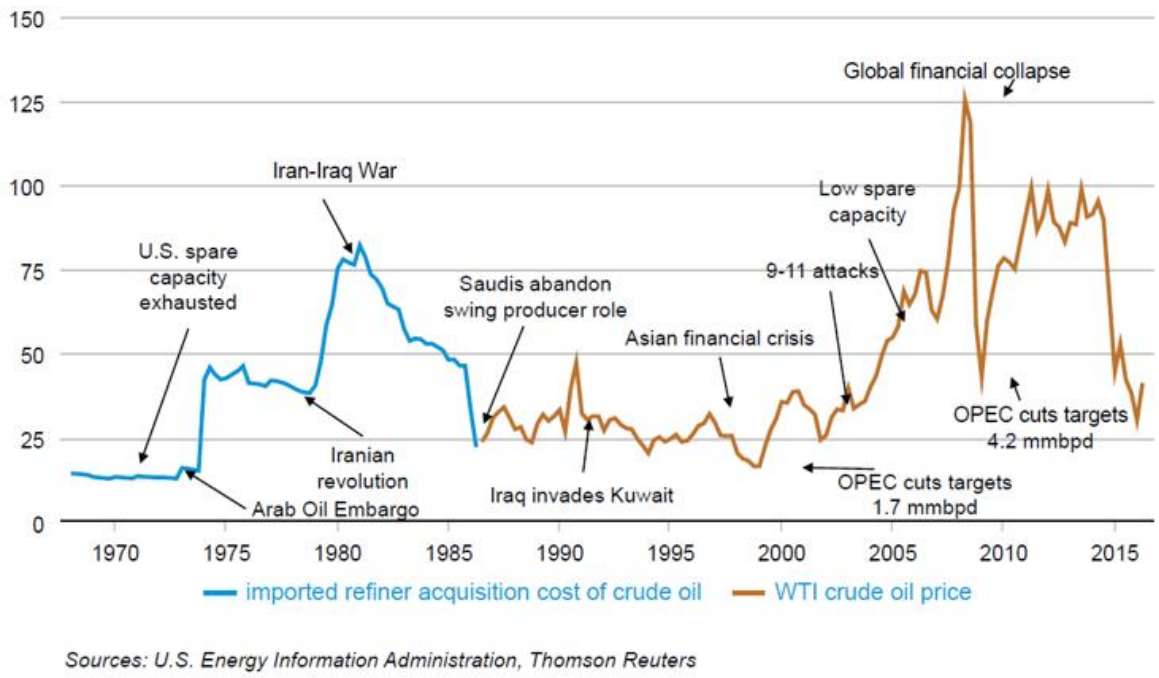

Fig1: Historical chart of cost of crude oil

This has resulted in uncertainty about where the oil prices are heading and consequently less spending on fuels across the world, further slowing down their demand. The downward trend continued as the importing countries reduced or deferred their shipments, excess supplies flooded the markets from exporting countries, which ramped up productions in the high price environment, filling up of inventories across the world etc.

United States of America (USA), the world's largest consumer of oil and gas, become a net exporter of energy rather than the importer, thanks to the U.S Shale Oil\Gas revolution. But the breakeven prices for the shale producers in USA and other high cost producers such as Canadian Oil Sands, Heavier crudes from Venezuela etc. are much higher than the current oil prices. Many of the producers either shut down their production or optimized their operations to sustain the production and bleeding the balance sheets, with even some producers become to bankrupt. Energy markets are in a constant turmoil due to the geopolitical situations ranging from Syrian civil war, ISIS invasion of Iraq, Turmoil in Libya etc.Ramp up of oil production from Iran post listing of international sanctions, excess supplies from Iraq due to political stability, increasing Russian supplies to Europe and Asia etc. causing excess

supplies to the already saturated markets, and the OPEC (Organization of Petroleum Exporting Countries)policy of keeping their quotas unchanged to gain market share further contributed to the low price environment.

Rescuers for Low Oil Driving Sector Consolidation: People and Processes

Oil's horror show has seen the Black Gold's price come down to historic lows and the commodity's collapse has threatened the industry's creditworthiness by hurting cash flows, drying up liquidity and narrowing profit margins. Oilfield services companies have been some of the hardest hit by diving commodity prices as top energy companies have resorted to spending cuts (costly upstream and deep water projects) owing to lower profit margins. This is leading to the cancellation or contract renegotiations from the equipment suppliers further eroding their investment decisions.

The two main things that can be consolidated to address the needs of organizations notably are People and Process. They are always interconnected and have to be addressed together so that the organizations can sustain their momentum and be competitive in the industry.

People

The biggest challenge for Oil and Gas Companies is to find the right talent at the organizational level. The challenge is to identify the right competencies that will give organizations an edge over their competitors.

Human resources are a term used to describe the individuals who comprise the workforce of an organization. Human resources in an organization are also charged with the overall responsibility for implementing strategies and policies relating to the management of staff.

Competency is an underlying 'characteristic' causally related to superior job performance. In any business strategy, people are more critical than the plan. Strategies or plans can be effectively implemented only when organizations have a competent workforce[3]. Global competition has prompted the organizations to restructure, resize production methods, globalize production and sales, outsource, decentralize, and flatten old hierarchies[4]. Changes at organizational level have impact on the work processes in the organization, which consequently provokes reactions from the teams or individual employees. This is a

continual process of mutual adaptation that works both top-down and bottom-up.

Changing skill requirements, coupled with new training delivery methods and demand for corporate learning strategies can make it difficult for HR professionals to keep pace with others in the industry. Therefore, an in-depth analysis of the target audience, the nature of the training content, and whether the training is focused on knowing or hands on are some of the important criteria to consider when selecting training methods for a global workforce[5].

Developing Technical and Professional Workers

Workplace learning represents a set of processes which occur within specific organizational contexts and focus on acquiring and assimilating an integrated cluster of knowledge, skills, values and feelings that result in individuals and teams refocusing and fundamentally changing their behavior. There are several challenges unique to the development of technical and professional workers.

In the ever changing technology landscape, technical and professional knowledge outdates quickly; that means that workers face skill obsolescence unless their knowledge is updated constantly, and it is a unique problem with individuals who are hired for their specialized knowledge. According to American Society of Training and Development (ASTD), now renamed as Association of Talent Development (ATD), "Half of what is known today was not known ten years ago, the amount of knowledge in the world has doubled in the past ten years and is doubling every eighteen months." Thus, learning how to learn is critical to job success and a crucial way to avoid skill obsolescence. This requires competence in how to learn and a work climate that encourages real-time learning to solve problems and keep skills updated. However, learning how to learn is not taught in schools and the supportive work climate depends on what employers and managers do to foster expansion of knowledge.

Second, employers face the threefold challenge of teaching technical and professional workers: (1) what has been learned in the past based on experience, (2) what has been learned recently about meeting current challenges, and (3) what new developments in the field are on the horizon. This implies that having a robust professional development program is need of the day so that the technical and professional workers efficiency is to be

realized. Many such workers expect such kind of development and will tend to quit the organization if they do not receive it.

Third, with technical and professional workers, it is important to combine technology-assisted methods (such as e-learning), social-networking methods along with opportunities for planned learning[6].
Technical and professional workers are generally more tech-savvy than those in other occupations, thus they are more willing to rely on blended learning methods and often prefer it[6].

The organizations have to reduce external hiring by creating internal talent pool for skills in demand. The positions can be filled internally by cross transfer of employees from one section to other based on their experience in cross functional operations as a team. It will further fulfill the career progression urges of contributing employees in a cost effective environment thus motivating them.

Handling the Data

Data visualization, sharing across multiple platforms and transparency can transform people awareness and can elevate the problems to different levels to get amicable solutions. Different companies operating in the same geographic area or region can collaborate each other to save costs in logistics, changing operating conditions to meet common specifications, contracts with suppliers etc. by pooling the necessary resources and the other companies also willing to cooperate as they too suffering in the low price environment.

One of the things that companies can try to implement and save significant costs is by using the Industrial Internet of Things (IIoT). IIoT is relatively new concept in the O&G Industry which can be a game changer. As a Subject Matter Expert (SME) retires or becomes technically redundant, substantial industry knowledge is potentially lost, as it is neither passed on nor stored centrally either in paper or electronic form. If one can save the expertise of such employees like a data repository, which can be shared across many assets using internet-based tools and secure cloud computing to manage the data flow. The concept of placing experts in regionally-located hubs is gaining pace as it ensures quick mobilization to the site, reducing shutdown time for the asset.

By using analytics and prediction based tools, the data can be used in the design, development and improve the usage of

industrial equipment by improving their life cycle, reduced maintenance costs, quick turnover of spares and asset management. As the industry strives to balance demand, supply and costs, strategies such as these help oil and gas companies to serve the world's energy needs using a combination of advanced technologies and innovative thinking.

The key factor that can help in gaining employment is to differentiate oneself from others. A more diverse academic background and a cursory understanding of the business can go a long way in impressing a potential employer. Every time we experience an economic upset, such as the current one, the companies take steps to reduce costs and will put a freeze on hiring[7].They look for ways to reduce the current workforce, rather than stop recruitment altogether. The new recruits are with less cost to company and this works to boost confidence in academic institutions and job seekers about the company's position and ability to ride through tough times.

Downsizing the people is one of the first tools used by Employers to reduce the costs. Caution should be taken while doing organizational restructuring and man power reduction as it has various consequences such as the image of company among the peers, fear among the employees on retrenchment, reduced levels of motivation etc. Organizations that consistently use workforce analytics are significantly more likely to be effective in addressing a range of workforce challenges[8]. The benefits can be increasing levels of Employee engagement, Talent retention, Performance management and Work force productivity.

Process

Davenport (1993) defines a (business) process as "a structured, measured set of activities designed to produce a specific output for a particular customer or market". It implies a strong emphasis on how work is done within an organization, in contrast to a product focus's emphasis on what. A process is thus a specific ordering of work activities across time and space, with a beginning and an end with clearly defined inputs and outputs, and a proper structure for action. Processes are the structure by which an organization does what is necessary to produce value for its customers[10].

Rummler & Brache (1995) says that a business process is a series of steps designed to produce a product or a service. Most processes are cross-functional in the

organizations. Some processes result in a product or service that is received by an organization's external customer. We call these as primary processes and the other processes produce products that are invisible to the external customer but essential for management of the businesses and we call these as support processes[11].

The above definition distinguishes two types of processes, primary and support processes, depending on whether a process is directly involved in the creation of customer value, or concerned with the organization's internal activities. The processes should be embedded in some form of organizational structure. They can be cross-functional over several business functions across the organization.

Johansson (1993), define process as "a set of linked activities that take an input and transform it to create an output. Ideally, the transformation that occurs in the process should add value to the input and create an output that is more beneficial to the recipient".

Organizations can save a lot of time and money by suitably altering the way they operate their processes, operations and tasks. Nonproductive units or operations can be shut down or mothballed and the excess manpower can be re allocated to other businesses. At the same time, excellence in Mergers & Acquisitions practices throughout the deal process from the identification of opportunities to post merger integration will remain an important contributor to value creation[13]. Further one has to ensure that the process should not siege or encounter due to legal hurdles.

Consolidating the market position

Many big Upstream oil and gas producers are looking to invest in the downstream companies like LNG production and Gas marketing, Refining and Petrochemicals their by integrating the supply chain and access to the emerging markets. Roseneft, one of Russia's leading upstream producers latest acquisition of entire refining operations of India's Essar Oil is solely based on the fact that Roseneft has access to the one of the biggest growing fuels market in the world and gave an outlet for its upstream produce. This ensures that they have access to growth markets and have the market share in the rear end of the oil and gas supply chain. National oil companies like Saudi Aramco (Saudi Arabia), China National Offshore Oil Corporation**,** or CNOOC Group &China Petroleum and Chemical Corporation, known as Sinopec

(China), Oil and Natural Gas Corporation, ONGC (India) thru ONGC Videsh limited etc., invested heavily outside their countries either to secure the crude as an equity and ensure a healthy supply chain to their refineries at cheaper rates.

During the last 20 years, the oil and gas industry is consolidated with many mergers and acquisitions to attain the scale and diversity. World's leading multinational oil and gas companies with operations across the continents continue to merge or take over similar operating companies to enhance their portfolio of operations there by chasing the much needed growth. Few mega deals in the oil and gas operations are Exxon-Mobil merger in 1994, British Petroleum (BP) merger with Amoco in 1998, Chevron's Texaco acquisition in 2000, Statoil of Norway acquiring Hydro Nordisk oil and gas assets in 2006 and Royal Dutch Shell's acquisition of BG group in 2015(to become world's leading producer of natural gas) etc. Every raise and dip in the oil prices present an opportunity for the companies to take over the weaker or smaller companies so that they become larger in size, offer bigger portfolio across the value chain and can tide over the price cycles to challenge the rivals and get to the bottom of the barrel.

Consolidation is happening in the oilfield services sector to save costs and rewrite balance sheets by optimizing production throughout the life cycle of the field. During 2014, Halliburton, which serves the upstream oil and gas services industry, announced its merger with the rival Baker Hughes, a leading supplier of oilfield services, products, technology and systems. This is to challenge Schlumberger, the world's largest oilfield services company[14]. The merger failed due to regulatory clearances and both companies terminated their proposal in May 2016.The merger's cancellation also represents a blow to the investment bankers who advised the companies, as their fee is largely predicated upon the transaction being completed[15]. The process failed eventually and both looking for other M&A opportunities.

In a similar deal announced in May 2016, which should close early 2017, Houston-based FMC Technologies, a major underwater energy equipment maker combining with Paris-based Technip, an offshore oil and gas field technology developer and EPC contractor. We have to see how the deal unfolds and how they manage to get regulatory approvals and anti-trust crusaders.

Thus organizations have to be careful about what their strengths are and remain focused to keep them intact or try to improve. By investing the resources in reducing the weakest part of their operations or divesting the stakes to other companies will help them to consolidate and concentrate holding their market strength. They can grow vertically by sharing resources with similar companies to reduce the costs and use savings to take over similar companies within their foot hold to gain more market share.

These interventions reduce a business's scale and scope, but do not fundamentally alter ways of working or the underlying cost structure.

Industrial Internet and Betting on Data analytics

One of the first attempts to integrate Industrial Internet with Data analytics and integrating the operations across the companies is attempted by General Electric, popularly known as GE. GE, is an American multinational corporation, headquartered in Boston, Massachusetts, U.S.A. It is the world's Digital Industrial Company, transforming industry with software-defined machines and solutions that are connected, responsive and predictive. GE is organized around a global exchange of knowledge, the "GE Store", through which each business shares and accesses the same technology, markets, structure and intellect. Each invention further fuels innovation and application across our industrial sectors. With people, services, technology and scale, delivers better outcomes for customers by speaking the language of industry[16].GE is pioneering the initiative by betting that IIoT (Industrial Internet of Things) would offer considerable productivity gains, cost efficiencies and new revenue opportunities across all its business units.

GE economists have calculated that the Industrial Internet could add an estimated $15 trillion to global GDP by 2030. There is massive opportunity to help the oil and industry to move as fast as a start-up and bring machines into the Internet age. The resulting gains in innovation and efficiency will yield true benefits to society. To do this, however, industry must move from a closed to open model. GE is creating an open standard thru a platform called "Predix"and an open ecosystem together with partners and customers[18].

There are more than 100,000 pieces of turbo machinery, about 2 million kilometers of pipeline and more than 1 million pieces of artificial lift equipment in the world,

generating petabytes of data each year. It is estimated that by harnessing and analyzing all of this data, oil and gas companies can improve production by up to 8%. By scaling big data and analytics across the enterprise, the best practices of one location can be applied across the total operation—resulting in millions of dollars saved by avoiding unplanned downtime[19].

In one of the latest developments in the Oil and Gas services industry, General Electric Company (GE) and Baker Hughes (which failed in its earlier merger with Halliburton in 2014 due to legal hurdles),are trying to merge into a new oilfield technology company with a value of $32 billion. The combined company will bolster its "competitive mettle" with competitor Schlumberger Ltd. However, the transaction assumes a slow recovery of $45 to $60 per barrel (bbl) through 2019.GE shows that through integrating Technology of GE and field expertise of Baker Huges,it would create $1.68 billion wealth due to operational synergies, leading to $1.2 billion in cost savings and about $400 million in annual revenue by 2020[20].

At the end of the day, every company has a single goal that is to increase Return On Investment, known as ROI. The process safety needs of manufacturers are to optimize process reliability, the flexibility to meet their project goals, increased visibility into their process so that they can better see the status of their equipment, reduced engineering and complexity to help drive costs down and to simplify regulatory compliance[21].

Conclusion

Today's oil and gas companies are encountering unprecedented challenges to improve Return of Investment (ROI) while staying on schedule and within the budget. Changing market conditions escalate the need for sustainable operations and help to reach operational excellence. A key component that has helped companies achieve this is technology, namely—Information and Automation or Internet of Things (IoT) which is the heart of all processes.

Human resources are key to any organization and companies have to resist the temptation of downsizing the people across the verticals so as to recover quickly when the prices are rebound. It is very difficult to get the same technical expertise and operate straight away with the new recruits and again invest a lot to train them on par with the old ones. The people can be

reassigned to temporary positions across the organization, may be in a different role, mentoring the others etc. We have to take the people along with any new initiatives so that we have gross root support and they are willingly participating bringing ownership to the process. All the Processes can be simplified by using automation and information technology tools so that we can maximize the efficiency with eventually saves cost and time.

By integrating the operations with data driven approach and handling it carefully to optimize operations and maintenance, significant costs can be saved in the organization**.** In the rapidly changing technology environment we have to focus to hire those who are agile and can quickly adapt to the situation. Forecasting areas where technology should be considered as a substitute for labor. Collecting data and metrics have no value if we don't use them to make decisions.

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Risk Profiling and mitigation measures for railway projects in India

Ravindra Shrivastava*, Dr. Sumeet Gupta**, Dr. B. K. Saxena***, Dr. Ankur Mittal****
*Assistant professor, National Institute of Construction Management & Research (NICMAR)
**Senior Associate Professor CoMES, University of Petroleum and Energy studies
***Professor, Tolani Maritime Institute
****Associate Professor CoMES, University of Petroleum and Energy studies

Abstract

A large number of railway projects are planned, under construction for capacity augmentation and to cater the need of transport Infrastructure of India. Since transport capacity is one of the key drivers of economic progress, it is essential that need of transport capacity should be fulfilled. In the past large number of railway projects planned by Indian railway in railway budget and implemented also. However, these projects consistently fallen short of achieving planned targets in last few years. These projects have been suffers with time and cost overruns. Large railway projects suffer significant from under management of risk in all stages and throughout the life cycle of railway project. Most of the overruns can be foreseeable and avoidable; many of the problems observe are due to lack of implementation of project management and forward-looking risk management approach. It is therefore essential to implement corrective measure by implementation of risk management processes through proper Identification, assessment, allocation and continuously monitoring of risk factors involved in the lifecycle of railway project to ensure completion of projects in all aspects i.e. design, construction and commissioning without cost and time overruns. The objective of the paper is to identify the core risk factors affecting the completion of railway projects in India and chalk out mitigation measure that needs to be acted upon by the implementation team to expedite the railway projects.

Key words: railway, transportation, risk management, overruns

Introduction

Indian Railways (IR) today has one of the largest customer bases of the world of any organization. It accommodates 7 billion passengers who travel on its network every year (as much as the global population). While there was not a single kilometer of railway line back in 1848, the country today boast 1,15,000 km of track over a route of 65,808 km and roughly 8,000 stations. It is

also the biggest freight handler, having moved almost 1.2 billion tones in the last year. India's rail network is the largest in Asia and the second largest in the world, after the US.

was a huge number of ongoing projects, completion timelines for the projects were fixed. However, continuous addition of new projects without ensuring availability of funds and resources further hampered the IR with additional financial burden. Many of projects suffer due to delay in pre-

(MoSPI) on the status of Central Sector Infrastructure- Projects costing Rs. 150 crore and above. There are of 297 railway projects under the screen, Out of these 31 are delayed from their planned completion date. The larger part of are influenced by time overruns, these overruns vary from a couple of months to as high as five years, setting the project viability at hazard. Delays in land obtaining and handover are the essential explanations behind over runs in the pre-execution stage. Time over runs can prompt to increment in the cost of project, can have direct impact on client capital and cash flow due to non-completion of the project. Time is an element that is fundamental for exercises and activities must be completed. In contract agreement, a particular time

engineering i.e. project detailing, lack of planning, budget sanction, and delay in land acquisition etc. As per the Flash Report for January 2016 release: the Ministry of Statistics and Program Implementation

To cater the need of infrastructure and traffic growth, to alleviate capacity constraints of its tracks and also to connect the isolated backward areas within the network, IR undertook projects of expansion by constructing New Lines (NL), Doublings (DL) and Gauge Conversions (GC). There

stage is given for completion of project. If the time is exceeded, more money is often spent, this could lead to increase in the final cost of the project and also wastage and under-utilization of manpower and resources. Hence, it is important to deliver project on time, as it would result in providing economies and social goods that thousands of people lack today and will create economic growth that will eventually pay for all stakeholders. Realizing the necessity of the present scenario, PMI in association with FICCI has identified three critical issues which need to be addressed to reduce the gap between the planed and actual deliveries. They are as follows:

- A framework and implementation plan for constant perfection in

quality of stakeholder commitment and risk management approach in large projects

- There should a nodal agency to monitor execution and provide necessary support for on-time completion and should involve when projects suffers to resolve the problems
- Training and tools for competency enhancing of organization with latest technology and process in the field of project management especially in government.

Objective

- To identify critical risk factors affecting railway projects in India
- To suggest the mitigation measures to reduce the impact of risk factors

Research methodology

- Nature of research – Descriptive
- Data source – secondary data from available literature

Organization of Indian Railways

The IR system is divided into 17 zones. Every zone is again separated into divisions; IR today has 68 divisions. IR has a matrix form of organization at three levels. The levels, in descending order are the Railway Board, zones and the divisions. IR uses two types of project organizations for execution of its projects. The first type is the zonal project organizations where in every zone is responsible for their operation. The second type is project organizations reporting directly to the Railway Board. These organizations handle large scale projects or projects involving work across geographical zones. IR also created partially or fully owned public sector corporations (PSCs) for project execution and operation. Examples are Konkan Railway Corporation (KRC), Rail Vikas Nigam Ltd. (RVNL) and DFCCIL.

Overruns in Indian Railways

Indian Railways has as much as $65 billion worth of pending undertakings with half of them being under development for over five years, prompting to cost-accelerations and making large portions of them un-bankable, Phillip Capital India Pvt. Ltd wrote in a report dated 07th October

2016. Of these 83% are development related—new lines, doubling and gauge change—while the rest are identified with road safety, signaling and telecom, and investments in production workshops and metro projects. Around 61% of the aggregate development related undertakings are getting to be un-bankable, the Phillip Capital report said. “"If IR somehow managed to execute its $65 billion of pending projects, it would need to take away four years of its financial budget (on FY17 base of Rs.1,200 billion), ruling out new activities. However, due to its prioritization, we trust it can now grant Rs.2,500 billion ($37 billion) of new projects over FY17-20, which otherwise would not have been possible" the report said. Execution delays, up until now, have to a great extent been because of new line extends because of land acquisition. This has made Indian Railways concentrate on organizing execution of system decongestion undertakings and road safety project, "as these projects are more bankable and don't confront issues, for example, land acquisition", the report said. Indian Railways would require about Rs.3,894 billion or $53 billion to execute pending undertakings and network decongestion projects over FY17-20, as indicated by Phillip Capital report.

Important risk factors

There are such a large number of factors if not mitigated adequately drives time and cost overruns of railway projects. These components incorporate specialized troubles, geographical and geological examination, Dearth of enough examination, Land obtaining issue, Rehabilitation and Resettlement of affected individuals, administrative issue, long clearance and approval procedure,, the dearth of good contractor, and sometime law and order problem and Centre - state issue are the cause for the slow development of railway. All these makes a railway project a risky in India. Table 01 highlights the major risk related with schedule and cost overruns across railway projects in India. These risks may get control by implementation of proactive risk management approach from the initial stage only. Majority of railway projects are delayed by these reasons only.

Table 1 Reason of Overruns

Stages	Reasons causes overruns
Pre-planning	Approvals & clearances (state & Center)
	Adequate investigations
	Technical feasibility and commercial viability
	Political Scenario
	availability of funds
	site handover
Planning, design & Procurement	Ineffective Procurement & execution strategy
	Inadequate project detailing
	Change in design & scope of work
	Delay in approvals & clearances (state & Center)
	Inadequate constructability aspects
Execution & Monitoring	Inadequate coordination & planning
	Disputes between stakeholders
	Inadequate cash flow to run the project
	Delay in part site handover

Factor's responsible for overruns during pre- execution phase

The Initial phase of projects i.e. pre planning, design and procurement largely influenced by various critical factors. These factors require special attention and measure to reduce the overruns.

Land acquisition

Land acquisition for transportation especially railways and road project require a large quantum of land. Due to high population density of India, land acquisition for such projects is quite difficult. Delays in land obtaining and handover are the essential explanations behind over runs in the pre-execution stage. Although IR enacted a legislation for land acquisition under the Railways Amendment Act (RAA) in 2008 to give a better framework/process for compensation and time line in India. The land acquisition process should be carried out with the support from the Land Acquisition Consultants, who undertake

land surveys and coordinate with the local revenue departments.

Scope change and inadequate detailing of the project

Inadequate detailing of the project during pre execution stage leads have ineffective survey every potential risk and could be effortlessly mitigated by setting up a powerful Project management System and giving training to project administrators.

Approvals and clearance

A railway project requires number of clearances at various stages of construction lifecycle. Requirement of these clearances may change from time to time based on changes in rules and regulations of the governments, which are quite often published during the annual budget. The requirements also vary from state to state. While an effort should be made to compile the total list of clearances required, it is desirable that this be checked with specific reference to each project being undertaken and finalized and necessary action is taken. These clearances shall be taken up and coordinated by the Project Management group. The other groups connected with the clearances such as Engineering, Finance, Commercial etc. shall be involved after necessary initiation by the PM group.

contract between party and requires a lot of modification during the execution stage further impact on success of the projects.. In dominant part of projects scope creep and insufficient DPRs emerges because of absence of all-encompassing planning and restricted capacity of project supervisors to

Factor's responsible for overruns during execution phase

Design/Scope change

At execution stage, the changes in design/scope put the project at more risk. The greater parts of the project are casualties of progress in project design and scope which frequently prompt to extend delays. Poor project planning combined with absence of consideration regarding subtle elements prompts to delayed decision between Project owners and contractors/ vendors.

Shortage of Project management professional's

It has been revealed through various research that infrastructure requires is consistently fallen short with the

experienced, knowledgeable and competent project managers who can manage these large infrastructure projects effectively. Apart from senior leadership middle and lower hierarchy also suffer with the shortage of Planning engineer's, quantity surveyor and risk management professionals in the industry. This leads to create problem in effective management of projects.

Lack of Contract Management expertise

Contract management expertise is essential to effectively address the issues pertaining to vital to keep the Railways in a continuous running condition and also to widen its activities. Most of the claims raised by the contractors are due to inadequacy of contract document to address the concerns of stakeholders.

Coordination Issue

Railway projects required close coordination and management on a day-to-day basis with each domain i.e. Civil, electrical and Instrumentation & controls etc. Its requires a lot of coordination to ensure their respective works fit in with the overall timely execution, quality and safety plan in terms of design as well construction too. Such coordination shall extend from the stage of preparing shop drawings for the respective trades, preparation of co-ordinate service drawings, discussions with the PMC/ Structural & Services Consultant and railways, getting the shop drawings, material specifications, samples etc. The coordination & Planning in all phases of execution such as project planning and scheduling, procurement, fabrication, installation, testing and commissioning as well as planning of all manpower, construction equipment, construction sequence etc. has to be duly approved and accepted by all stakeholders.

claims. The contract management expertise requires during pre execution i.e. at procurement stage as well as during construction. Ensuring competitive rates, engagement of qualified and capable contractors to execute the works including time bound completion of work are the essence of efficient and effective contract management. Efficient and effective contract management is also

Ineffective Project planning and monitoring

Efficiency in execution of projects plays a vital role in completion of projects in a time bound manner so as to minimize time and cost overrun. Deficiency at the planning

phase has adverse impact on timely completion of project. There was adverse impact on physical progress and the cost of the project due to deficient planning and monitoring. It was seen that most of the delays were attributable to failure of Railways' planning, preparatory works before award of tenders. The trend of extensions and resultant delay in execution of contracts indicated that extensions to contracts have become a norm rather than

Non availability of funds

The key issues in the financing of private railway projects are bankability and affordability. The size of the capital expenditure in projects has grown by leaps and bound which has made the need for cost control even more critical. However currently projects are facing huge cost overruns due to multiple reasons ranging from delayed approvals to scope creep and shortage of project professionals to price escalations and contractual disputes. The key issues in the financing of private railroad projects are bankability and moderateness. The measure of the capital consumption in projects has developed by jumps and bound which has made the requirement for cost control significantly

exception of contract management in IR which is required to be improved upon. Proper monitoring of project with reference to scheduled base line is also essential part of management of projects and can reduce the delays and expedite the decision making in projects. Monitoring of execution of projects both at the Railway Board and at the Zonal Level needs to be strengthened to avoid wasteful expenditure and blocking up of fund.

more basic. However as of now projects are confronting colossal cost invades because of various reasons extending from postponed approvals to scope creep and lack of project professionals to value accelerations and contractual disputes.

Material price escalation

Material value heightening past projections is the essential explanation behind cost invades amid execution. It is a business chance confronted by all contractual workers. As of late expenses of key sources of info, for example, iron and steel, bond, bitumen, solid, unrefined petroleum and so forth have changed strongly. The risk of material cost change is intrinsic in infrastructure projects and to some degree is contemplated in general project cost gauges.

However the instability in material costs makes determining a testing activity and prompts to incorrect conjectures. Besides the cost assess accept the project completion according to the schedule and does not represent swelling past the schedule date. Accordingly any postponement in project completion makes the underlying cost gauges out of date prompting to cost overwhelms. Frequently an expansion in material cost over the concurred rate prompts to debate between project owners and contractors.

the work to reduce the claims of the contractors. Drafting of right contract document plays a vital part in decreasing the cases amid execution stage. Ineffectively outline contract document leave space for temporary contractors claim which leads assist the cost invade of the project. Unique care should be taken amid the drafting of the contract document. Additionally proactive Contract administration is required amid the execution of the work to decrease the claims of the contractors

Weak Contract Administration & Poor framing of Contract documents

Framing of contract documents plays a very important role in reducing the claims during execution stage. Poorly frame contract document leave space for contractors claim which leads further the cost overrun of the projects. Special care needs to be taken during the drafting of the contract document. Also proactive Contract administration is required during the execution of

Other factors impacting overruns

In adequate technical investigation (site survey & alignment, geotechnical, Geological, hydrological & runoff calculations) wrong technology selection, inadequate allotment of fund lead and weak procurement strategy are some other reason responsible for overruns in railway projects. Proper detailing and right project execution strategy can reduce the overruns during construction phase.

Table 2: Analysis and suggestive mitigation measures

Sr.	Reasons for Time/Cost Overruns	Mitigation Measures
1	Lack of site infrastructure facilities	All the service/supporting infrastructure should be into contractor's scope of work. These include service roads, all temporary works required to facilitate construction, construction site office, Telephones, inspection labs, power and water connection and transport facilities etc
2	Delay design engineering and release of drawings	Specialized Consultants should be engaged to prepare the scope and detailed engineering before tendering and procurements. all the special investigation i.e. Geotechnical, hydrological, seismic and environmental should be carried out before design closure and tendering. Detailing of design procedures, criteria, specifications and processes with clear responsibilities should be outlined in bid document.
3	Changes in scope or delay in finalization of the scope lack of clarity of project scope resulting in rework or scope creep due to misunderstanding by the contractor or project manager	· Consultants have to be engaged to prepare the scope and the conceptual engineering plans before bidding. · All the special investigation i.e. Geotechnical, hydrological, seismic and environmental should be carried out before design closure and tendering · Detailing of design procedures, criteria, specifications and processes with clear responsibilities should be outlined in bid document.. · Project Management Consultant should be appointed for high valued projects for supervision of construction work · Interfaces and obligations of contractors to other contractors should be defined in bid document · 80% of land acquisition is required to be completed before award of contract
4	Construction Safety issues and law & order problems	· Safety, Health and Environment procedural manual should be prepared by owner, incorporating best practices laid down in relevant legal provisions and appropriate for execution of projects with such complexity, to guide contractors' effort towards maintaining industrial relations and law & order. Suitable rewards and penalties in this regard defined in bid document. · social impact assessment carried out in advance, which enables deployment of counter-measures in advance · process of stakeholder consultation incorporated in project planning and execution process · regular coordination is maintained with state governments on security issues
5	lack of implementation of latest technology	· PMC should be appointed to prepare specification, design and bid. All the documents should be in line with international best-practices · Comprehensive evaluation of bidders' Technical Proposals to assess their familiarity with technology appropriate for the work · Interfaces defined · PMC should reviewing construction methodology at critical stages to ensure that project construction methodology employs
6	Unforeseen geological conditions	Investigations such as Geotechnical, hydrological, seismic, environmental surreys needs to be done and should included these in the bid documents wherever considered appropriate with instructions to bidders. Also contractors should also consult with appropriate consultant before bidding for the project
7	Changes in rates of foreign exchange and statutory duties	Foreign currency denominated loan, close co-ordination Ministry of Finance regarding statutory duties. In case of other countries currency the base price of currency can be fixed for project duration

8	Increase in cost of rehabilitation of displaced persons and providing environmental safeguards	Environment & Social Impact Analysis completed in advance; hence cost included in project cost estimate. A proper planning for rehabilitation and resettlement of project affected people should be done to reduce the overruns in turn of agitation by this people.
10	inflation over project duration	Inflation should be based on WPI is built in the project cost estimate
11	Accidents due to improper or obsolete construction methods and delay in material delivery	Develop a Safety, Health and Environment plan incorporating best practices to prevent accidents at site. The complete review of Technical Proposals submitted by bidders and frequent review of methodology and programme should be done by PMC to mitigate risks
12	In effective implementation process and supervision, inadequate experience of contractor, lack of control over subcontractors	Measures such as appointment of PMC Consultant for drafting of bid specifications, selection of right construction methodology, Method statement, safety plan, quality plan and work programme.
13	coordination issues between site and design office, non availability of drawings/designs on time, unrealistic time schedule built in the contract	Suitable provisions such as periodic submission and review of drawings/designs by the contractor prior to commencement of work, adoption of good coordination software across all contracts should be done to reducing these risks. Extensive due diligence by stakeholders needs to be carried out to avoid the error of committing to unrealistic time schedules.
14	Improper planning low labour productivity due to extreme weather conditions, errors in time estimation; incorrect estimate for skilled and unskilled labour equipment requirement and their utilization	Trend of climate condition throughout the year should be in included in the bid documents and preparation of Safety, Health and Environment with appropriate penalty/incentive mechanism aim at mitigating risks emanating from low labour productivity due to extreme weather conditions. Skilled, unskilled labour, long lead delivery schedule along with labor productivity should be signoff from the contractors. The Comprehensive review of bidders' Technical Proposals and appointment of PMCs are likely to help mitigate risks arising from errors in estimation of requirement/deployment of specialized equipment and skilled operators for such specialized equipment.
16	lack of coordination with local authorities resulting in delays in permissions;	The approval plan should be prepared in advance, highlighting all the approvals needed for the project and timeline should also be agreed all the stakeholders and close coordination should be done by PMC reduce all the risk arising from this factor.
17	selection of contractor - with inadequate experience or skill sets, optimistic cost and time duration built in the contract	Prequalification of job award is best tool to mitigate this risk. As discussed above, adequate safeguards have been envisaged at the planning, bidding and execution stages to reduce possibility of committing to optimistic cost and time duration.

Conclusion

The Indian Railways is in a changing phase, trying to become more accountable and transparent, delegating decision-making power in order to fast-track project approvals, bringing in a more collaborative work culture within different verticals and

partnering with various countries (for CAPEX funding and technology transfer) as well as state governments (to improve railways infrastructure). This strong infrastructure growth in the Indian Railways will, in time, begin to have a bigger effect on the economy. However IR also needs to ensure that such a large infrastructure projects should complete without overruns within budget. The proactive steps towards risk management i.e. identification, qualitative and quantitative risk assessment and allocation of risk to the party who are competent to face the risk and thereafter monitoring the behavior of parties towards risk can reduce the overruns. The IR should implement strong management processes to ensure that they deliver their responsibilities, manages and monitors suppliers to delivering their contractual obligations. The following suggestion can be consider to expedite the railway projects.

- Making roles and responsibilities during construction and operation clear, transparent and consistent with the regulatory and contractual structure.
- Accepting that every risk has a price that the client and supplier will perceive differently. Some risks are more cost-effectively retained by the client including those associated with option development, statutory planning and revenue.
- Planning complex rail programmes and projects carefully including the many interfaces with the external environment.
- Deciding the extent of client-side project development before transfer of responsibility to suppliers. Clients often obtain better value by doing more of the project design and planning internally if they have suitable expertise.
- Preparing the client's project and commercial management organization to deal with suppliers fairly and firmly and ensuring they provide visibility of plans and progress.

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Role clarity, trust and sustained performance: A strategic approach towards managing human capital

Dr. Pooja Kushwaha*

**Assistant Professor, SOM, IMS Unison University*

Abstract

Managing human capital in organizations is considered as a prominent activity which offers a key to achieve sustained performance at individual and organizational level. In present scenario, the quest for developing human capital remains a major agenda to explore in the context of highly competitive business environment where the elements of volatility, uncertainty, ambiguity and complexity exist. Next, issue is to identify and implement the course of action to develop human capital and subsequently accomplishing the organizational goal. This study intends to explore the linkages among role clarity, organizational trust and employee's sustained performance. Prior literature on the above linkages has been reviewed to shed light in to proposed relationship and to provide evidences to the research framework conceptualization. Based on the theoretical underpinnings, several research hypotheses were formulated. Further, data were collected from 253 employees relating to Indian knowledge intensive organizations. Structural equation modeling technique was used to examine the proposed linkages using SPSS 20 and AMOS 20. However, study findings present the empirical evidences to validate proposed relationship among study constructs. It also proves the mediating role of organizational trust between role clarity and sustained performance of employees. This study adds value to the previous literature by adjoining the linkages and providing insights in to significance of trust in developing human capital with special reference to Indian knowledge intensive sector. Further, a discussion on the study results has been provided along with limitations, implications, and suggestions for the future researchers.

Keywords

Clarity, Organizational Trust, Sustained Performance, Human capital

Introduction

Present ambiguous and volatile business environment instigate managers to plan and act beyond traditional organizational practices for managing and retaining organizational competitive edge which can be done through managing the most valuable resource 'human capital'. Since few decades, a remarkable change in technology, production processes, customer preferences, and managerial activities has been noticed. This change gradually prompts organizations toward emerging requirement of novel ideas, concepts and methods to develop and sustain competitiveness, in order to remain in market for gaining profitability and long-term survival. There is a common viewpoint on the notion that human resource is the most valuable and unique asset among all other resources.

Ability of people to think, observe, innovate and learn new things depicts several characteristics, which distinguishes human resource from other resources. Nowadays, organizations are investing on people to derive long-term value across the organizations. Shalley and Gilson (2004) suggest that organizations must keep faith on employees to practice innovational activities in methods, processes and operations. Further, sustaining individual performance is a pre-requisite condition to engage employees' in continuous organizational development process. Identifying and developing human capital is a central goal for all the organizations (Hollenbeck & Jamieson, 2015). However, Prieto and Santana (2014) describe that work practices has been considered as pre-requisite for achieving sustainability, with emphasis on relative level of individual outcome rather than organizational outcome. Previous studies shed light in to predictors of developing trust among employees. People willingly practice work activities when they receive an assurance of fulfilling their personal objectives. In other words, employees expect fair treatment and distinct authority line (role clarity) from employer side, which helps them to up-build a level of responsiveness and trust in organizations.

Further, the organizational trust encourages employee to work efficiently and basically, develops avenues for growth of human capital in organizations. Several researchers (Carmeli & Spreitzer, 2009; De Hoogh & Den Hartog, 2008; Lee, 2008; Newman, Kiazad, Miao & Cooper, 2014) explored the linkages and found the empirical evidences of positive interaction. However, there is lack of studies adjoining role clarity, trust and sustained performance in a single

framework. Role clarification is one among the key dimensions of ethical leadership style such as power sharing, morality and fairness perception. Moreover, it is suggested by previous researchers that impact of several elements on the relationship between role clarity leadership dimension, commitment level, and trust can be explored in future to derive innovational outcomes (Zhu, May & Avolio, 2004). Further, Avolio & Gardner, 2005 elicit that there is a need of investigating the direct effect of the leader's psychological capital such as trust, commitment, resilience and role clarity on follower's performance and its mediating role on sustained performance. Hence, this literature call prompts to extend the research horizon by exploring research possibilities into afore-said issue. The above discussion provides a basis to conduct the present study. However, this study intends to bridge the previous literature gap by exploring the relationship among role clarity, organizational trust and sustained performance of employees.

***Objective of the Study*:**

The main purpose of this study is to address the following research questions. First, whether role clarity helps to develop the level of organizational trust among employees. The second purpose is to examine whether organizational trust mediates the linkages between role clarity and sustained performance of employees in the context of knowledge intensive organizations in India.

The objectives of this study are:

- To study the relationship between role clarity and organizational trust.
- To examine the relationship between organizational trust and sustained performance of employees in organization.
- To examine the mediating role of organizational trust between the linkages of role clarity and sustained performance.

Section 2 of the study, provides deep insights in to conceptual background of the study constructs. Next, section 3 explains the methodology applied to explore the proposed hypotheses. Fourth section presents the study results and subsequently a discussion has been provided along with theoretical and managerial implications of the study. Further, study limitations and future suggestions have been discussed in the last section of the study.

Conceptual background

***Sustained Performance*:**

Firm specific human capital is valuable and individual can create specific human capital only during the job and subsequently they can add value to the firm (Becker, 1964). Previous researchers (Levinthal and March, 1993; March, 1991) elicit that overall success in organization and long term effectiveness highly depends on its ability to exploit firm's resources and subsequently by exploring the new competencies. Individuals' positive and creative behavior in the workplace serves as a basis for any high performance organization (Carnelli et al, 2006).

Organizations attract, retain, and manage human resource to sustain their long-term competitive edge. It is remarkable that value oriented, rare, unique and non-substitutable offerings can be produced and developed by incorporating a sense of trust among employees in diurnal practices at a large extent. Further, human capital can be utilized to derive value and sustain competitiveness. However, less control over the working patterns of employees, environment conducive to developing new ideas and supportive attitude toward implementing novel ideas may lead to engage employee in creative work behavior (Ramamoorthy, Flood, Slattery & Sardessai, 2005) which will subsequently lead to develop sustained performance of employees.

***Role Clarity**:*

According to Harris et al. 2014, role clarity is a specific byproduct of leadership empowerment preferably in the socialization context. Role clarity is a dimension of ethical leadership that can be described as the process of demonstrating appropriate behavior through personal actions, interpersonal relations and by enabling such behavior through communication, reinforcement and decision-making (Brown, Trevino & Harrison, 2005).

Role clarification and fair practices among employees play a significant role in developing trust and boosting up employee morale over existing organizational system. Ethics relates to observe that how individual's action influence others (Zhu et al, 2004). In case, the leader's moral values are susceptible, the leader will more likely to fail to affect their follower toward achieving organizational goals (Kanungo, 2001). Employees expect a fair and equal treatment to all who are accompanying them at a similar level. Failing on which, a downfall in their morale and motivation toward task

accomplishment can be observed remarkably.

Role of Organizational Trust:

Trust can be described as a psychological state of people, having the intent to accept positive behavior or intent of others (Rousseau, Sitkin, Burt & Camerer, 1998). Developing trust among employees is a long-term process where organizational practices, role clarity leadership dimension and morality in work practices play a prominent role to provide assurance to employees regarding fair practices, job satisfaction and fulfillment of individual goals. According to Galford and Drapeau (2003) the ability of leaders to gain follower's trust has been recognized as a crucial element for retaining and managing organizational effectiveness.

Moreover, trust is likely to influence employees' contribution in organizational activities particularly, in terms of sustained performance, intention to stay and other individual behaviors (Robinson, 1996). In addition, trust has been considered a key element in developing and strengthening social exchange relationship (Konovsky & Pugh, 1994). Ramamoorthy et al (2005) found that the extent to which people perceive their personal objectives have been fulfilled or (not fulfilled) seems to directly affect their perceived obligation to the employer, which influences their performance level in long term.

Role Clarity and Organizational Trust:

Newman et al. (2014) point out that role clarity as a dimension of ethical leadership is likely to encourage followers to view their leader as being actually concerned about followers' well being, strengthening the employee-employer relation and up-building higher level of trust. Further, Zhu et al. (2004) elicit that commonly, it is expected to ethical leaders to implement the role clarity among employees and practice the fairness concept using unbiased and impartial manner for guiding their behavior.

However, employees' expectations of being treated fairly may affect their job attitude such as commitment, trust, satisfaction and organizational outcomes (Dailey & Kirk, 1992; Koh & Boo, 2001). In the previous studies, many researchers have conceptually and empirically investigated the effect of ethical leadership dimensions on employee work behavior and found 'role clarity' as a predictor of organizational commitment, trust, job satisfaction, moral identity and work behavior (Brown et al, 2005; Brown & Trevino, 2006). Summing up the afore-said

statements, it can be concluded that role clarity may affect the level of organizational trust positively. Hence, the following hypothesis is being formulated:

Hypothesis 1: *Role clarity positively relates to organizational trust*

Organizational Trust and Sustained Performance*:*

Human resource as a valuable asset, contributes to achieve organizational objectives. Due to distinct characteristics (ability to think, observe, decision making) human resource possesses capability to analyze various concepts, select the best alternative, and implement ideas in to practical terms.

In present turbulent environment, incorporating innovational activities in work practice is highly required. Previous researchers (Gabris, Grenell, Ihrke & Kaatz, 2000; Serva, Fuller & Mayer, 2005) highlighted the significance of trust for developing innovational practices. Further, Serva et al. (2005) found that a direct relationship exists between employee trust and long-term performance, which is often accompanied by risk taking behavior. However, trust plays a vital role in creating, nurturing, and maintaining social exchange relationships because it promotes the sense of fulfilling obligations and reduces the uncertainty of exchanging ideas with others (Blau, 1964). In line with the previous theoretical and empirical evidences, it can be hypothesized that organizational trust is related to long-term performance of employees in a positive direction.

Hypothesis 2: Organizational trust has a positive relation to sustained performance.

Role Clarity and Sustained Performance:

Yidong and Xinxin (2013) elicit that individual are more likely to perceive psychological safety toward expressing their innovative ideas and challenging the status quo because ethical leaders are expected to represent the specific traits such as honesty, integrity, altruism (Gardner, Avolio, Luthans, May & Walumba, 2005) commitment and trust toward the organization (De Hoogh & Den Hartog, 2008).

In addition, Heap (1989) found that role clarity as a crucial element in the innovation process. In fact, the characteristics of role clarity as a dimension of ethical leadership can bring changes in how individual perceives about the work. Additionally, it can also bring changes in beliefs and values

about the work environment (Brown & Trevino, 2006) through personal traits and ethical leadership behavior due to which likeliness of enhancing motivation toward high performance in work becomes stronger (Yidong & Xinxin, 2013). Hence, it can be concluded that role clarity may likely to affects sustained performance of employees in a positive manner.

Hypothesis 3: Role clarity positively relates to sustained performance.

Mediating Role of Trust:

Hayton (2005) added that social capital, trust and existence of supervisor's support helps in enhancing employee's extra role behavior that includes co-operative behavior as a basis of role clarity and employee performance. Further, Parker, Williams and Turner (2006) elicit that presence of trust positively relates to proactive work behavior of employee within the organization. Likewise, several researchers (Eisenbeiss, 2012; Zhu, Newman, Miao & Hooke, 2013) argued that role clarity offers people to trust that their leader is reliable, dependable and holds integrity to work. Several beliefs are likely to endow employee with the motivational intent to develop emotional linkages, which further leads to higher level of trust (Schaubroeck, Lam & Peng, 2011). Aronson (2001) depicts role clarification and ethical behavior as a medium, which leaders commonly used to gain loyalty and confidence of the employees.

After reviewing, afore-said statements, it can be summed-up that organizational trust may likely to mediate the relationship between role clarity and sustained performance. Hence, the following hypothesis is being formulated:

Hypothesis 4: Organizational trust mediates the relationship of role clarity and sustained performance.

Based on prior theoretical underpinnings, a research framework has been proposed depicting linkages among role clarity, organizational trust and sustained performance *(See Figure 1)*

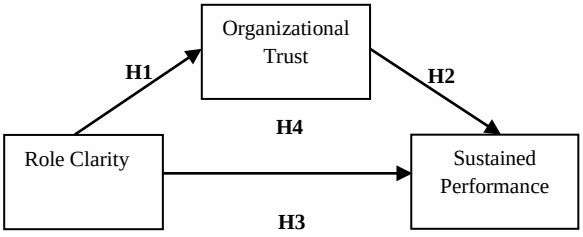

Fig 1: Research Framework

Research methodology

Population, Sample and Data Collection*:*

The participants included two hundred and fifty three employees of knowledge intensive sector particularly from information technology (IT), banking and telecommunication organizations located in northern region of India. Author requested respective branch managers to grant permission for conducting the survey and after receiving approval, total 470 questionnaires were sent to employees through e-mails. Convenience sampling technique was used for sample selection. After two week, a reminder mail was sent to employees with the purpose of increasing response rate. However, 259 filled questionnaires were received back. After eliminating six records during data screening process, total 253 clear records with the response rate of 53.8 percent remained for further analysis. Respondents' proportion was composed of 30 percent (76 employees) from IT, 37.1 percent (94 employees) from banking and 32.8 percent (83 employees) from telecommunication sector. In which 66.4 percent (168) respondents were males and rest 33.6 percent (85) respondents were females.

Measures:

A multi- culture leader behavior (MCLQ) questionnaire developed by Hanges & Dickson (2004) was used to assess role clarity. This dimension was measured using five items namely leader's transparency, engagement in open communication, scope of authority, clarification of expectation and responsibility. Lee and Choi (2003) six items scale has been adapted to measure organizational trust. Further three items from the scale developed by (Goodhue and Thompson, 1995) were taken to measure employees' sustained performance. All the three scales were enumerated on five point

linker scale pointed from strongly agree (5) to strongly disagree (1).

Data Analysis Method:

In this study, SPSS 20 and AMOS 20 software was used to analyze the data. PROCESS macro developed by (Hayes, 2013) was used to test the mediation effect. Exploratory factor analysis was conducted to extract the factors initially (Hair, Black, Babin & Anderson, 2010). Further, scale reliability and validity were examined and confirmatory factor analysis was performed in the next step using maximum likelihood estimation technique on all the three extracted factors (Brown, 2006) to assess the measurement model fit indices. In the next stage, path analysis was performed through structural equation modeling (SEM) technique comprised of two-stage model building approach (Anderson & Gerbing's, 1988; Joreskog, 1993) to explore the proposed research hypotheses and validate the model specification.

Results

In exploratory factor analysis, factor loading were suppressed below 0.4 for analyzing pattern matrix. Kaiser- Meyer- Olkin (KMO) value was noted as 0.762 significant at 0.01 level and the total variance explained by all the three extracted factors was 70.29 percent. Further, reliability and validity for the scale items was examined and cronbach's alpha was noted as 0.942, which confirms the reliability criterion. Factor loading of the extracted items extends from 0.71 to 0.85 for sustained performance (SP) from 0.74 to 0.86 for role clarity (RC), and from 0.84 to 0.88 for organizational trust (OT).

Further, Harman's single factor test (Podsakoff, MacKenzie, Lee & Podsakoff, 2003) was conducted for analyzing the probable issue of common method variance in the data. During common method bias test, a factor analysis including scale items were done with the threshold of eigen-value greater than one using un-rotated factor solution and 40.8 percent variance was noted which signifies that common method bias is not a problematic issue in this study. Table A depicts the correlation and average variance value for the study variables. Average variance extracted (AVE) values should exceed 0.5 (Fornell & Larcker, 1981; Segars, 1997) to fulfill the precondition of convergent validity and all the AVE values were found beyond the acceptable threshold which confirmed the existence of convergent validity.

Table 1: AVE and Correlations among constructs

	CR	AVE	MSV	ASV	RC	SP	OT
RC	0.936	0.598	0.220	0.152	*0.773*		
SP	0.944	0.590	0.220	0.153	0.469	*0.768*	
OT	0.924	0.673	0.087	0.085	0.289	0.295	*0.820*

Note: CR= Composite Reliability, AVE= Average Variance Extracted, MSV= Maximum shared variance, ASV= Average shared variance, RC = Role Clarity, SP= Sustained Performance, OT= Organizational Trust
Diagonal (Italics values) represents square root of AVE, Off diagonal are inter-item correlation among constructs

Next, the assumption of discriminant validity was also confirmed because the maximum shared variance (MSV) and average shared variance (ASV) values were found as lower than their respective AVE values (Hair *et al*, 2010).

Further, it was observed that inter-item correlation is substantially strong to predict the relationship among constructs. The results of model fit indices i.e. comparative fit index (CFI), goodness of fit index (GFI), root mean square error of approximation (RMSEA) (Hooper, Coughlan and Mullen, 2008) were noted as (χ^2=854.1; degree of freedom (df)=306, p<0.01, cmin/df=2.791, CFI= 0.940, GFI= 0.815, adjusted goodness of fit index (AGFI)= 0.755, RMSEA=0.08). The results were found beyond acceptable limit i.e. 0.9 for CFI, 0.8 for GFI (Hu and Bentler, 1999). Since, AGFI lies below the acceptable limit of 0.90 (Bollen, 1990; Miles & Shevlin, 1998). Therefore, it remains the chance for improving model at certain level. RMSEA value below 0.08 (Dudgeon, 2004) is considered appropriate for mediocre fit. However, the model fit indices confirmed model fit. Further, hypotheses were examined using regression results obtained through PROCESS macro (Hayes, 2013) to predict the proposed relationships (*See Table 2).*

Table 2: Regression Results

Mediation of organizational trust between role clarity and sustained performance				
Direct and Total Effects	**B**	**SE**	**t**	**p**
OT regressed on RC	0.3042	0.0610	4.9844	0.0000
OT regressed on SP controlling for RC	0.1519	0.0504	3.0132	0.0029
OT regressed on RC controlling for SP	0.3924	0.0505	7.7668	0.0000
SP regressed on RC	0.4386	0.0481	8.9640	0.0000
Bootstrap results for Indirect effect	**Effect**	**Boot SE**	**LLCI**	**ULCI**
	0.0462	0.0168	0.0160	0.0836

Note: Model = 4 (Simple Mediation), Sample Size=253, Dependent Variable Y = Sustained Performance (SP), Independent Variable
X = Role Clarity (RC), Mediator Variable M = Organizational Trust (OT)
Bootstrap sample Size= 1000, CI= Confidence Interval, LL=Lower limit, UL= Upper Limit

Further, structural analysis for the model using path diagram (*See Figure 2*) shows the regression results and validates the proposed hypotheses. The standardized estimates (***B***) for organizational trust (OT) regressed on role clarity (RC) were noted as (***B***=0.3042, p<0.01). Further, the estimates for sustained performance (SP) regressed RC were (***B***=0.4386 p<0.01) and OT regressed on SP controlling for RC were noted as (***B***=0.1519 p<0.01). OT regressed on RC controlling for SP signifies the estimates as (*B*=0.3924, p<0.01) to examine the mediation effect. However, the bootstrap analysis shows the indirect effect as (Effect=0.0462, SE=0.02, Boot LLCI=0.0160 and Boot ULCI= 0.0836) which predicts the mediating role of organizational trust in proposed relationship.

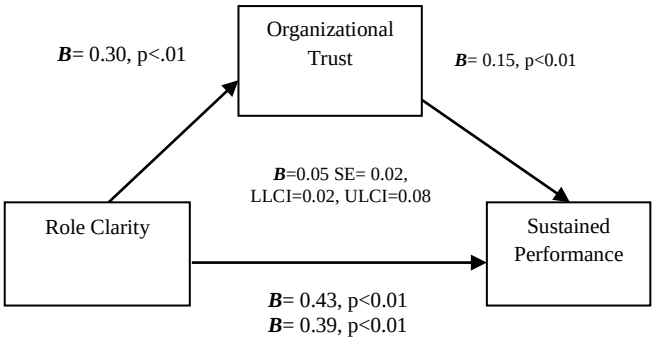

Fig 2: Path analysis and mediation result

Findings

Analysis of the Findings:

The model estimate result (*See Table 2*) shows the positive directed relationship among hypothesized linkages. The standardized estimates indicates (*B*= 0.30, p< 0.01) for role clarity and organizational trust; (*B*=0.15, p<0.01) for organizational trust and sustained performance; (*B*=0.43, p<0.01) for role clarity and sustained performance. The indirect effect of organization trust between role clarity and sustained performance was noted as (*B*=0.39 p<0.01). However, all standardized estimate (*B)* values were noted positively significant.

Therefore, it can be said that proposed hypotheses were supported in a positive direction at their respective significance level. The study result proves the positive relationship among study constructs, which remains a requisite condition for the mediation effect.

Further, direct effect without mediator, direct effect with mediator and indirect effect was analyzed through bootstrapping process (*See Table 2*). The result shows that standardized estimate (*B)* value for direct effect was dropped to certain extent when mediator was added to the linkages. However, the relationship remained significant at both stages that indicate the partial mediation of organizational trust between role clarity and sustained performance.

Discussion

Human capital is central to the resource based view. A firm's specific and unique capabilities require valuable and rare knowledge (Barney, 1991). Human capital plays a pivotal role in the strategy literature as a potential source of competitive advantage drawn on the basis of human capital theory (Raffiee & Coff, 2016). This study explores the linkages among role clarity, organizational trust, and sustained performance in the context of Indian knowledge intensive sector. Past researchers (Avolio, 2005; London, 2002) describes that all organizational activities occurs in a volatile and emerging context, which is important for researchers to include the specific context in predicting human capital development and effectiveness. Further, empirical model provide deep insight in to level of role clarity dimension of leadership that enables organizations to build trust, increase profitability and gain more effective outcomes in long-term (Caldwell, Bischoff & Karri, 2002). Unless employees

trust their organizations, they will not be motivated to engage with their task (Agarwal, 2014). According to Budhwar and Varma (2011) organizations need to address employees' individual objectives and frame uniform policies for multiple genres, in order to implement fair practices in workplace.

The first objective of this study was to study the relationship between role clarity and organizational trust and result shows the significant positive values for the proposed relationship and supports the hypothesis 1. The next objective was to examine the relationship between organizational trust and sustained performance. Again, the study result provides empirical evidences to support the second hypothesis and fulfill the second objective of the study by analyzing the significant positive relationship between proposed relationships. The third objective intends to explore the mediating role of organizational trust between role clarity and sustained performance. Study result shows the partial mediation of organization trust between the linkages of role clarity and sustained performance. Therefore, hypothesis 3 was supported. The utmost objective of the study was to explore the relationship among role clarity, organization trust and sustained performance in the context of knowledge intensive organizations in India. Newman et al. (2014) examined relationship among ethical leadership dimensions; trust and employee work outcomes and found its positive impact on trust which subsequently leads to follower work outcomes. Similarly, role clarity as a dimension of ethical leadership posits a significant impact on trust which will further leads to long term performance of employees in the present study. This study hopefully contributes to previous literature in several ways, particularly relating to role of employee-employer dimension in developing organizational human capital.

First, the study attempts to bridge the previous literature gap by following the suggested guidelines. Next, this study provides a discussion on the requirement of clarity of authority line among employees and fair work practices in organizational activities, in order to create and manage sustainability in competitive and complex environment.

Human capital and behavior offers innovational initiatives as a key input during value creation process (Chen & Huang, 2009). However, commonly it is expected that the extent of trust at different level will

help to enhance commitment and subsequently affect sustained performance at different organizational levels (Lee, 2008). Previous research studies outlined that people who possess capability to perform effectively and contribute beyond the scope of routine work at job, offers a continuous flow of work practices (Parker et al, 2006). The study results were found consistent with the prior findings that reflects the positive influence of role clarity on organizational trust (Zhu et al, 2004; Newman et al, 2014), and a significant positive relationship between organizational trust on long-term employee performance. (Carmeli & Spreitzer, 2009; Lee, 2008).

Study Implications:

Present study attempts to integrate previous literature and findings to adjoin role clarity, trust and sustained performance under a single framework, which aims to explore the relationship among aforesaid construct after harmonizing with a separate context i.e. Indian knowledge intensive sector. First, it was examined that how role clarity may influence the level of organizational trust perceived by individuals. Social exchange theory has been reviewed to justify the trust development through addressing employees' personal goals and implementing fair practices. Further, practitioners may review the individual aspirations of employees to offer them avenues to express their creative ideas, opinions and plans in a hassle free environment, which will subsequently lead to incorporate innovation in routine work practices. However, author argued, that the sense of organizational trust among employees might likely to promote the level of sustained performance through experimenting and practicing role clarity as a dimension of leadership in routine activities within the organization.

Research Limitations and Future Directions:

Like most of the prior studies, this paper also contains several limitations and offers an insight to conduct future studies. First, the data suffers from endogeneity issue due to self- reported nature of responses. Second is, data were collected from a selected sample of knowledge intensive industry i.e. IT, Banking and telecommunication sector. Hence, the findings cannot be generalized in other sectors. In future more studies on the role clarity should be conducted including manufacturing sector in Indian context as this study is limited to exploration of knowledge intensive sector particularly.

Future researchers should further extend the research horizon by combining other mediating variables such as commitment

level, resilience, and self-efficacy and so on. Though, the issue of common method variance was not problematic in this study yet, there is need to re-examine potential common method variance problems may likely to be caused because of self reported dataset. Another limitation of the study reflects in the assessment of organizational trust. In fact, organization trust has been examined using an integrative approach. Further, it can be evaluated by classifying into affective and cognitive dimension of trust respectively.

Conclusion

Human resource upholds a prominent role in economic growth of the country. At present, market turbulence, volatility and complexity are the major factors, which prompt organizations to develop and sustain core competence. This study shed light in to role of managers and leaders for up-building and developing employees' trust in nurturing creative work and sustained performance particularly in the context of Indian knowledge intensive sector.

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Study on Falling Solar Tariff

Chakrabarti Nilanjan[*], Maity Gopa[**]

[*] *Manager, Corporate Services, CESC Limited, Kolkata*

[**] *Senior Executive, Corporate Services, CESC Limited, Kolkata*

Introduction

Solar energy tariff has seen unprecedented fall over past few years in India. The tariff of energy using solar photo voltaic (PV) technology was INR 18.44 per kWh in 2009-10 (FY10). It has come down to INR 4.34 per kWh in 2016, resulting in more than 21% per annum drop.

With extremely ambitious solar capacity target of 100 GW by 2022, it is important to understand the reason for such steep fall in solar tariff. As against India's 100 GW solar target, the present power generation capacity from all sources in India is 305 GW[1] and solar capacity across the globe is 242 GW[2].

Indian Solar Sector

Regulatory Framework

In FY10, tariff of solar power was INR 18.44 per kWh. Even at this tariff, not many projects were taken up. Thereafter, the Central Electricity Regulatory Commission (CERC) started notifying the benchmark capital and operational expenditure figures on yearly basis, after conducting public consultation process. The public consultation processes have witnessed wide participation of interested solar power developers and other stakeholders.

As the benchmark costs are notified after a detailed public consultation process, we have considered such notified capital cost figures for the study. Also, the CERC notified tariff works as benchmark tariff in Indian context. The Table 1 below shows the notified capital and operational expenditure; along with, the CERC notified tariff. CERC notified tariff is the levelised cost of energy determined by considering standard representative figure for Indian power sector of 15.5% cost of equity, 12% interest rate and 70:30 debt-equity ratio. Tax and depreciation treatment has been considered as per CERC regulations and other applicable statutes.

As may be seen from the table, drastic reduction in operation and maintenance

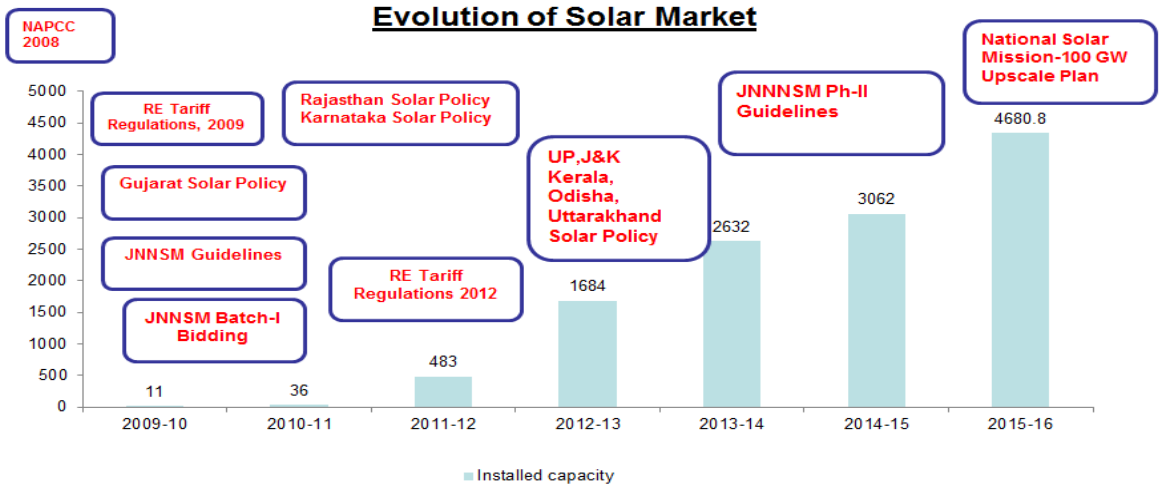
(O&M) expenditure norm has been set for FY17. O&M expenditure for proper upkeep is not expected to fall to such low figure, considering the stated position of India to have targeted inflation of 4%[3]. For uniform treatment, we have considered O&M expenditure per MW as INR 10 lakhs for FY 17, and INR 10.4 lakhs for FY 18 with 4% year on year escalation. This assumption has been used while computing Internal Rate of Return (IRR), as shown in Table A.

Various state regulatory commissions also independently notify tariff for solar power. However, as the states as well as central government relied more on competitive bidding for awarding solar projects, such feed-in-tariffs are of little use for this analysis. The CERC benchmark tariff however, is being used as a benchmark against the tariff discovered through competitive bidding.

Table A : Movement of capital cost, O&M cost and tariff of solar project as approved by CERC

Source: Central Electricity Regulatory Commission Regulations and Orders

Item	Unit	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17
Capital Cost	INR Crore per MW	17.0	16.9	14.4	10.0	8.0	6.9	6.1	5.3
First year O&M Cost	INR Lakhs / MW	9.00	9.51	10.06	11.00	11.63	12.29	13.00	7.00
CERC Benchmark Tariff	INR per kWh	18.44	17.91	15.39	10.39	8.75	7.72	7.04	5.68



Government Schemes and Installed Capacity

The Government of India launched Jawaharlal Nehru National Solar Mission (JNNSM) in 2011, setting up a target of installation of 20 GW of solar capacity by the year 2022. JNNSM was divided into three phases. Competitive bidding was conducted under JNNSM phase-1 under domestic content requirement and open category. Competitive bidding has also been conducted under various state policies. The following table captures the evolving nature of solar sector in India.

Change in guard: New found optimism

With change in guard in political domain in India, the target for solar capacity installation had been revised in 2015.Target solar capacity installation increased by more than 500% at 100 GW, instead of 20 GW. Out of 100 GW, 40 GW is expected to come from roof-top installations, 20 GW by Central Public Sector Undertakings, 20 GW under employment generation scheme and 20 GW by private investors at solar parks. If achieved, solar energy is expected to meet about 50% of the country's peak demand of 200 GW in 2022. A number of competitive bidding processes had been conducted, wherein, the lowest bidder was awarded to develop the project. Total installed solar capacity in India as on 31 August 2016 is about 8 GW[4], of which 300 MW comes from roof-top installations[5].

Outcome of Competitive Bidding

In the past, one bidding process each was conducted in 2011 and 2012. Four bidding processes for 235 MW was taken up in 2012, six in 2013, four in 2014, thirteen in 2015 and two in January 2016. Recently, the discovered tariff has shown a dramatic reduction, reaching a level of INR 4.34 per kWh[6]. Such tariff seems unremunerative considering the conventional capital structure and cost of capital prevalent in Indian power sector.

However, the quote of INR 4.34 per kWh was not an outlier. Many project developers quoted similar tariffs. The total capacity offered under this particular bidding was 420 MW. There were six blocks of 70 MW each. The lowest bidder (Finnish company Fortum Finnsurya Energy) quoted INR 4.34 per kWh for 70 MW. The next higher bid was INR 4.35 per kWh for 280 MW (Rising Sun Energy Private Limited and Solairedirect both quoted INR 4.35 per kWh

and won two blocks each of 70 MW). Third lowest bid INR 4.36 per kWh was quoted by Yarrow Infrastructure for 70 MW. The capacity on offer was grabbed by four parties. There were thirteen bids under INR 5.00 per kWh.[7] Results of the bidding processes are placed in Appendix 1.

Analysis of Bidding Results

Out of these bidding processes, we have not considered bidding results of Punjab, Uttar Pradesh, Uttarakhand and Haryana, as these states are not solar rich and cost of land in these states being higher, resulted in higher tariff. Expected date of commissioning has been considering as 18 months7 from bidding date. As applicable regulatory norms prevailing on the date of commissioning is considered for tariff determination in Indian context, we have computed project IRR1 considering the CERC benchmark parameters applicable for the financial year of expected project commissioning. Along with project IRR, equity IRR2 has also been computed considering interest rate at 12.76%, 12 years loan repayment period and 70:30 debt equity ratio. As mentioned earlier, the O&M expenditure has been considered at INR 10 lakh per MW and INR 10.4 lakh per MW (with 4% escalation) for FY 17 and FY 18, respectively.

For ease of representation, we have computed the commissioning timeline-wise weighted average of tariff discovered through bidding, expected to be commissioned in a particular financial year. 1.5 years have been considered as the project commissioning timeline from the bidding date. Such weighted average bidding tariff was compared against the CERC benchmark tariff for the concerned year. Also, project IRR considering the CERC benchmark parameters (namely the capital cost and O&M expenditure) applicable for the particular year, and the computed weighted average bid tariff has also been computed up to FY18.

[1] *Internal rate of return (IRR) is a metric used in capital budgeting measuring the profitability of potential investments. Internal rate of return is a discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero. Initially IRR is determined at the project level, without considering cash flows related to financing. In this computation of project IRR, interest and debt-service payments are kept out.*

[2] *For equity IRR, debt-service payments are introduced in the calculations and IRR is re-worked. Since the cash flows after debt-service payments belong to equity shareholders, this re-worked IRR is essentially the return on equity invested in the project i.e. Equity IRR.*

The benchmark capital cost as notified by CERC for 2016-17 is INR 5.30 Crore per MW. We have assumed a further 5% reduction in capital cost for 2017-18, and considered it at INR 5.04 Cr per MW.

As a reasonable estimate, we have considered O&M expenditure per MW as INR 10 lakhs for FY 17, and INR 10.4 lakhs for FY 18 with 4% year on year escalation. Other assumptions are CUF at 19%, normal tax rate 34.61%, MAT rate 21.342% and interest on working capital at 13.26%.

Working capital base consists of Maintenance Spare at 15% of O & M expenses, O & M expenses of one month and receivables from debtors for two months. The results are shown below.

As expected, Equity IRR is lower than Project IRR, when the tax adjusted interest rate of 8.34% is lower than the Project IRR. Tax adjusted interest rate has been computed with an interest rate of 12.76% and Tax Rate of 34.61%.

Table C : Project IRR considering weighted average bid price

Expected Commissioning (FY)	Weighted Average Bid Price	Benchmark Tariff	Bid Tariff / Benchmark Tariff	Project IRR at the weighted average bid price and CERC notified benchmark project cost and O&M expenditure. Other assumptions mentioned above	Equity IRR considering 12.76% interest rate, 12 years repayment period and 70:30 debt equity ratio
	INR/kWh	INR/kWh	%	%	%
FY13	10.39	10.39	100%	10.24%	10.93%
FY14	8.56	8.75	98%	10.25%	10.95%
FY15	6.60	7.72	85%	8.13%	7.42%
FY16	6.79	7.04	96%	10.12%	10.73%
FY17	5.99	5.84	103%	10.58%	11.55%
FY18	4.60	5.63	82%	7.08%	5.78%

The formula used is given below:

$$Tax\ Adjusted\ Interest\ Rate = r_d \times (1 - T)$$

$$where\ r_d\ is\ interest\ rate, T\ is\ Tax\ Rate$$

It can be seen from the above that there are clearly two periods when we have experienced sudden dip in solar tariff, exhibited by weighted average bid price being less than 90% of CERC benchmark tariff. These dips are characterized by low Bid Tariff to CERC Benchmark Tariff ratio and low project IRR. The first one is for projects being commissioned in FY15, and the second one is for projects expected to be commissioned in FY18. Copy of the financial model used for this study is placed in the Appendix 2.

Projects commissioned in FY15

During 2010 to 2013 period, there has been a massive increase in solar installation in Germany, encouraged by remunerative Feed-in-Tariff (FIT). However, cut in FIT has reduced solar installations addition pace in Germany, leading to manufacturing overcapacity of solar PV module.

This overcapacity led to drop in solar PV module cost across the world. Global module prices in 2014 were at a historically low level.[8] However, thereafter, the expected CAGR decline in module prices is only 8%, whereas the CERC benchmark capital cost has been reduced at CAGR 13%.

Projects expected to be commissioned in FY18

Project IRR for projects expected to be commissioned in FY18 is again considerably lower than that of previous years. This project IRR is at project capital cost of INR 5.04 Cr per MW.

Any project, generating such a low IRR in Indian context will normally not be taken up, as weighted average cost of capital in India is more than the project IRR.

Cost of capital and project viability

The benchmark capital cost as notified by CERC for 2016-17 is INR 5.30 Crore per MW. We have assumed a further 5% reduction in capital cost for 2017-18, and considered it at INR 5.04 Cr per MW. The projects awarded in the latest round of bidding is expected to be commissioned in 2017-18 as the developer is expected to set up the plant only when the land and evacuation infrastructure is ready, and typical time needed in Indian context is about 1.5 years[8].

With INR 5.04 Crore per MW project cost and O&M cost of INR 10.4 lakhs per MW as a reasonable estimate, INR 4.60 per kWh tariff results in Internal Rate of Return of about 7%. The lowest tariff discovered in competitive bidding of INR 4.34 per kWh results in project IRR of 6.25% and equity IRR of 4.55% at project cost of INR 5.04 Cr per MW & O & M cost of INR 10.4 lakhs per MW. Considering 70:30 debt equity ratio and 3.5% interest rate, the weighted average cost of capital comes out to be 6.25%, at which the project would be marginally financially viable, with cost of equity of 15.5%.

Thus, with a capital structure, where interest rate is lower than 3.5% or the debt percentage is higher than 70%, the project is economically viable. Formula used for cost of capital is given below.

$$WACC = r_d \times \frac{D}{D+E} \times (1-T) + r_e \times \frac{E}{D+E}$$

Where

- *WACC is weighted average cost of capital*
- *r_d is cost of debt (interest rate)*
- *r_e is cost of equity*
- *D is contribution of debt in project cost*
- *E is contribution of Equity in Project Cost*
- *T is the Tax Rate*

Table D : Sensitivity analysis of cost of capital[3]

Factor	Changes in cost of capital
1% increase in debt-equity ratio	0.07% decrease
1% decrease in interest rate	0.46% decrease
1% decrease in cost of equity	0.30% decrease
1% decrease in tax rate	0.08% increase

[3] *Apart from debt-equity, all other sensitivity relationships are linear in nature.*

Traditionally, such a low cost of capital is difficult to achieve. Typical cost of capital for Indian power sector projects hover around 10.19%, considering 70:30 debt equity ratio, 15.5% of cost of equity, 12% interest rate and around 34% tax rate. For non-conventional projects like solar etc., the borrowing cost is expected to be higher than 12%, making the cost of capital even higher. Hurdle rate for Indian power sector hovers around 12% to 14% from investor's perspective. Sensitivity analysis of cost of capital yields are mentioned in the above table D.

It appears that the phenomena of falling solar tariff is resulting from availability of cheaper capital flowing from developed economies, as cost of Indian capital is still quite high. It seems availability of funds with extremely low cost of capital from developed economies is at all time high. Inflation adjusts real interest rate has continually fallen over last 30 years in developed economies. The real interest rate (average ten-year inflation–indexed born yield) of developed economies namely the United States, Canada, France, Germany, Japan and the United Kingdom was about 4% in 1985. The same has fallen below zero per cent in 2013 and has more or less stayed at sub-zero level since then.[9] This ultra-low cost capital is flowing to emerging markets with growth potential, and the Indian renewable sector, with a potential of resulting in positive yield offers great market for such capital.

For last one year, the Indian government has made great pitch across the world, stating the ambitious solar capacity addition plan. Assured by the government support, this cheap money is now flowing in Indian solar sector. Solar projects being a clean source power and aligned with clean funding requirement are preferred in comparison to other power projects. The solar projects being backed by credible government undertaking companies (NTPC) and land and evacuation infrastructure availability assurance also provide reasonable revenue certainty. Also the technology being passive in nature, the plant operation process is simple and chances of encountering unexpected operational challenges during the life of the project is remote. One concern remains though, is the risk of foreign exchange variation. The project life of these PV projects is considered to be twenty five (25) years. The debt financing appears to be

spread over a longer tenure, and expecting favourable foreign exchange movement is a risky proposition. If this risk is managed efficiently, availability of low cost capital for renewable energy projects will usher in a new era in Indian power sector. Foreign Exchange Rate Variation in terms of INR-USD for past twenty five (25) years presented below. It can be seen that INR has depreciated by 4% per year rate over this period.

Table E: Foreign Exchange Rate Variation[10]

Year	Exchange rate INR per USD (average)
1992	25.92
1993	30.52
1994	31.37
1995	32.42
1996	35.43
1997	36.32
1998	41.27
1999	43.06
2000	44.94
2001	47.19
2002	48.60
2003	46.58
2004	45.32
2005	44.10
2006	45.31
2007	41.35
2008	43.50
2009	48.40
2010	45.73
2011	46.67
2012	53.44
2013	58.60
2014	61.03

Year	Exchange rate INR per USD (average)
2015	64.15
2016	67.10

This is where rupee denominated loan in form of Masala Bond, issued by Indian corporations to non-domestic investors, can offer significant push for solar energy projects. In case of Masala Bonds, the foreign exchange risk is on account of the investor, not on the issuing corporation. NTPC Limited, the Indian state owned power generation company, has successfully listed INR 2000 Crore Green Masala bond on the Singapore Stock Exchange in September 2016.

With INR at all time low against US Dollar and lot of economic uncertainty, it remains to be seen whether inflow of cheap foreign debt keeps flowing into Indian solar sector and help it in achieving grid-parity.

Word of Caution

Poor financial conditions of distribution licensees have added additional problems for the already commissioned renewable projects. Payment delay by financially distressed distribution licensees is a reality. Payment delay even by more than a year is not uncommon. Our calculation shows that in case of payment delay by a year, the IRR gets reduced by about 3%. This is also in line with estimation by industry experts[11].

Moreover, curtailment by the load dispatch centres is also a reality today, where integration of solar capacity of about 8 GW has become challenging for a system with peak load demand of about 153 GW[12] (5% of peak demand). 10% curtailment results in reduction of IRR by about 1.4% for solar projects. Ministry of New and Renewable Energy recently wrote to the Central Electricity Regulatory Commission to curb the phenomenon of backing down of solar projects[13]. With solar capacity projected to reach about 50% of peak demand (100 GW solar in a system of 200 GW peak demand), such curtailment is bound to increase. India's peak demand is considered as 200 GW by 2022 with a CAGR growth of 5% from 153 GW as on today, when solar capacity is expected to reach 100 GW.

Conclusion

India has witnessed tremendous growth in solar installations and sharp reduction in the discovered solar tariff. It has also set an extremely daunting target for solar capacity addition in next few years.

Availability of cheap overseas funding may fuel capacity addition growth and low tariff in near-term, but it would be interesting to track how such large solar capacity is integrated with the electricity grid, with perennially distressed cash strapped buyers.

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Appendix 1

Previous bid results					
	Year	Capacity on Offer (MW)	Highest Bid (Rs./KWh)	Lowest (Rs./KWh)	Weighted Avg. Price (Rs./KWh)
NSM Batch 1	Dec'10	150	12.76	10.95	12.16
NSM Batch2	Dec'11	350	9.39	7.49	8.79
Orissa Phase 1	Mar'12	25	8.98	7	8.36
Orissa Phase 2	Dec'12	25	9.5	7.28	8.73
Karnataka	Apr'12	60	8.5	7.94	8.34
Madhya Pradesh	Jun'12	125	12.45	7.9	8.05
Tamil Nadu	Mar'13	150	14.5	5.97	6.48*
Rajasthan	Mar'13	75	8.25	6.45	6.45 (L1)
Andhra Pradesh	Apr'13	226	15.99	6.49	6.49 (L1)
Punjab Phase 1	June'13	270	8.75	7.2	8.41
Uttar Pradesh Phase 1	Aug'13	130	9.33	8.01	8.9
Karnataka Phase 2	Aug'13	130	8.05	5.5	6.87
Madhya Pradesh Phase 2	Jan'14	100	6.97	6.47	6.86
Andhra Pradesh Phase 2	Oct'14	500	5.99**(7.03 Levelized)	5.25** (6.17 Level.)	5.75** (6.75Level.)
Karnataka	Nov'14	500	7.12	6.71	6.94
Telangana	Nov'14	500	6.9	6.46	6.72
Punjab (Capacity 5-24 MW)	Feb'15	100	7.45	6.88	7.17
Punjab (Capacity 25-100 MW)	Feb'15	100	7.56	6.88	7.16
NTPC Anantapur	May'15	250	-	-	6.16*** (L1)
Uttar Pradesh Phase 2	June'15	215	8.6	7.02	8.04
Madhya Pradesh	June'15	300	5.641	5.051	5.36
Telangana Group 1****	August'15	500	5.8727	5.4991	5.73
Telangana Group 2****	August'15	1500	5.8877	5.1729	5.62
Punjab	Sept'15	500	5.98	5.09	5.65
Uttarakhand	Oct 2015	170	5.99	5.57	5.766
AP-500 MW Bundling scheme******	Nov,2015	500	4.63	4.63	4.63
AP-350 MW Bundling scheme*******	Dec,2015	350	4.63	4.63	4.63
AP-150 MW Bundling scheme(DCR)********	Dec,2015	150	5.13	5.12	5.123
Haryana(State scheme)	Dec,2015	150	5	5	5
Rajasthan-420 MW Bundling	Jan,2016	420	4.36	4.35	4.351
*5% escalation for 10 years					
** 3% escalation for 10 years. Separate L1 for 9 districts					

*** EPC Bids with Domestic content requirement. Capital subsidy of Rs. 1 Cr/MW
****Results for the lowest bid for 500 and 1500 MW respectively. The sub-station wise final list to be declared soon****** Online reverse action concluded on 03.11.2015. Entire capacity has been won by Sun edission. ******* Online reverse action concluded on 14.12.2015. Entire capacity has been won by SB Clean ******** Online reverse action concluded on 15.12.2015 under DCR category.

Appendix 2

Assumptions		
Capacity	*MW*	1
Auxillary Consumption	*%*	0
PLF	*%*	19%
Capital Cost	*Rs Lakhs/MW*	504
Capital Cost	*Rs. Lakhs*	504
Discount Rate	*%*	10.64
Depreciation Rate in first 12 years	*%*	5.83
Depreciation Rate for 13 years onwards	*%*	1.54
Normal tax rate	*%*	34.608
MAT rate	*%*	21.3

O & M cost For first year of operation (2016-17)	*Lakhs/MW*	10.4
Escalation	*%*	4
Repayment period		12
Interest rate		12.76
Working Capital		
O&M Expenses	*Month*	1
Maintenance Spare % of O & M charges	*%*	15
Receivable for Debtors	*Month*	2
Interest on working capital	*%*	13.26
Tariff discovered at bidding	*Rs./kwh*	4.34

For Project IRR Calculation																										
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Gross generation	*MU*	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Investment	-504.0																									
Revenue		72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2
O & M expenses		-10.4	-10.8	-11.2	-11.7	-12.2	-12.7	-13.2	-13.7	-14.2	-14.8	-15.4	-16.0	-16.7	-17.3	-18.0	-18.7	-19.5	-20.3	-21.1	-21.9	-22.8	-23.7	-24.6	-25.6	-26.7
Taxes		-6.9	-6.8	-1.8	-19.8	-20.6	-20.6	-20.4	-20.3	-20.1	-19.9	-19.7	-19.5	-19.2	-19.0	-18.8	-18.5	-18.3	-18.0	-17.7	-17.4	-17.1	-16.8	-16.5	-16.1	-15.8
Increase in Working Capital		-14.5	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
Salvage value																										50.4
Total cash flow	-504.0	40.4	54.5	59.1	40.6	39.4	38.9	38.5	38.2	37.8	37.4	37.0	36.6	36.2	35.8	35.3	34.8	34.3	33.8	33.3	32.7	32.1	31.5	30.9	30.2	80.0
IRR	*6.25%*																									
Working Capital Schedule																										

For Project IRR Calculation																										
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Maintenance Spare considered for working captial		1.6	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.2	3.3	3.4	3.6	3.7	3.8	4.0
O&M charges		0.9	0.9	0.9	1.0	1.0	1.1	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.4	1.5	1.6	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.1	2.2
Receivables for debtors		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
WC Requirement		14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.4	15.5	15.6	15.8	15.9	16.1	16.2	16.4	16.6	16.8	17.0	17.2	17.4	17.6	17.8	18.0	18.3
Tax Depreciation for Project IRR																										
	80%																									
Opening Balance		504.0	100.8	20.2	4.0	0.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Depreciation		403.2	80.6	16.1	3.2	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Written down asset		100.8	20.2	4.0	0.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CERC Depreciation		29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
Book Profit		32.5	32.0	31.6	31.2	30.7	30.2	29.7	29.2	28.6	28.0	27.5	26.8	47.8	47.2	46.5	45.7	45.0	44.2	43.4	42.6	41.7	40.8	39.8	38.8	37.8

For Project IRR Calculation																									
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Profit for Tax computation		-34 1.4	-19 .2	44.9	57.3	59.4	59.5	59.0	58.5	58.0	57.4	56.8	56.2	55.6	54.9	54.2	53.5	52.8	52.0	51.2	50.3	49.4	48.5	47.6	46.6	45.6
Normal Tax		0.0	0.0	15.5	19.8	20.6	20.6	20.4	20.3	20.1	19.9	19.7	19.5	19.2	19.0	18.8	18.5	18.3	18.0	17.7	17.4	17.1	16.8	16.5	16.1	15.8
MAT		6.9	6.8	6.7	6.6	6.5	6.4	6.3	6.2	6.1	6.0	5.9	5.7	10.2	10.1	9.9	9.8	9.6	9.4	9.3	9.1	8.9	8.7	8.5	8.3	8.1
Applicable Tax		**6.9**	**6.8**	**18.8**	**19.8**	**20.6**	**20.6**	**20.4**	**20.3**	**20.1**	**19.9**	**19.7**	**19.5**	**19.2**	**19.0**	**18.8**	**18.5**	**18.3**	**18.0**	**17.7**	**17.4**	**17.1**	**16.8**	**16.5**	**16.1**	**15.8**
MAT Credit Set Off		0.0	0.0	13.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cumulative MAT Credit		6.9	13.8	13.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

For Equity IRR Calculation																										
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Gross generation	*MU*	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Investment	-151.2																									
Revenue		76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6
O & M expenses		-10.4	-10.8	-11.2	-11.7	-12.2	-12.7	-13.2	-13.7	-14.2	-14.8	-15.4	-16.0	-16.7	-17.3	-18.0	-18.7	-19.5	-20.3	-21.1	-21.9	-22.8	-23.7	-24.6	-25.6	-26.7
Taxes		0.0	0.0	-4.7	-10.3	-12.3	-13.6	-14.8	-15.9	-17.0	-18.1	-19.2	-20.3	-20.7	-20.5	-20.3	-20.0	-19.8	-19.5	-19.2	-18.9	-18.6	-18.3	-18.0	-17.6	-17.3
Increase in Working Capital		-15.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
Salvage value																										50.4
operating cash flow		51.0	65.6	60.5	54.5	52.0	50.2	48.5	46.8	45.2	43.5	41.8	40.1	39.0	38.6	38.1	37.6	37.2	36.6	36.1	35.5	35.0	34.4	33.7	33.1	82.8
Principal repaid		-29	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29	0	0	0	0	0	0	0	0	0	0	0	0	0
Interest		-43	-	-	-	-	-	-	-	-	-9	-6	-2	0	0	0	0	0	0	0	0	0	0	0	0	0

For Equity IRR Calculation																										
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
			39	36	32	28	24	21	17	13																
Total cash flow	-151.2	-22	-3	-5	-7	-6	-4	-2	1	3	5	7	9	39	39	38	38	37	37	36	36	35	34	34	33	83
IRR	*5.78%*																									
Working Capital Schedule																										
Maintenance Spare considered for working captial		1.6	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.2	3.3	3.4	3.6	3.7	3.8	4.0
O&M charges		0.9	0.9	0.9	1.0	1.0	1.1	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.4	1.5	1.6	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.1	2.2
Receivables for debtors		12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8
WC Requirement		15.2	15.3	15.4	15.5	15.6	15.7	15.8	16.0	16.1	16.2	16.4	16.5	16.6	16.8	17.0	17.1	17.3	17.5	17.7	17.9	18.1	18.3	18.5	18.7	19.0
Tax Depreciation for Equity IRR																										
	80%																									
Opening Balance		504	101	20	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

For Equity IRR Calculation																										
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Depreciation		403	81	16	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Written down asset		101	20	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CERC Depreciation		29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
Book Profit		-6.4	-3.0	0.3	3.6	6.9	10.1	13.4	16.6	19.8	23.0	26.2	29.3	52.2	51.5	50.8	50.1	49.3	48.5	47.7	46.9	46.0	45.1	44.2	43.2	42.1
Profit for Tax computation		-3802.2	-54.3	13.5	29.8	35.6	39.4	42.7	46.0	49.2	52.4	55.5	58.7	59.9	59.2	58.6	57.8	57.1	56.3	55.5	54.7	53.8	52.9	51.9	50.9	49.9
Normal Tax		0.0	0.0	4.7	10.3	12.3	13.6	14.8	15.9	17.0	18.1	19.2	20.3	20.7	20.5	20.3	20.0	19.8	19.5	19.2	18.9	18.6	18.3	18.0	17.6	17.3
MAT		0.0	0.0	0.1	0.8	1.5	2.2	2.9	3.5	4.2	4.9	5.6	6.3	11.1	11.0	10.8	10.7	10.5	10.4	10.2	10.0	9.8	9.6	9.4	9.2	9.0
Applicable Tax		**0.0**	**0.0**	**4.7**	**10.3**	**12.3**	**13.6**	**14.8**	**15.9**	**17.0**	**18.1**	**19.2**	**20.3**	**20.7**	**20.5**	**20.3**	**20.0**	**19.8**	**19.5**	**19.2**	**18.9**	**18.6**	**18.3**	**18.0**	**17.6**	**17.3**
MAT Credit Set Off		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cumulative MAT Credit		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Year		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Debt Amount	*Rs.*	35	32	29	26	23	20	17	14	11	88	59	29	0	0	0	0	0	0	0	0	0	0	0	0	0

For Equity IRR Calculation																										
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
	Cr	3	3	4	5	5	6	6	7	8																
Repayment	*Rs.*	29	29	29	29	29	29	29	29	29	29	29	29	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cr																									
Balance	*Rs.*	32	29	26	23	20	17	14	11	88	59	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cr	3	4	5	5	6	6	7	8																	
Interest on term	*Rs.*	43	39	36	32	28	24	21	17	13	9	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0
loan	*Cr*																									

Vibrant debt market –supplement to healthy banking system.

Rabindra Kr. Singh*

**Assistant Professor of Finance at Chetana's Institute of Management and Research.*

Abstract

Indian banking system has evolved rapidly over period of time. It has successfully transformed itself from regulated entity to market force driven entity. The banking system has supported the Indian industry successfully and has emerged as a preferred source of finance. It supported the growth of an efficient financial infrastructure. Entry of private sector bank has given new dimension to banking services. It has given an enhance customer experience.

But with changing time, the scale of economic activity has increased. The rapid pace of globalization has increased the demand from the banking system. The volume of business and requirement of capital has increased manifold. Hence time has come, when government has to enhance the other source of fund i.e. debt segment of capital market. It will not only reduce the burden of bank but also bank will get an extra source of income. A vibrant debt market will attract more foreign investment.

This paper will aim at exploring the reason for sudden spurt in NPA of banks especially PSU Bank, how debt market can help bank in reducing NPA, how debt market be developed so that it can reduce the burden of bank in financing corporate India.

Key words: Credit growth, Gross NPA, Net NPA, Debt Market.

Introduction

Capital is essential for growth of any business. Companies use various sources to raise capital. It can raise money by selling its ownership to many investors; this form of fund raising is called equity financing. In this process company has to involve all investors in every decision making and dilute its ownership. Company can also raise fund by issuing debt instrument, on which company has to pay some cost in form of coupon payment. In this form of fund raising company need not to dilute ownership neither has to involve debt owners in day to day

decision making process. Company also raises money from banks in form of various types of corporate loans. In India the major sources of funding has been bank based financing. The reason for higher dependency on bank for fund by corporate is because of absence of a healthy corporate bond market. Indian corporates sector has grown phenomenally in last few years; it has explored various geographies, sectors, economies. But the funding pattern of the Corporate India is still heavily bank dependent. Among banks, PSU banks have greater share of corporate loans. As companies are in multiple businesses, geographies, they are exposed to higher risk. The higher risk is directly transmitted to banking sector. This higher risk is transmitted to banking sector with rising NPAs and higher slippage ratio. So there is a need to reduce the dependency of corporates on banking system only, hence one of the possible solutions is to develop corporate debt market. Development of corporate debt market will reduce the burden of banks and hence bank can expand its retail customer base.

Objectives:

- To explore the reason for the rising NPA
- To explore the potential of debt market in India
- How debt market can reduce the burden of Indian banking System

Literature Review

In any economy, a healthy debt market is considered crucial for development and Stability. Armour and Lele (2009) proposed that economic structure is determinant of financial structure. As Indian economy is service led economy, hence equity market liberalization is preferred over debt market liberalization in the financial structure.

The International capital markets Association (2013) argues that vibrant corporate debt market brings substantial economic benefits and is important for all stakeholders concerned viz. companies, investors, economies and government.

Good Friend (2005) says that transparent firm use debt market to lower their effective cost of fund.

World Bank (2000) observes that the corporate bond market can substitute bank finance and can help bank to clean up their Balance Sheet in developing country. It needs strong institutional and regulatory support. World Bank (2000) specifically identifies seven necessary development components for effective functioning of vibrant bond market.

The components are

- Disclosure and information system
- A credit rating system
- Effective bankruptcy law
- Market intermediaries
- Institutional investor
- A trading system and clearing platform
- A depository system.

Any absence, deficiency or inefficiency of any of the above component can halt the development process.

Sengupta (1998) establish a direct correlation between firm's disclosure practices and its effective interest cost.

Theory

Non-performing Asset are also called non-performing Loans. A loan is an asset for a bank as the interest payments and the repayment of the principal create a stream of cash flows. It is from the interest payments that a bank makes profits. When a bank stops getting interest and installment of principal for last 90 days, loans turns into NPA or Non-performing Loans

Rise in Non-Performing Asset of Banks

Non-performing Asset are also called non-performing Loans. A loan is an asset for a bank as the interest payments and the repayment of the principal create a stream of cash flows. It is from the interest payments that a bank makes profits. When a bank stops getting interest and installment of principal for last 90 days, loans turns into NPA or Non-performing Loans. There are various reasons for rise in NPA of banks. For years Indian lenders especially state run banks, were engaged in volume game to balloon their balance sheet and appease their promoter (Government).There used to be competition among PSU Banks to grab borrower without paying attention to sustainability of the business. Every outgoing chairman passed the buck to his successor. The GNPA of Banks as percentage of the total loans has grown from 2.11% to 5.08% from 2008 to 2015. Bank lending was majorly focused to big ticket corporate loan in hope of higher return.

Apart of Poor credit appraisal process, turbulent industrial scenario also impact asset quality of banks. Oil price change, falling commodity prices, stagnating Chinese economy are the few factors which impacted profitability of many industry.

These factors have eroded the debt paying capacity of many companies.

Debt market can be a support to ailing banking sector. As debt market provides capital at market driven rate, company's dependency on Bank for finance will reduce. Hence bank can focus more on smaller segment of Industry.

Because of excessive focus on large corporate client PSU banks ignored the retail customer. Retail customer gradually shifted to private sector banks. The good retail customer base served as the cushion to rising NPA. Retail loans are less prone to NPA formation. Indian consumption story is mainly funded by private sector banks.

SME & MSME segment –A hedge against NPA

SME's are growth engine of economy. It contributes 8% in GDP. It provides 45% in manufactured output, 40% of export. SME also provide job to 60 million people. This segment of economy is very poorly served by Indian Bank especially PSU bank. While analyzing the NPA proportion of SMEs in total advances, it is observed that percentage share of non performing SME advances in total advances of 102 respondent branches was less than 10%, which represent 60% of total numbers (SME finance from Bankers perspective.2014-15).This indicates that 90% contribution in NPA of these branches is from other segment of business such as agriculture, wholesale banking and others. This proves that SME loans are less risky.

Analysis

Debt Market and Banking System

Debt market is the market through which company raise money by issue of Debt instrument. These debt instrument carries interest cost which gives tax benefit to the issuing the company.

A liquid corporate debt market can play a great role by supplementing the banking system to meet the requirements of the corporate sector for long-term capital investment and asset creation.

Credit flows to the system through public and banking channel. But in current scenario major credit flows through on banking system. Among borrowers largest borrower is still government of India. Private sector either raises money through banks or equity market. As economy is mainly driven by services so equity market appears more attractive.

So far banks are the one of the largest investor in Debt market, but due to SLR requirement and LAF facility, banks major investment still goes to government securities. As the return on investment in case of Government security is less, so banks lend money to poorly rated companies. These types of lending creates risky asset. As there is no regulation regarding exposure to any one particular borrower, all banks chase fewer borrowers irrespective of their existing debt burden.

In this cut throat competitive banks ignore retail borrowers. Private sector banks and NBFC companies grabbed this opportunity to gain market share.

When company gets capital from corporate debt market, they will not approach banks for funds. Hence banking company can lend more to retail segment. Banks can increase their interest margin. Also quality of asset will improve. With the growth of corporate bond market, cost of funding will come down, which in turn increase the business growth. Bank can concentrate more on under banked segment such SME, MSME sectors, which in current scenario is capital starved segment.

So development of debt market can complement the bank finance and improve the industrial growth. A healthy debt market provides an opportunity for banks to invest and generate higher return on investment.

Following are the initiative which government can take to develop corporate bond market and support development of a healthy banking System.

Developing Rating Agency

Rating Business in India is not very developed and not institutionalized so to develop debt market we must facilitate the growth of rating business in India. A Credit rating evaluates the creditworthiness of an issuer of specific type of debt, specifically debt issued by a business enterprise such as a corporation or government. It brings transparency and liquidity in debt market. It will increase retail participation in debt market. Common public know very little of debt market, rating agency can increase the awareness level of Bond Market. This increased awareness will reduce the NPA formation.

Corporate debt based repo

Liquidity adjustment facility is available with all banks for meeting their temporary requirement of funds. This facility is availed by repo and reverse repo process. Repo process is collateralize borrowing

.Government bond is used as collateral for these borrowing.

Government can provide similar facility to corporate and corporate bond can be used as collateral for borrowing.

This step will create demand for corporate bond, company can get easy fund. When company get good subscription of debt instrument, then their dependency on Bank for fund will reduce.

Bankruptcy regulation

An efficient regulation is pre-requisite for health debt market and Banking system. It should aim at consolidating various outdated laws to enable faster resolution of NPAs, improve recovery rates and provide equal treatment to all stakeholders. It also aims to bring about a comprehensive and consistent treatment for bankruptcy and insolvency. The implementation of this bill could result in the emergence of new players in the market of distressed assets and a likely deepening of / growth in the corporate bond market, with banks likely to be key beneficiaries.

Institutional Intermediaries

Government must create more intermediaries for debt market trading. Currently the Debt based intermediaries are very small in number. Many brokers have license of Debt market but still they prefer Equity over Debt. Primary dealers business should increase.

These developments will increase the liquidity of debt market and hence banks find an alternate avenue of investment. Retail participation in debt market will increase with growth of debt market intermediaries.

Curb on lending to large corporate

Government must discourage banks from lending to large corporates. As major component of NPA are large corporate loans. As the large corporates enjoys good credit rating so they must be encouraged to raise money through debt market. With large corporates raising money through market, banks can finance Small and Medium enterprise.

Banks can lend money to large corporates by subscribing their debt issue; thereby banks compensate their loss of interest income.With banks investment shifting from advances to investment, quality of asset will improve and income remain unaffected.

Innovative debt instruments should be introduced

To develop debt market as alternate source of fund, government must encourage the innovation in designing of debt instrument. Masala Bond is innovation in Debt instrument. It Rupee denominated debt instrument offered to foreign investor.

Banks must be allowed to raise money through these instruments. It attracts foreign investor in Indian market. Convertible, Floating rate based CD, Municipal Bond should be introduced.

FII limit in Corporate Debt market should be increased

Foreign participation in Indian debt market has increased significantly. FII has understood the return potential of Indian Debt Market. We have increased limit of FII investment in Government Securities, so we must increase limit of FII investment in corporate debt too.

FII participation will attract other investor in market. So far FII limit in corporate bond market is USD 51 billion, of which 70.69% already subscribed (NSDL, 2nd Dec, 2016).

Increase retail participation

Regulator and policymakers should encourage investor friendly technological trading platform for debt instruments. Lot size should be reduced. Better risk management mechanism must be introduced. Transaction cost should be brought down. Tax benefit like equity investment should be introduced. Investor awareness programme on debt market should be organized.

Conclusion

This paper tries to find solution of rising NPA in bank by developing debt market. Economic growth of 7% to 8% can't be sustained by only bank finance. It must be supplemented by strong and efficient debt market. Debt market will not only support the growth of economy but create a strong banking system. It will increase the attractiveness of India as an investment destination. Debt market will bring transparency and reduce the NPA burden of banking system.

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External Business Environment

A comparative study on operating performance of public and private sector banks in India with special reference to SBI and ICICI.

Richa Arora* ,Dr.R.S.Pandey**

**Research scholar, School of Commerce HNB Garhwal University*

***Associate professor, Dr.R.S.Pandey,School of Commerce,HNB Garhwal University*

Abstract

The banking system is a major part of fiscal sector and it plays an important role in economic development of the country. In many researches ,the public sector banks in India have been compared adversely with private sector banks, domestic and foreign banks but this comparison generally rests on financial measures of performance which provides much of the rationale for privatization of public sector banks but the present study focus on comparing the operational performance of public and private sector banks .

In the past times, the prime motivation for companies to implement business performance management lies with budgeting and planning applications business but now makers are focusing on creating value by more effectively managing their operations and business processes. The evolution of operational performance management helps organizations do just that. It is the practice of understanding, optimizing, and aligning operation centric business activities and processes to a common set of goals and objectives to reach higher levels of business effectiveness.

The present research compares the operating performance of public and private sector banks in India. Operational performance is defined in terms of employee productivity and to measure it, values of two variables profit per employee and business per employee has been used in the study. An effective operating performance of the banks helps

them to grow up speedily in terms of their profitability also. The study measures the operating performance of two banks SBI and ICICI and the data has been collected from the thirteen years (2001-02 to 2013-14) annual reports of the selected banks. The collected data is analyzed by using descriptive statistics and independent t- test and it is found that there is a significant difference between the operating performances of the two selected banks. Thus, the present study discovers that employee's productivity is higher in private banks as compared to public banks and it also suggests some measures to improve operating efficiency of the banks.

Keywords

Operating performance, banks, profit per employee, and business per employee.

Introduction

Most of the organizations are intensely interested in making their financial position better than others by the use of various techniques but, rarely does it understand the worth of operational drivers for overall financial and corporate performance. In today's increasingly competitive and global environment, it is becoming more and more important for successful concerns to ensure operational effectiveness and efficiency. According to the Law dictionary, an operating performance refers to the firm's performance measured against prescribed standards, such as compliance with regulations, waste reduction, productivity; etc. It is the measurement which is used as an evidence to determine progress toward specific defined organizational objectives. This includes both quantitative evidence as well as qualitative evidence.

The operating performance of banks has been the matter of research since long time and extensive amount of attention has also been received by it. This is primarily due to the fact that operating efficiency is of particular interest for both managers and policy makers because first improves the performance of the firms and second one has to assess the market structure in order to secure the stability of the financial system.

There are various stakeholders in an organization but the chief strategic goal of any private business is higher financial performance and maximization of wealth for the shareholders whereas the goal of public firms is to provide wider services to public at low cost. Financial performance of an organization depends to a large extent on effective operational performance. The

operational performance is a function of people, process and technology (Curtis et al., 1995).

The Operating function of the employees can provide a competitive advantage through its quality, speed, reliability, cost and flexibility. (Johnson et al , 2001). The use of specific objectives to manage operational performance is common practice among self-sustaining private and public organizations that are responsible for generating sufficient revenue to meet costs and, to produce profit. The experiences of these organizations are a rich source of information to be consider in the public sector. Human Resource Practices also play a very important role in increasing the operating performance of any organization as effective implementation of these practices by HR manager improves the employee productivity which leads to increase in the operating efficiency of any organization.

Thus, present research tried to measure the operating performance of the public and private sector banks in India. Operational performance has been defined in terms of employee productivity. Employee productivity is an important performance criterion for a service organization such as commercial banks where human resources are its biggest asset (Mehra, 1996). It can be measured in terms of profit per employee and business per employee.

Review of Literature

Mitra and Ravi (2008), attempts to evaluate the efficiency of 50 Indian banks by using DEA model. The analysis is supposed to verify or reject the hypothesis whether the banking sector fulfils its intermediation function sufficiently to compete with the global players. The results are insightful to the financial policy planner as it identifies priority areas for different banks, which can improve the performance. This paper evaluates the performance of Banking Sectors in India.

Dhanabhakyam, M. and Kavitha, M. (2012), conducted a study on financial performance of six public sector banks and analyse the data by using ratio analysis, correlation and regression. The results reveal that all the selected banks have good financial efficiency and growth rate and the credit for their performance goes to effective marketing of the banks.

Movalia and Parekh (2014), tried to compare the financial position of public and private sector banks by using five years data i.e the

period from 2007 – 08 to 2011 – 12 and on analysing it , they found that public sector banks are better than private sector banks in the area of profitability, EPS and debt-equity ratio but price earning ratio is better in private banks as compared to public banks.

Mohapatra, Lenkan and Pradhan (2015), attempts to make the comparison between the operating efficiency of public banks and foreign banks by using variables like labor productivity, profitability ratios etc and found that foreign banks are performing well in comparison to public banks because of their effective management, using of advanced technologies by the employees. The results also reveal that business per employee and profit per employee is also high of these banks.

Ashokan and Menon (2016), attempts to find out the substantial performances of the banks and found that the private sector banks and SBI and its associates have to improve on their branch development and employee strength.

It is apparent that the internal management and employee efficiency of nationalised banks are far better than other sectors of commercial banks.

Upadhyay (2016), aims to discover the effect of return on assets, return on equity, business per employee and profit per employee for measuring the performance of three private sector banks which are Axis bank, HDFC and Indusland bank.

They selected the data of 5 years i.e. from 2011 to 2015 and found that there is no significant difference between the performance of all the three banks.

Objectives

- To compare the operating performance of SBI and ICICI between public and private sector banks in India.
- To suggest some measures for increasing the operational efficiency of public and private sector banks in India.

Hypothesis

H1: There is significant difference between business per employee in SBI and ICICI.

H2: There is significant difference between profit per employee in SBI and ICICI.

Research Methodology

Sample

The sampling population of this research includes one bank from public sector i.e State Bank of India (SBI) and one bank from private sector i.e. Industrial Credit and Investment Corporation of India (ICICI). The study comprises of 10 years data of business per employee and profit per employee from the selected banks.

Data collection

The type of data used in the study to analyse the operating performance of the banks is secondary data. Operational performance of banks is defined in terms of employee productivity. Employee's productivity is an important performance criterion for a service organization (Mehra, 1996) and to measure it,values of two variables profit per employee and business per employee has been collected from the thirteen years (2001-02 to 2013-14) annual reports of the selected banks.

Research Variables

The variables that are being considered to measure the operating performance are described in the theoretical framework.

Business per Employee: Business per employee is a measure of management efficiency. It is a potential of the banks i.e. a combination of deposits and credits. It takes the company's operating income from the income statement and divides it by the number of employees needed to produce that revenue. It can be calculated as:

Business per employee = Total Business/ Total Employees

Profit per Employee-Profit per employee measures the average profit generated by each employee of a company. It is a measure of how effectively a particular concern is utilizing its employees. In general, relatively high profit per employee is a positive sign that suggests the company is trying to find more and more income from its workers. It is based on the assumption that profit is an accurate measure of return on rational capital.

Profit per employee can be calculated by dividing a firm's net profit by its total number of employees' i.e.

Profit per employee = Net Profit/ Total Employees

Tools Used

To test the hypothesis, framed for the research work, secondary data is collected and analyzed by using Independent sample t - test , in addition to it descriptive statistics is also utilized to compare and check the operating performance of the banks.

$$S = \sqrt{\frac{\sum (x_1 - \bar{x}_1)^2 + \sum (x_2 - \bar{x}_2)^2}{n_1 + n_2 - 2}}$$

where,

$\overline{X}_1$=mean of sample 1 X_2= mean of sample 2S = standard deviationn_1= number of items in sample 1 n_2 = number of items in sample 2

Data Analysis and Interpretation

Comparing Employees' Productivity of SBI &ICICI

The formula of t-test is as follows:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S} \sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

- *valuating business per employee of SBI and ICICI*

Table 5.7: Business per Employee of SBI and ICICI (Amount in Rs. '000')

Year	SBI	ICICI
2001-02	17300	48600
2002-03	19100	112000
2003-04	21056	101000
2004-05	24308	88000
2005-06	29923	90500
2006-07	35700	102700
2007-08	45600	100800
2008-09	55600	115400
2009-10	63600	76500
2010-11	70465	73500
2011-12	79800	70800
2012-13	94400	73500
2013-14	106375	74700

Table 5.8: Descriptive Statistics of business per employee of ICICI and SBI

Mean and Standard Deviation of Business Per Employee					
	Ownership	N	Mean	Std. Deviation	Std. Error Mean
BPE	ICICI	13	86769.2308	19235.57402	5334.98834
	SBI	13	51017.4615	30011.23236	8323.61824

*Table 5.9: Comparing business per employee of ICICI and SBI(Independent sample test),*indicates significance at 0.5 level.*

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
BPE	Equal variances assumed	3.734	.065	3.616	24	.001	35751.76923	9886.59300	15346.84415	56156.69431
	Equal variances not assumed			3.616*	20.436	.002	35751.76923	9886.59300	15156.85529	56346.68317

All values are summarized in the above table, calculated value of t = 3.616; when calculated value and critical value are compared at the 5% level of significance, null hypothesis is rejected because calculated value of t (t=3.616) is more than the critical value of t ($t_{0.5}$ = 2.064) at 5% level of significance. Calculated value of t = 3.616 > table value $t_{0.5}$ = 2.064 i.e. critical value is 2.064. Thus, t-test shows significant difference in per employee business of SBI and ICICI. Hence hypothesis 1 has been accepted.

Evaluating profit per employee of SBI and ICICI

*Table 5.10: Profit per employee of SBI and ICICI (Amount in Rs. '000')*Source: *Annual reports of SBI & ICICI during 2001-02 to 2013-14..*

Year	SBI	ICICI
2001-02	115.82	500
2002-03	147.83	1100
2003-04	176.61	1200
2004-05	207.5	1100
2005-06	216.76	1000
2006-07	236.81	900
2007-08	372.57	1000
2008-09	473.77	1100
2009-10	446.03	900
2010-11	384.63	1000
2011-12	531	1100
2012-13	645	1400
2013-14	485	1400

Table 5.11: Descriptive Statistics of profit per employee of SBI and ICICI

	Ownership	N	Mean	Std. Deviation	Std. Error Mean
PPE	SBI	13	341.4869	168.31678	46.68268
	ICICI	13	1053.8462	229.54805	63.66517

*Table 5.12: Comparing profit per employee of SBI and ICICI,*Indicates significance at 0.05 level.*

Independent Sample t –Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
PPE	Equal variances assumed	.056	.815	-9.023	24	.000	-712.35923	78.94635	-875.29650	-549.42197
	Equal variances not assumed			-9.023*	22.010	.000	-712.35923	78.94635	-876.07958	-548.63888

To test the above hypothesis an independent sample t-test has been applied, calculated value of t = 9.023; when calculated value and critical value are compared at the 5% level of significance it is found that null hypothesis is rejected because calculated value of t (t=9.023) is more than the critical value of t ($t_{0.5}$ = 2.064) at 5% level of significance. Calculated value of t = 3.616 > table value $t_{0.5}$ = 2.064 i.e. critical value is 2.064. Thus, t-test shows significant difference in per employee profit of SBI and ICICI. Hence hypothesis 2 has been accepted.

The above analysis indicates that among the selected variables of operating performance private banks are experiencing more productivity from employees as compared to public banks and, thus, there is a significant difference between the operating efficiency of these two sector banks. It could be interpretive by the mean score of business per employee and profit per employee. The mean of business per employee of ICICI bank is 86769.23 and mean of profit per employee of ICICI bank is 1053.85 while on the other side mean values of business per employee of SBI is 51017.46 and mean value of profit per employee of SBI is 341.49 which evidently indicates higher

growth in employees' productivity of ICICI in comparison to SBI.

Suggestions

- Today's business environment is highly competitive and uncertain and that is the reason why banks are finding difficulty in service grow. In the present scenario for better performance, management must keep watch on the emerging trends in business environment. The proper and timely strategies are to be adopted to improve efficiency of the whole organization.
- Healthy discussions, meetings and proper guidance among employees working at different levels can improve the employees' productivity in banks.
- Goodwill of the organization and employees play an important role in creating new accounts in banks. The focus of management should be on employees' recruitment and selection procedure, training and development, motivation which will improve friendliness of banks with the public.
- Performance appraisal planning and methods should be properly carried out as the improper appraisal is creating problems for further actions. Head of HR Department should look into this, take help of experts and implement the performance appraisal strongly. A lot of irregularities would be overcome.
- Employees are the most important resource for banks. They contribute in achieving higher profitability, business, competitive advantage and goodwill of the banks. Management should treat them as business partners.

Conclusion

In the present research focused is on operating performance of the public and private banks in India and it is found that there is a significant difference between business per employee and profit per employee of SBI and ICICI. The study also exposes that operating efficiency of private sector banks is high as compared to public sector banks. It could be interpretive by the mean score of business per employee and profit per employee. Thus, higher growth in per employee business and per employee profit of private banks is largely attributed to higher contribution of technology based banking, impressive training sessions for employees, setting goals for the employees in the prominent locations and increasing their motivation potentially by establishing easy recruitment procedure ,flexible working

schedule and effective supervision. All these factors improve the productivity of the private banks' employees which ultimately increase the operating performance of these banks. Chen (1998) in Taiwan, and Mercan et al. (2003) in Turkey also said in this context that operating efficiency of privately-owned banks is higher than that of state-owned banks.

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Application of Portfolio approach towards Energy Security: A case study of Japan and implications for India

Dulal Halder*, Dr. Anshuman Gupta**

** ONGC Videsh Limited as Chief Engineer (Strategy, Corporate Planning & Portfolio Management)*

** Professor CoMES, University of Petroleum Energy Studies.*

Abstract

Adequate, reliable, consistent and affordable energy supplies are lifeline of modern economies. That is why energy reserves are also termed as strategic reserves. Security of energy supplies lies at the center state of international politics. Energy security is an important issue of concern for all countries, including India, to ensure its national defense, economic development and social cohesion. At the same time rational understanding of what energy security means is significant for resolution of the energy security problems. Extensive reliance on imported fossil fuels, which is the historical mainstay of India's energy supply, is counterproductive for sovereignty and economic wellbeing of any country. Energy policy planners face a diverse range of technological and institutional options for generating energy strategy that is simple and dynamic. Therefore, the challenge in addressing energy security is finding a framework that allows policymakers and others to conceptualize the status of a nation's current energy arrangements, then analyze the risks and take appropriate measures to correct deficiencies. This article describes application of portfolio approach as a function of state energy policy for handling of energy security issues, analyses the case study of Japan as a developed economy devoid of domestic energy resources, and brings out the key lessons and opportunities for India's energy security pursuits.

Key Words: Energy Security, oil imports, diversification, energy strategy, Japan, India

OBJECTIVE

For this article on application of portfolio framework for energy security, the state and its policymakers are the focal point. This paper explores the topic of energy security by first defining energy security in all its dimensions and proposing a portfolio approach for conceptualizing the energy security at the policy level. In order to achieve the goal of finding an energy security solution, the theories surrounding energy security are examined as they apply to the concepts of energy independence. The aspect of 'energy diversification' is examined through a portfolio approach and its role in promoting energy security is evaluated. This paper describes the underlying portfolio-theory ideas and illustrates through the portfolio approach the principles of both source and supplier diversification for benefiting the energy security situation of nations. Japan, which is severely deficient in fossil fuel energy resources and one of the world's largest energy consumers, has been chosen as a case study to illustrate how portfolio model can assist in the development of energy policy options and ideas for national policy makers. A chapter is dedicated to describe what could be the lessons for India and the challenges and opportunities.

Introduction

Energy has always been important to humanity. Interruptions of energy supply are associated with the potentiality of serious financial, economic, social losses as well adversity of military strengths. For these reasons, energy resources are treated as strategic resources. Energy, particularly fossil fuel resources has historically played the central role in world economy and social development. Inspite of sustained emphasis to alternative renewable sources of energy sources of solar, wind, water and nuclear power, the role of crude oil and natural gas in macroeconomic movements could not wane for decades. Crude Oil shocks have had macroeconomic consequences in both oil exporting and oil importing countries. In oil exporting countries, crude oil has remained major source of State revenue whereas in oil importing countries it is a major input for production system. The strategic importance and consistent vulnerability of fossil fuel supply and prices led to a great number of scholastic research studies on effects of oil price and supply disruptions on the overall macro-economic

factors and activities, effective monetary policy effects and fiscal policies. These studies empirically established relationship between oil price volatility, fiscal policy and macroeconomic performance of both oil importing as well as oil exporting countries.

Amongst all forms of energy resources, crude oil is the world's most tradable fuel and hence dominates the notion of energy security. Generally speaking, volatility of oil prices has had negative repercussions on the aggregate economy of consuming nations, as has been abundantly depicted through energy and economic literature. Fossil fuel supply risks are costlier in developing nations and emerging economies that import higher shares of their energy needs and are subject to additional currency fluctuations. In oil exporting countries, their governments directly receive the oil revenue from exports. The government's behavior in the short and long run in spending this petroleum export revenue becomes the single most significant indicator and characteristic of its economy. In these economies, when crude oil price rises the government earns additional revenue and has more money to spend. This easy availability of oil revenue sometimes encourage public spending in areas that are non-priority and may even be frivolous, as far as planned allocation of resources shall be expensed by a responsible nation. Over a period of time this counter-productive and non-essential spending tendency becomes economic practice of the ruling regime and invariably turns the economy to be more vulnerable to global price volatility particularly in the environment of abundance of capital market imperfections.

Emergence of crude oil as energy security tool

The concept of using oil as a tool for security dates back to British premier Winston Churchill's war time strategic moves for military purpose. Churchill made that historic decision on the eve of World War-I to shift the power source of British navy's ships from coal to crude oil so as to make the navy fleet faster than its German counterpart. That fuel switch turned in a new leaf in the world history. The British Royal Navy shifted its reliance from coal for which the supply was coming from the Wales from its mines. Instead, the crude oil supplies were to come from the Persia (ancient Iran). Oil suppliesfrom the Persiawas always going to be uncertain, on supply as well as

on costs. Securing uninterrupted supply and managing costs slowly but surely warranted the attention of the highest echelons of the ruling and military regimes. Energy security thus gradually emerged as a strategic issue of national importance.

In the contemporary past, securing the supplies of crude oil and making it reach citizens at affordable costs, a matter of consumer interest, grew into strategic matter of the greatest significance after the oil crises of 1970s and early 1980s. The Arab oil embargo and price increases led to speculative hoarding when oil companies started manipulating the market for profiteering. Companies often disagreed to sell crude oil stocks on a given day at a prevalent price in the expectation that the price shall be higher on the next day and hence large hoardings were created. In response, many countries introduced price controls to keep oil prices under control at low levels. The imposition of superficial price ceilings and State controls consequently resulted in adverse consequences in terms of demand distortions and impacts on treasuries. Modern and advanced economies started freeing up gradually and restored natural market equilibrium, with the United States becoming the first nation to decontrol prices in 1980. However the poorer countries in Asia Africa continued with the superficial controlling practice and struggled to manage consequent distortions in fiscal prudence and national economic health.

The crude oil trading market globally integrated and reached balancing equilibrium over a period of time under various demand supply dynamics. The Organization of the Petroleum Exporting Countries (OPEC) came into and the picture in September 1960 and immediately got into an overtly dominant role forming the first-ever cartel of five oil producers, effectively managing higher prices of crude for the supplier nations. Oil has ever since remained a tool of political and strategic influence.

Defining Energy Security

Energy security is used in various contexts for covering different purposes. Given its consequences for the present and the future, energy security now-a-days is taught in universities and is a common topic in research institutions and global policy making think-tanks. Governments have created dedicated authorities and ministries

dealing with the issues of energy, inter-wined with economics, military capabilities, foreign policy and strategic affairs. Given its wider perspectives, the term Energy Security has been described from time to time keeping in the context multi-dimensional aspects like:

- Supply disruptions caused by war, natural disasters, terrorism, civil unrest
- Availability of supplies for longer period without possibility of sudden interruptions
- Effects of price shocks on economic activity and wellbeing of citizens
- Affordability of the physical commodity. The multi-dimensions could be addressed in defining energy security as "the availability of usable energy supplies at affordable price levels and in sufficient quantities with due regards to energy efficiency, demand side management and economic development of a country".

The concept of energy security has been delved in detail and defined in Indian context also. The Integrated Energy Policy 2008 of the Planning Commission, Government of India (now NITI AYOG) provides a broader definition of energy security as "The country is energy secure when we can supply lifeline energy to all our citizens as well as meet their effective demand for safe and convenient energy to satisfy various needs at affordable costs at all times with a prescribed confidence level".

The most significant element of energy security that would relate to most of us is the continuous availability of supply at a price which is affordable, even at the increased demand level. Reputed energy author and expert Mr. Daniel Yergin, in his exhaustive write-ups also prioritized the physical availability aspect amongst all other key dimensions describing energy security. He articulates that that the foremost dimension of energy security is the physical security which implies protection of assets, infrastructure, chain of supply, as well as trade routes. Scarcity of resources and concentration of resources in select countries (refer Table 1) make physical availability of resources a foremost concern.Energy security demands policies to

enable insuring adequate and affordable supplies in the present as well as in the future when demand shoots up

. Table 1: Top Ten Producers of Petroleum and Other Liquids, 2015

Sl no	Country	Oil production in Million Barrels per day
1	United States	15.12
2	Saudi Arabia	11.95
3	Russia	11.03
4	China	4.72
5	Canada	4.51
6	Iraq	4.05
7	United Arab Emirates	3.47
8	Iran	3.45
9	Brazil	3.19
10	Kuwait	2.71

Given that coal, oil and gas currently make up around 80% of the global energy mix, only a few resource supplier countries dominate the world energy landscape. Fossil fuel reserves and price control dictate regional geopolitics and will continue for many years to come. International Energy Agency (IEA)'s World Energy Outlook 2016report predicts fossil fuels to account for around 60% of the global energy mix in 2040 and renewable energies increasing its share to 30%.The dominance of fossil fuels in the energy mix continues unabated. Given the historical trends and energy outlook, it can be forecast that supplier nations shall continue to have the upper hand in rebalancing global energy trade.

Energy Dependency

The relationship between the supply and demand of energy is the cause of dependency. It is not only the importing countries that depend on supply countries, but the energy producers remain dependent on steady consuming growth market to make sales. .

Dependency of supplier countries wield strong relationship in creating and sustaining stronger demand which, inter-alia, depends on economic and industrial activities in purchasing nations.

While reserves of fossil fuel energy resources are confined to select region or countries, demand is regular, sustained and if not for economic slowdown, is in continuity in the increase because of the functions of modern economies. The factors underlying the demand supply dynamics causes the trade of energy sources to grow and become important to an extent that energy trade becomes issue of public importance. The relations between the supplier and the buyer are not confined only by economic logicsbut also by political motives and inter-state interests. The relations and state involvement in energy supply results in sovereign handling of price and supply volatility.

Energy Outlook and the challenges of sourcing energy

Whereas oil producing countries seek certainty of demand, sense of energy security vulnerability leads countries to search for instruments of securing supplies. The United States is currently the world's largest oil producer. Saudi Arabia and Russia rank second and third respectively. The United States, Saudi Arabia and Russia together account for 40% of global crude oil production. Adding Canada and China, the percentage share of oil production from the five countries reaches 50% of the global production. Major producers of crude oil next in line are Iraq, United Arab Emirates and Iran, in that order.

In case of natural gas, Iran and Russia hold between them a third of total global reserves. With Qatar and Turkmenistan, the percentage of natural gas reserves in four countries rise to 60% of global reserves. Other large gas reserve holders are the United States, Saudi Arabia, United Arab Emirates, Venezuela and Nigeria, in descending order. In all, nine countries account for 80% of global natural gas reserves and the Middle East holds 40% of share. The distribution of proved oil reserves in the thresholds of the last two decades are shown in Fig.1 below.

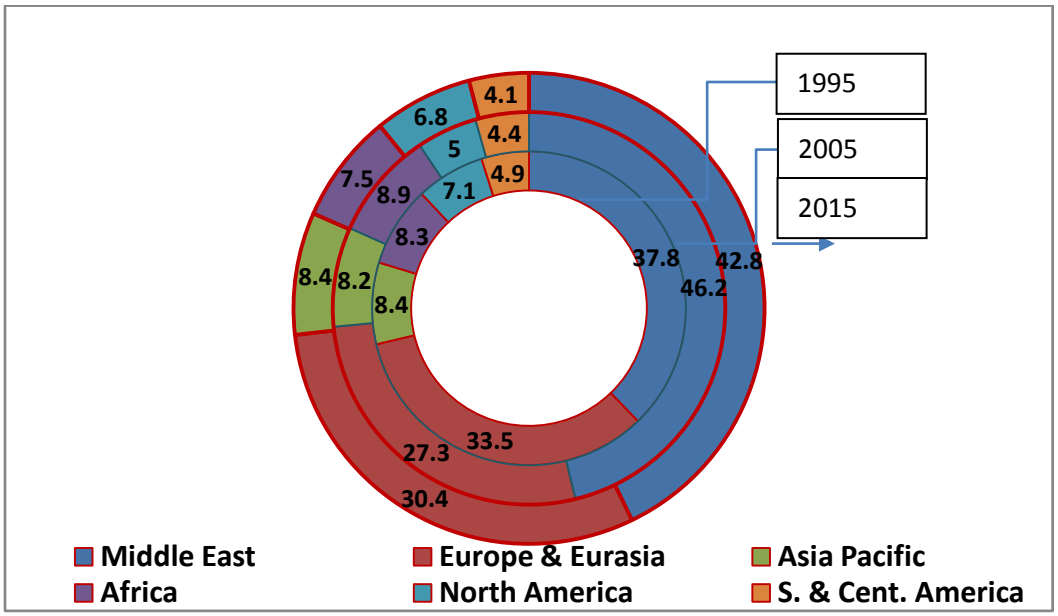


Figure 1: Distribution of Proved Reserves of crude oil: 1995, 2005 and 2015

Source: BP Statistical Review of World Energy 2016

The IEA projections of 2016 have fossil fuels likely to continue dominate and meeting more than 80% of projected demand increase in future. Crude Oil shall have the largest fuel share with two-thirds of increase in oil consumption coming from transport sector. Extensive usage of crude oil shall continue in the transportation sector as it is the most economical means of running a multi-mode transportation system. The World Energy Outlook 2016 forecasts higher oil demand emanating from freight, aviation fuel and also petrochemicals.

Amongst the larger causes of demand growth forecast, IEA identifies Indian consumers, where daily crude oil consumption is slated to rise by 6 million barrels. On the supply side, US tight oil output is expected to be higher for longer. The oil exporting cartel OPEC is predicted to have its share of global production rising towards 50% by 2040. The crude oil supply from Iran and Iraq which has remained curtailed for years, is expected to rebound.

Natural gas is projected to overtake coal as the world's second-largest primary energy source with an annual growth rate @ 1.5%

to 2040. However, the demand growth projection in natural gas might need to be caveated as gas markets, trading models for gas and pricing arrangements are no more standardized, and is still searching a balancing point. Demand growth in natural gas is further subjected to the impending oversupply of gas in market with 130 bcm of additional liquefaction capacity under construction in the United States and Australia.

The energy value chain has become more integrated with innovation, policy implementation and natural integration. The vulnerability of any one component and effects of its failure in the entire value chain have been magnified purely based on historical facts. Increasing integration and long-term supply agreements improve energy efficiency and reduces uncertainty for investments in energy infrastructure.

The disrupters in energy supply

There are several disrupters in global energy market place and supply value chain. Disruptions can be broadly described as events that cause imbalances between supply and demand in global energy markets. Disruptive causes arise when international energy markets become politically charged but they can also arise from within the market itself and from random incidents. Disruptions also occur simultaneously from one or more suppliers. Ensuring energy security is more difficult when the probability of disruptions and communication between them are uncertain. A disruption can arise from force majeure conditions leading to non-compliance of commercial commitments in contracts. Supply disruptions can be from producer cartels as deliberate restrictions are put for political and strategic reasons. Disruptions occur on demand side through embargo restrictions. Embargoes are when consumer countries restrict purchases from chosen countries to set political scores. In embargoes, like that of 1970s Arab embargo, the consuming nations have to worry about politically induced disruptions as well as market disruptions and state economies.

Portfolio Approach for Energy Security

Preferential access by major oil and gas companies to reserves is increasingly being restricted with additional access conditions from host countries. Diversification for energy mixing has emerged as a powerful

method in understanding the risks of energy market disruptions and policy formulation. Reliance on single country for energy imports can give rise to a situation where importer risks losing all its imports if supplier fails to supply. In contrast, by relying on several countries an importer can reduce risks of disruptions and escape energy supply hostage situations. Even if one supplier is unable to deliver energy supplies, importer nation would be able to secure supplies from other sources. Hence, diversification essentially targets to spread the dependence and reduce supply disruptions in energy markets.

Portfolio theory aids deeper insights into the dynamics of energy politics. Portfolio approach delves into a framework that allows policymakers to conceptualize status current energy arrangements analyze risks and take appropriate measures to correct deficiencies. While the theory was primarily developed for application in financial markets, the theory aids in analyzing relationship between diversifying and managing energy security risks. Various frameworks have been applied by researchers to the concept of energy security revolving around risk assessments and diversification models. This article proposes a portfolio approach as a framework for conceptualizing energy security and hedging risks.

Portfolios are commonly used in banking to describe a group of investments in various financial or banking instruments which are held by investors (see Figure 2). The diversification strategy is to create a portfolio that includes multiple investments to reduce risk of failure in individual items. For example, an investment portfolio comprising single company stock shall be generally viewed a high risk portfolio.

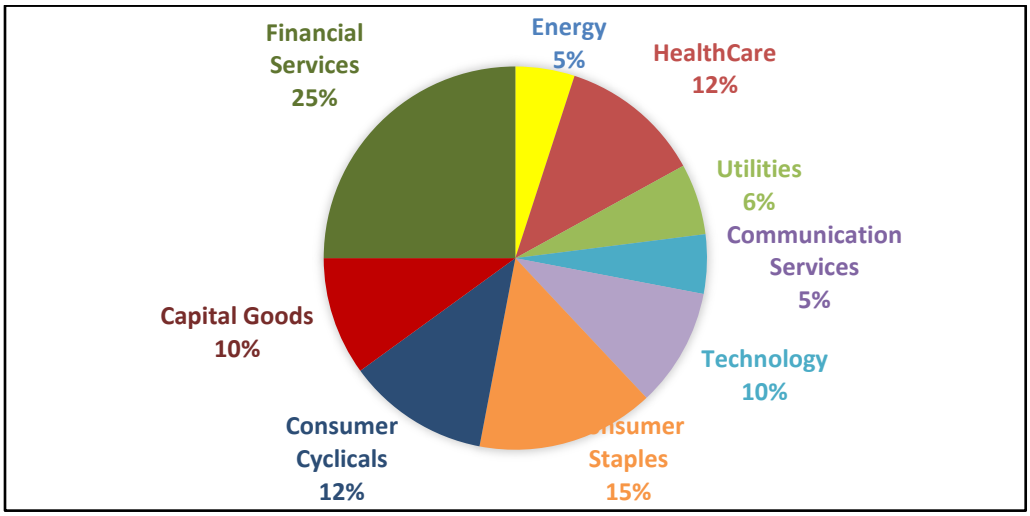


Figure 2: Sample of stock portfolio

If company's stocksdowngrade, the portfolio goes into full decline. This can be partly avoided by splitting investments by purchasing stocks of a variety of companies which will reduce risks because simultaneous slowdown in each stock shall be a low probability incidence. On the flip side some companies in the portfolio may have high costs or have low returns, but astute combination of alternatives generally optimize returns relative to risks. Therefore, the most significant feature in managing a portfolio is achieving the best return while minimizing risk of overall portfolio.

Portfolio risks can be specific or systematic. Specific risk derives from events that are unconcerned with general trends in international markets. Accordingly, specific risks affect relatively smaller number of suppliers while systematic risks are wider and can generate impact on regional and global scale. Terrorism or severe unrest might be prevalent in a particular nation or region like the Niger Delta oil producing regions of Nigeria. Such systematic risks affect the ability of that nation to export uninterrupted supplies. Dependence on a nation with systematic risk as cited exposes the importing nation to such unique risks of the region.

Putting country's energy sources and suppliers in a portfolio, this theory can be used to explore individual asset risks within a particular portfolio. The aggregate risks of all assets within the basket shall provide the portfolio risk estimates. The import risks from one country can be very different from risks of imports sourced and combined from

different countries (portfolio). The approach will provide for a view to the current source and supply diversifications. It then leads to the crucial policy decisions concerning the adjustments that are required to be made to the energy mix in order to achieve the optimal sourcing while simultaneously reducing failure risks in any one supplier source.

The principle of diversification

Since Winston Churchill's day, the key to energy security has been diversification. Diversification of supply is one of the main guarantors of security. Diversification can be explained with source and supplier factors. Source diversification deals with various energy resources mixing to depict a state's energy needs. These resources are grouped as petroleum, natural gas, coal, nuclear, solar, wind, biofuels, etc. Supplier diversification pertains to the mix of providers supplies like of petroleum, natural gas, coal etc. The current major suppliers of petroleum are Saudi Arabia, Russia, Iran, Iraq, Venezuela, Kuwait, Nigeria, etc. Since majority of supplier countries suffer from political instability, overt dependence on such countries places the importers at risk. A prudent policy maker would therefore explore to diversify supplier mix among several countries, so that failure of one does not cut off the supply chain and supply restoration can be attempted from alternative supplier countries within the sourcing nations group.

Like crude oil, LNG is a global energy attraction. The world's proved natural gas reserves are large but not developed because gas can't be transported without pipeline unlike oil. Advancement in liquefaction technology has provided an alternative in gas transportation through pipelines.LNG transportation through tankers have made distant markets accessible to suppliers. More recently, a spot market is developing fast for LNG trading where LNG can be purchased on short notice. The market for LNG trading is still emerging, but in spite of various limitations, development of liquefaction and regasification technologies has added significant flexibility to managing supply resources.

Energy Portfolio of Japan – A Case Study

Japan's Energy landscape

Japan is the third largest oil consumer and net importer in the world. Japan is also world's largest importer of LNG and second-

largest importer of coal.It has limited fossil fuel reserves and therefore is highly dependent on imports from abroad. Lack of energy resources within the country causes Japan to have an energy structure that gets affected from domestic and global factors more severely than other developed nations.

Figure 3 shows the energy portfolio of Japan. Crude oil is the largest source of primary energy consumption commanding a share of 44%. Coal comes as the second dominant sources in primary energy consumption however, the share of natural gas is fast catching up. In 2013, share of natural gas rose to 22% of total primary energy consumption. Japan's nuclear energy share shows a mere 1% in the energy mix, a fallout of natural calamities the country was forced into in the immediate precedent year. As of mid-2011, Japan replaced some of the lost nuclear power generation with heavy crude oil sourced from Gabon, Angola, and Nigeria (West Africa); and Vietnam, Indonesia, and Malaysia (SE Asia). After the U.S. began permitting export of light condensate in 2014, Japan was one of the first countries to import U.S. crude oil cargoes.

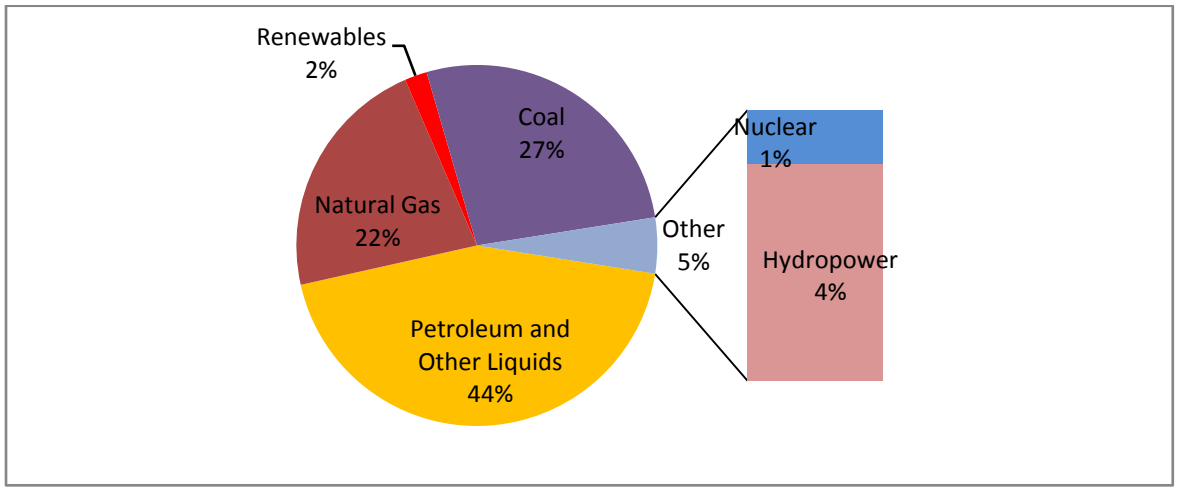


Figure. 3: Primary Energy Basket of Japan, 2013

Source: EIA 2016

Prior to the 2011 earthquake and Tsunami, nuclear energy share was about 27% of power generation of Japan. The natural calamities of March 2011 caused serious damage at the Fukushima-Daiichi nuclear plants and Japans' energy infrastructure collapsed in immediate shutdown of about 10 gigawatts (GW) of power generating capacity. Japan replaced this loss of nuclear power with natural gas, crude oil and coal imports. The substitution by more expensive fossil fuels led to higher electricity prices for consumers, higher government debt levels, and revenue losses for electric utilities. Japan spent about $270 billion which was about 58% more for fossil fuel imports in the three years following the Fukushima accident.

Japan developed a spread-out sourcing policy keeping its enormous energy dependence on foreign sources. In 2012 Japan imported 83% of its oil imports from the Middle East countries. Saudi Arabia was its largest supplier of crude oil with 33% share. The UAE, Qatar, Kuwait, and Iran are other large sources of oil imports into Japan. For natural gas Japan relies on imports to meet nearly all of its needs. In 2012, Japan consumed 4.4 trillion cubic feet of natural gas making the country world's largest LNG importer accounting for 37% of global LNG demand. The LNG import increased by 24% as a result of the March 2011 earthquake and tsunami.

Vulnerability of Japan energy supply

Japan's energy supply structure has been historically more vulnerable because the country is dependent on foreign imports for meeting 94% of its primary energy supply. Given its over-dependence on foreign resources which shall have at all times serious effects on its economic development aspirations, Japan was one of the pioneering countries to adopt the portfolio approach in energy management. As a state policy, Japan diversified energy requirement and usage and adopted partial replacement of large crude oil imports with increased use of nuclear energy, natural gas and coal. In simultaneous federal policy interventions, Japan vigorously adopted the promotion of energy efficiency, energy conservation and demand side management.

Empirical results show that crude oil is still the main energy carrier in Japan, although the share of oil consumption in total energy consumption in the country declined from

about 80% in the 1970s to 44% in 2013.Crude oil still accounts for about 40% of Japan's primary energy supply, a fact that depicts the limited success of diversification away from crude oil in a developed economy. In 2014, Japan was the world's third-largest net importer of crude oil and petroleum products after the United States and China. The Country-wise distribution of Japan's crude oil import in two recent time intervals is shown in the **Table 2.**

The dominance of crude oil, despite sustained diversification efforts, can be explained from the view of Japan's usage of oil. There are six oil-consuming sectors in the economy of Japan; they are commercial, industrial, energy power generation, non-energy, residential, and transportation sectors. The transportation and industrial sectors consumed the most oil in Japan. Between the two high consuming sectors, the transportation sector has been the top most consumer of oil in the country from 1990s and volume consumption in the sector has been remained almost constant. For the industrial sector, higher oil prices led to increased energy efficiency and affected total costs and final prices in the sector, so hence demand for oil diminished. The same reasons are applicable to commercial sector. As for transportation sector, with higher oil prices, Japanese households used their private automobiles less and demand for public transportation increased. On the other hand, Japanese automotive manufacturers have increased the energy efficiency of their products in recent years and the share of hybrid cars has risen.

Table 2: Country wise distribution of Japan's crude oil import volumes

Countries/ Region	Nov. 2016		Nov. 2015	
	Volume (kl)	Share (%)	Volume (kl)	Share (%)
Saudi Arabia	5,876,777	39.2	5,659,392	36.4
UAE	3,676,071	24.5	3,339,924	21.5
Iran	1,133,516	7.6	802,656	5.2
Qatar	1,123,615	7.5	1,068,372	6.9
Russia	798,005	5.3	1,286,432	8.3
Kuwait	781,866	5.2	1,436,248	9.2
Mexico	475,649	3.2	174,016	1.1
Iraq	374,712	2.5	462,268	3.0
Oman	276,231	1.8	-	-

Indonesia	103,588	0.9	357,769	2.3
Africa	99,526	0.7	346,924	2.2
Colombia	96,956	0.6	-	-
Australia	66,587	0.4	178,609	1.1
Viet Nam	45,100	0.3	31,715	0.2
Malaysia	49,179	0.3	119,189	0.8
Venezuela	-	-	150,498	1.0
Ecuador	-	-	106,992	0.7
Brunei	-	-	31,741	0.2
Total	**14,977,378**	**100**	**15,552,745**	**100**

Japan is susceptible to high level vulnerability also because of the fact that for Japan, the prospects for importing electricity from neighboring countries are poor because Japan is an island nation. Japan produces electricity directly by burning crude oil. Environmental concerns have helped shifting Japanese electricity generation away from direct burning of oil. Japan's stable electricity supply requires optimal combination of power sources, which can deliver economic efficiency and also concurrently address environmental concerns. The 'Strategic Energy Plan' of April 2014 of the Japan government emphasizes nuclear power as the key base load power source that can provide stability of the supply and demand structure. In June 2015, a plan was announced to maintain the proportion of nuclear power at 20 to 22 percent in the energy mix by 2030.

Historical Perspective of Japan's energy diversification

In 1973, the Arab oil producers imposed an oil export embargo against America and other western nations in response to their support for Israel in the Yom Kippur war against Egypt. This was a first-ever joint action by oil producers to curtail oil supply to the destinations that provided the major revenue earnings. The Oil embargo caused disturbances not only in USA and its western allies, but throughout the world economy. Crude oil rose rapidly, soaring four-fold from US $3 per barrel to $12 within months. The skyrocketing of prices caused havoc to the economy of multiple countries, triggering them to scramble for securing fuel. The crisis generated widespread fear that crude oil will not be available and consumers could be seen across countries rushing to supermarkets to stock up daily use products like toilet paper and detergent. This embargo symbolized the

crisis in ordinary people's lives that can be triggered by vulnerability of oil supply and pricing.

In response to the global crisis, Japan pledged to reduce its dependence on crude oil and adopted a portfolio approach, which comprised reducing share of oil in primary energy mix, and supplementing the fuel gap by increasing share of natural gas and nuclear as fuel sources. According to the Ministry of Economy, Trade and Industry Ministry (METI), Government of Japan, the share of oil in Japan's primary energy basket declined from 77% in fiscal 1973 to 44% in 2010, while that of natural gas rose from 1.5 % to 17.3% in the same period. The share of nuclear power jumped from 0.6 % to 10.8% concurrently. Electric power produced by nuclear power plants grew to account for some 30 percent of Japan's total electricity supply by 2010.Expanding nuclear power generation capacity helped Japan resuming economic growth.

Japan established an Energy Security Study Group in December 2005 under the Director-General of the Agency of Natural Resources and Energy, with the purpose of evaluating policies related to Japan's future energy security. As a prelude to its suggested portfolio approach to address energy security, this study group evaluated and identified major external energy risk factors for Japan. The key factors identified included (1) political instability chances in Middle East, (2) terrorism, natural disasters and accidents (misconduct), (3) reduction of investments from supply nations and (4) fuel consuming trends in China and India as major energy consumers. The study group detailed out prevention measures, structural improvement measures and emergency response measures for each of the identified external risk areas, and delved into policy formulations for enhancing international countermeasures and enhancing Japan's domestic countermeasures.

Portfolio approach in energy security of Japan also comprised establishing a crude oil stockpiling system within Japan. By January 2014, Japan stored oil stocks corresponding to 190 days' demand, thereby creating the ability to offset supply disruptions to some extent and gaining valuable time to come out to instant responsive interventions to resume supplies. For natural gas, its usage for power generation was increased rapidly even

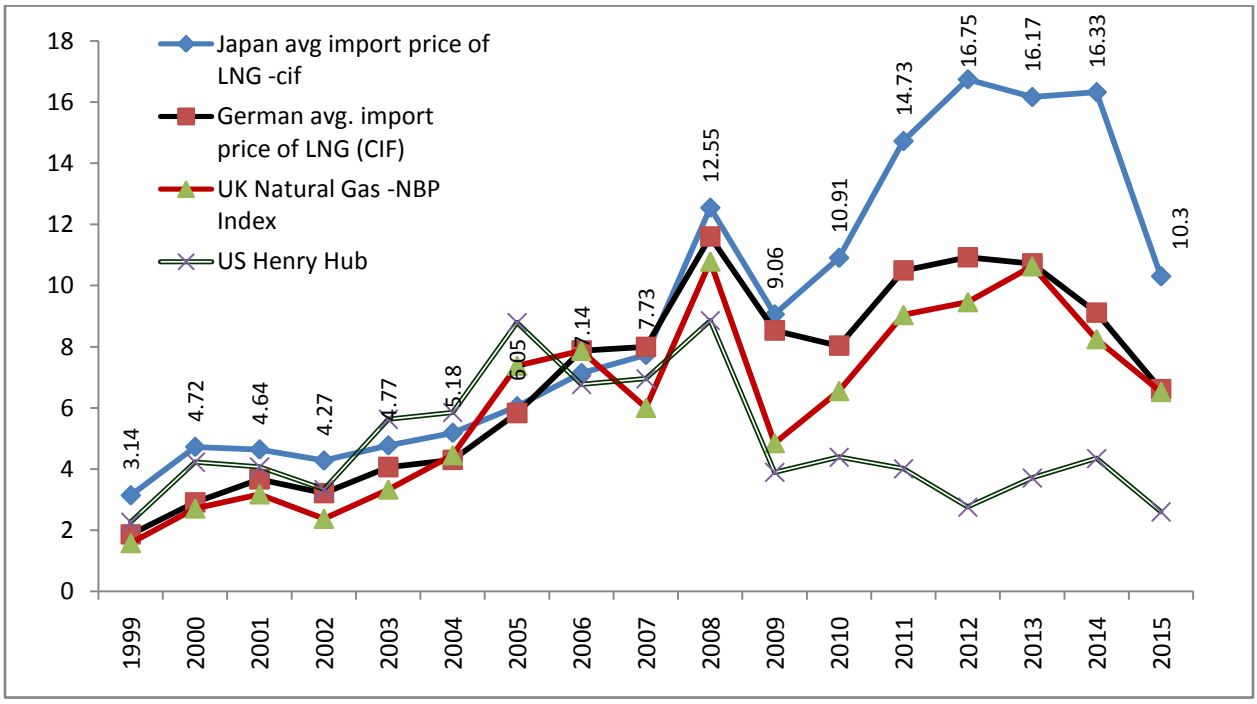
though the supply sources were diversified. In its new energy policy of 2014, Japan has pledged to further diversifying the supply sources, including LNG supply from North America. **Chart-1** shows LNG import price of Japan vis-à-vis other developed economies. It can be derived from the chart that compared to its peers, the LNG import price for Japan has historically remained on the higher side, given the country's vulnerable position on energy stocks.

Outflow of national wealth and increased supply instability

It has been emphasized in this article that Japan's energy supply structure is more vulnerable due to low self-sufficiency in energy resources. According to METI data, energy self-sufficiency rate of Japan as of 2012 declined to 6.0% after nuclear power plants were shut down in March 2011. Imports of crude oil and natural gas went up

Chart-1: LNG import price of Japan has historically remained on the higher side

Natural Gas Prices (US$ / MMBTU)



Source: METI, Japan

drastically to fill the gap in nuclear energy supplies, resulting in an upsurge in Japan's dependency on fossil fuels as power source. That dependency rose from 60% before the March 2011 earthquake to 90% by the close of 2012.

Japan's trade balance in 2011 turned to a deficit for the first time in 31 years, caused by the enhanced imports of oil and gas. The trade deficit continued to expand through 2012 and reached a record high of Japanese ¥11.5 trillion by 2013. Japan's current account was significantly affected by the deterioration in trade balance. The increased imports of fossil fuels catalyzed macroeconomic issues at the national level.

Portfolio Spread

Japan's regional dependence on imported energy sources is heavily skewed in Middle East countries for crude oil and LPG and in Asia-Pacific for LNG and coal. **Fig. 4** shows the country-wise spread of crude oil import to Japan in November 2016. To a limited extent, Japan has been able to diversify away from the Middle East into the Asia-Pacific, though UAE and Saudi Arabia together constitute 65% share of Japan's crude imports.

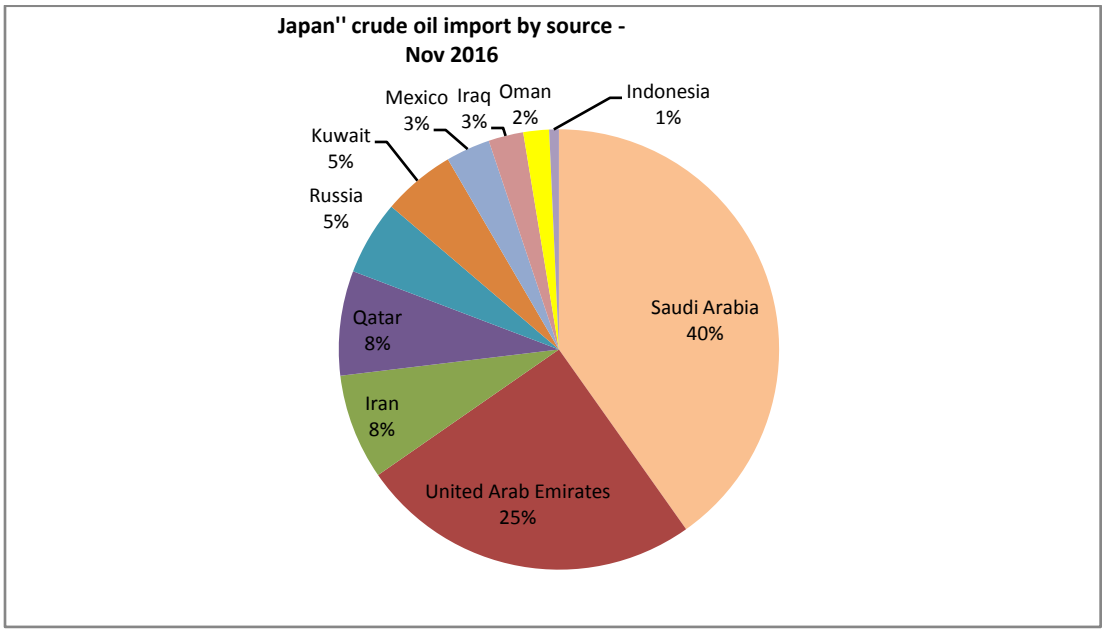


Figure. 4: Japan's crude oil imports by Source: November 2016

Source: Natural Resources and Fuel Department, Agency for Natural Resources and Energy, METI

Japan's move away from crude oil began decades ago. Japan began importing LNG from Alaska in 1969 making it a pioneer in the global LNG trade. Japan is world's largest LNG importer. It accounted for 37% of global LNG market demand from 2012 through most of 2014. Japan developed large LNG infrastructures on its shores and operated 23 LNG import terminals with a combined annual capacity of 9 Tcf of natural gas in 2014.

Several factors favored use of LNG in Japan over other fossil fuels and nuclear energy. Environmental concerns led to the government pledging lowering greenhouse gas emissions on the world stage, which resulted in promoting natural gas usage within the country as clean fuel. It was also the price factor as natural gas prices were less expensive than crude oil in the initial period. However, Japan's LNG import prices rose to reach on par with crude oil prices by 2012. After the Fukushima incident, Japan quickly replaced loss of nuclear power source with natural gas-fired power. Consequently, Japanese companies signed several LNG purchase agreements with suppliers to hedge against higher rates.

Japan makes large imports of LPG for cooking gas fuel. Middle East countries dominate LPG supply amounting to about 80% share. An import share from Asia-Pacific has increased but nowhere matching with the Middle East. Like oil and LNG, proportion of LPG imports from the Middle East declined but then grew later over a period.

Japan depends on imports for almost all of its energy resources. Since energy saving alone is not enough to resolve supply vulnerability, Japan made concerted efforts in adopting portfolio approach in early stages. As a result, Japan's energy self-sufficiency (including nuclear power) in 2010 improved almost to 20%. The basic factors of vulnerability in supply structure still remains but through portfolio approach Japan is able to better assess and address those in more informed and equipped ways.

Lessons and Implications for India

Japan's tryst with portfolio approach to address energy security derives great lessons for India given the country's unique resource positions and developmental aspirations of its billion plus population. India has the world's largest challenges of

sustaining a rapid economic growth curve with modest energy resources of its own. In the decade from 2004 to 2014, India's economy has grown at an average annual rate of approx. 11%, a direct correlation to the country emerging as the third-largest energy consumer after China and the United States. India has the second-largest population in the world with 1.3 billion people in 2014, growing about 1.4% each year since 2004, according to World Bank data. India's need for energy resources are slated to climb faster fueled by country's economic growth and modernization over the past several years.

Fig.5 shows the primary energy mix of India in 2013. India's largest energy source is coal (44% share), followed by crude oil at 23% share. Natural gas makes up a smaller share of 6%. Baring biomass, other renewable fuel sources make up a small portion of primary energy basket.

Energy demand forecast of India

Energy demand in India is projected to soar over the coming decades, propelled by an economy that grows to reach more than five-times its current size by 2040. The World Energy Outlook 2015 predicts energy demand in the world will grow by nearly one-third between 2013 and 2040 primarily propelled by developing countries, and led by India (see Fig. 6). It is projected that India's total primary energy demand will grow by more than 1000 million tones oil equivalent from 2014 to 2040 to reach 1900 million ton. This growth projection is larger

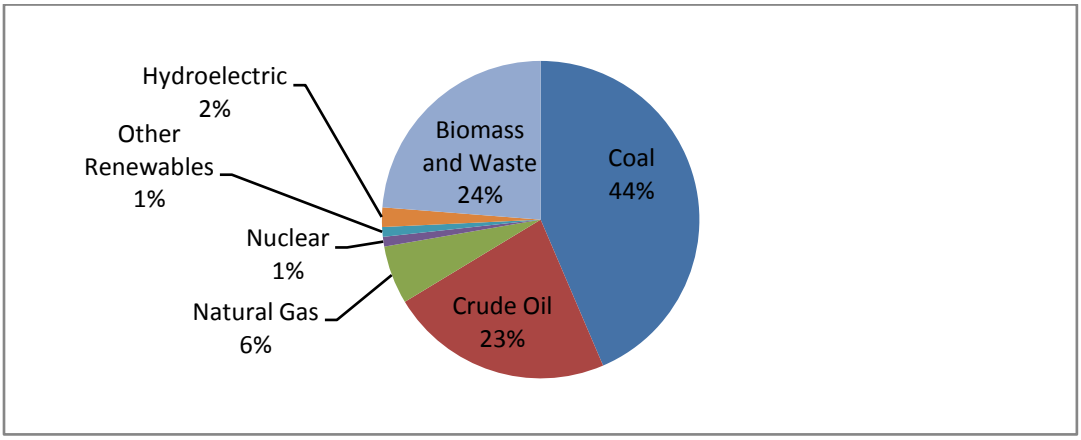


Figure 5: Primary Energy Basket of India, 2013

than the growth anywhere in the world, including Africa, China, South East Asia, Middle East and Latin America. A large part of the growth shall need to be met by crude oil, coal and gas. India's demand for oil is predicted to grow by 6 million barrels daily to reach around 9.8 million barrels daily consumption in 2040. The contribution of transport sector shall rise substantially from the current 40% to approx. 65% by 2040. Other sectors fueling oil demand growth are identified as buildings, industrial and agriculture.

Renewable energy sources shall have significant role in the energy portfolio of India, partly fueled by a supportive government and easy credit. EIA analysis indicates that while the share of oil, gas, coal and nuclear shall increase marginally, renewable share shall grow substantially by 2040. India has already adopted an ambitious target to install 175 GW of renewable power generation capacity by 2022 out of which 100 GW is slated to be contributed by solar panels. Due to enormous population and economic growth aspirations, despite sustained focus on renewables, the IEA outlook provides share of fossil fuel in India's energy supply to increase from 73% in 2013 to about 80% by 2040

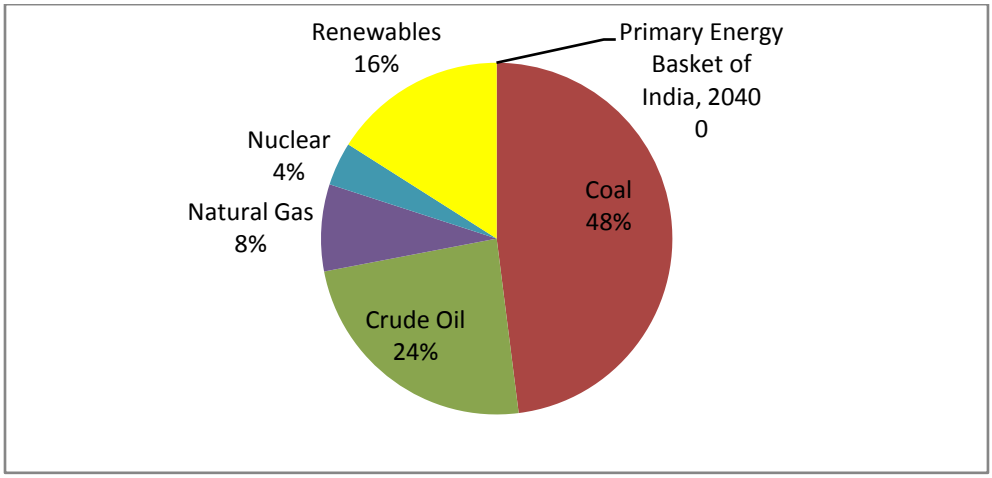


Figure 6: The share of primary energy for India projected for 2040

Source: IEA 2015

Import dependency of India

India is the third-largest importer of crude oil in the world and competes with Japan for trading the fourth position. Crude import on volume basis accounts for one-third of total imports and averages in excess of US $100 billion yearly outgo of foreign exchange since 2011, baring relief due to recent slump. In modern times of increasing oil demand, the government of India has been making concerted efforts to lower its reliance on crude oil imports by focusing on boosting domestic production, promoting renewable energy resources, improving refining process, promoting conservation and energy efficiency methods. Highlighting the growing importance of energy security, Prime Minister Mr. Narendra Modi in December 2016 pledged to reduce crude oil imports by 10% by 2022.

In 1990, India imported 42% of its demand which steadily rose to above 75% in 2015. India imported 197.5 million ton of crude oil in the first 11 months of 2016, which amounted to an increase of 10.5% year on year. Demand outlook is further bullish on increased oil import dependence. The government's clean fuel drive, sharp anticipated growth in transport demand and air travel, and the country's insatiable growth for petrochemicals will act as a boon for gasoline, jet fuel, LPG and naphtha, sustaining oil demand growth. For a country dependent on imports for nearly 80% of its crude oil consumption, India's oil import bill is highly vulnerable to international price volatility, which in turn has repercussions on the country's current account balance and overall economy.

Table 3: Top Ten suppliers of India's Crude Oil Imports ('000 barrels per day)

Rank	Country	2001-02	% share of Total	Rank	Country	2010-11	% share of Total	Rank	Country	Jan-Feb 2015	% share of Total
1	S. Arabia	268	17%	1	S. Arabia	549	16%	1	S. Arabia	713	18%
2	Kuwait	240	15%	2	Iran	372	11%	2	Iraq	511	13%
3	Nigeria	235	15%	3	Iraq	345	10%	3	Venezuela	466	12%
4	Iran	170	11%	4	Nigeria	318	9%	4	UAE	416	10%
5	UAE	153	10%	5	UAE	295	9%	5	Nigeria	344	9%
6	Yemen	90	6%	6	Kuwait	231	7%	6	Kuwait	332	8%
7	Egypt	80	5%	7	Venezuel	207	6%	7	Angola	270	7%

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8	Iraq	76	5%	8	Angola	194	6%	8	Iran	192	5%
9	Venezuela	71	4%	9	Qatar	113	3%	9	Mexico	124	3%
10	Middle East Neutral Zone	48	3%	10	Oman	109	3%	10	Colombia	97	2%
	Others		9%		Others		24%		Others		13%

Source: Reuters

Table-3 above indicates the top oil suppliers to India by volume. A cursory look indicates overdependence on countries which are prone to political instability and can cause sudden price increase due to threat of disruptions. It is estimated that at a crude oil price of $60/barrel, India makes annual savings in its import bill to the tune of $70 billion; compared with average oil price above $100/barrel. Hence increase in energy demand has a cascading effect on import dependency. The recent statistical tool developed by the NitiAyog, named India Energy Security Scenarios-2047 (IESS-2047), forecasts an increase in India's import dependence for coal, oil and gas. The forecasted ranges of import dependency for fossil fuel calculated by the statistical model for year 2027 and 2047 are shown in **Table 4.** The data analysis indicate doubling of demand for natural gas and significant rise in the import dependency of crude oil throughout the projection period till 2047.

Energy Strategy of India –time for Portfolio Approach

Ensuring physical availability of energy at affordable prices and ensuring unfettered energy flow is paramount for India's economic growth. Growing import dependency requires there should be sufficient infrastructure in place for domestic distribution of resources. This shall require enhancing port capacity, country-wide pipelines, rail infrastructure, LNG terminals and storage capacity for crude and

Table 4: Import dependency for fossil fuels

	2012	2047
Coal	16%	44-87%
Oil	77%	74-96%
Gas	26%	59-75%
Overall	31%	48-85%

LNG. The long term solution of India's energy security lies in self-sufficiency and for that India has to change its energy mix by increasing the share of renewable, non-renewable and nuclear energy resources. Portfolio approach thus become imperative to address serious issues of supply disruptions and price blackmails.

Government of India has been taking several policy initiatives, though a national energy security policy is yet to evolve. The Integrated Energy Policy of 2008 is an early-stage comprehensive documentation on energy policy. The integrated energy policy is linked with sustainable development that covers all sources of energy and addresses usage and supply; access and availability, affordability and pricing, as well as efficiency and environmental concerns. The amount of energy India needs to sustain yearly economic growth of 8% to 9% over the next 25 years until 2032 was addressed in the policy document by looking beyond the traditional five-year plan period. The integrated policy offers various scenarios based on energy mixes and implementation of demand-side management. However, the portfolio based energy policy demanding diversification of supplies and demand side management is yet to be devised as a state policy in India.

Key Lessons and Opportunities for India

India imports 75-80% of its energy needs which might reach further higher levels with growing consumption in times to come. As a state policy it is essential for India to devise mechanism to reduce import dependency and diversify supply sources. In the short-to-medium term, promoting energy efficiency and making infrastructure for cost effective transport might have key roles in managing energy demands. By following energy efficiency in every day working life, at home and office buildings, India could be able to reduce its electricity shortages and reduce non-coking coal imports. The government needs to put in place multi-pronged energy efficiency initiatives that shall apply to all stakeholders including consumers, producer companies, suppliers, and financial institutions.

The drive for energy efficiency needs to be supplemented by a conscious push towards renewable energy resources including solar, wind, hydro and biomass. This will provide the country more secure and long-term

energy security options. India's commitment at the Paris COP21 to reduce carbon intensity shall call for an increased share of renewables in primary energy basket. As renewables are locally distributed sources of energy, it increases India's energy independence in two important ways, i.e. (i) by replacing fossil fuel imports, renewables has the potential to strengthen India's balance of payments position, and (ii) renewables bring price stability to electricity markets by making power generation less dependent on fossil fuels price volatility.

The recent downturn in global oil prices provides demonstrable impetus for India to quickly practice portfolio approach. The price of crude oil has dropped by half from its level of above US$ 100 per barrel in mid-2014. The low prices brought windfall gains to consuming India. Imports are lower in value in dollar terms. Inflation trends have fallen due to lower fuel expenses. Subsidies have reduced. The under-recoveries by public sector undertakings has reduced to Rs. 72,300 crore in 2014-15 from the level of Rs 1,40,000 crore the previous year 2013-14. Low crude oil prices aided decontrolling of diesel price which in turn induced private refiners to re-enter the domestic retail market. India could expect to see a more competitive retail regime now than ever.

As oil demand grows and government pushes its "Make in India" initiative, India has set up strategic petroleum reserves in three locations i.e. Visakhapatnam, Mangalore, and Padurin the Southern states with a combined storage capacity of 5.3 million metric ton of crude oil. India's petroleum ministry has additionally finalized plans to set up two new larger storage facilities, each with about 5 million metric ton capacity, in the eastern state of Odisha and in the northwestern state of Rajasthan. The reserves shall help avoiding economic losses in oil shocks prevent the use of oil as a political weapon. The reserves can be used as a short term stabilizing source in case of price rise. Strategic reserves can also be used to earn revenues, as when the oil is purchased at prices lower than the selling price during emergencies, returns accrue to the government. The strategic storage caverns shall be increasingly used by foreign oil producers to stock up oil, providing economic and strategic gains to India.

The economically stronger countries are moving towards more structured energy

interdependence environment by using institutional framework though energy diplomacy. The future of transnational pipelines and sea trade cannot be controlled by any single country. Hence growing interdependence is giving additional incentives for closer cooperation with countries that can potentially strategic win-win partners. It consists of substantial multifaceted engagement across the world to promote India's energy security interests.

Acquisition of equity oil overseas by India's state owned oil companies fill an important element in India's energy security matrix. India's domestic production has been flat for decades with little chances of material increase in production in the near future. Acquiring energy assets overseas in geographically spread-out regions is a sensible step to augment energy security as it provides security of supplies and ensure rights of offtake in geo-politically tough times in any particular region of the world.

India faces unique challenges on its neighborhood. It has China systematically encircling it and on the other hand it has politically volatile neighbors of Pakistan and Bangladesh. A strong regional cooperation between India and its neighbors might boost its regional energy trade. Given the uneven spread of natural resources across many regions, a practical way to accomplish the diversification could be an integrated supply network within specific region. Myanmar and Bangladesh have huge gas reserves. India is the largest target consumer for bringing in natural gas through trans-country pipelines from Myanmar via Bangladesh and from Turkmenistan or Iran via Pakistan. Development of trans-ASEAN gas pipeline or across Middle East to India are concepts worth pursuing. The integration of energy systems reduces competition and costs, thereby assist balancing supply and demand.

Consumer country like India, as well as OPEC and other producers shall increasingly feel the need to adapt to a changed supply-demand dynamic caused by North America shale development. Shale gas has forced gas prices to remain low within US borders. A new gas trading market is emerging where prices are determined differently from the price mechanism prevalent in international market. In oil supply, the world has seen production volume of shale oil in the United States more than doubling between 2010 and

2012. The U.S. has already become the world's biggest oil producer and therefore its dependency on foreign oil will naturally decline. North America's shift from dependency to independence shall create new balancing structure. It is more possible now that the Western Hemisphere gradually disengages from supplies of the Middle East. The Middle East shall look for new buyers with Asian economies emerging natural favorites due to proximity and demand. New dynamics and oil politics shall significantly change global demand-supply structure, with India forced into the game willingly or unwillingly.

Conclusions

The descriptive analysis of portfolio approach to energy security of Japan establishes two broad observations. At the aggregate level, Japan has diversified considerably with respect to fuel type imports and regional sourcing. Japan still is dependent on Middle East for oil and LPG, and the Asia–Pacific for LNG and coal. Within the Asia–Pacific, Japan's imports of LNG are dominated by East Asia while imports of coal are dominated by Australian imports. Yet, there have been quite important changes in the pattern of import dependencies both across and within regions.

It could be derived from the given descriptive analysis that effective energy policy formulation will certainly rely on portfolio approach in sourcing and usage management. Changed levels of dependence may or may not mean changed levels of risk. For example, reducing dependence on a particular source of energy import might actually reduce security if risks of increasing dependence on another supplier are higher. Similarly, increasing stockpiles might be costlier option than diversification and collaboration. An informed assessment of various risks shall provide more scope for targeted energy policy responses. It is hoped that this paper is helpful in generating ideas regarding the portfolio application on a wider scale across energy resources and demand side management. It is also hoped that this paper will stimulate further research into this technique and aid designing appropriate policies at the federal level to deal with energy security.

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Decoding Healthcare Service Quality: A Review

Raghav Upadhyai*, Dr. Arvind Kr, Jain**, Dr. Hirarmoy Roy***, Dr. Vimal Pant****

**Research scholar, University of Petroleum and Energy Studies, Dehradun, raghav.upadhyai@gmail.com,*
***Associate Professor, CoMES, University of Petroleum and Energy studies, Dehradun, akjain@ddn.upes.ac.in,*
****Associate Professor, CoMES, University of Petroleum and Energy Studies, Dehardun, Hiranmoy@ddn.upes.ac.in,*
*****Associate Professor, NIFTEM, Sonepat, vimal.niftem@gmail.com*

Abstract

Healthcare services today face a significant challenge of changing needs of population, emergent technology and knowledge in the field of delivering and managing patient's health. This has resulted in huge gap in managing demand and modifying supply mechanism in delivery of healthcare services.

This paper reviews 100 research studies on service quality that were (i) published in peer reviewed journal (ii) provide a full text article published in English (iii) include an analysis or views related to services sector (iv) has some qualitative and/or quantitative findings related to hospitals/healthcare settings. The results suggest that there are varying dimensions and measurement techniques of healthcare service quality. However, reliability, assurance, tangibility, empathy and responsiveness were the most researched upon dimensions of service quality. SERVQUAL scale and its modifications were one of the most prevalent measurements scales used in assessment of service quality. The results suggest that there is a need for patient satisfaction ratings which affect the service quality. Service quality improvements are linked to the financial outcomes. The limitations include excluding studies related to patient ratings. Conclusively, not only the satisfaction but also delivering memorable patient experiences is important for good service quality. Service quality measurement from both service provider's and service receiver's side will result in plugging the service gaps and delivering service quality.

Keywords: Service Quality, Service Quality Dimensions, Service Quality Measurement, Service Quality Models. Health care Services.

Introduction

The Healthcare sector is a significant contributor to the economy of our country.

Not only social but economic upliftment of India is impacted by Healthcare sector. Trends like 100 percent FDI in the healthcare sector, emergence of medical tourism and mergers and acquisition by global players, are changing the perception about healthcare sector. For a private player to maintain their competitive advantage in an industry, which is transiting from supply to demand driven factors of care, complimented with huge disease burden, changing socio economic conditions, increase in level of awareness and knowledge of patients and multiple service providers, is a daunting task.

Demand for greater access to quality of care is increasing in Indian Healthcare market(Bain & Co., 2015). In a report published by Delloite, 2012 it is observed that on one hand world class hospitals, state of the art technologies, highly qualified doctors and health care professionals are attracting patients from all over the world while on the other hand the average Indian patient faces high prices, inadequate access, and inconsistent quality. The situation in quality of care in India as stated in National Health Policy Draft, 2015, is a matter of serious concern and compromises the effectiveness of care. Inspite of all public and private sector efforts healthcare in India still faces the challenge of affordability, availability and quality of care.

In spite of good amount of work done in the field of service quality, there is still a rift between academicians and industry professionals about what constitutes healthcare service quality. Almost all the previous studies have either amended the previous measurement tool or have devised a new scale to measure healthcare service quality. This is adding divergent knowledge to field of healthcare service quality. This paper is an attempt to converge this of knowledge into what is known so far into a meaningful picture related to service quality with special emphasis on healthcare services.

Method

A literature search was conducted using the database *ebsco* database and google scholar. The following search terms and their combinations were entered with regard to *service quality* specifically: “service”, “service quality”, “healthcare services”. Studies were selected based on the following inclusion criteria: (i) published in peer reviewed journal (ii) provide a full text article published in English (iii) include an analysis or views related to services sector (iv) has some

qualitative and/or quantitative findings related to hospitals/healthcare settings. The databases were searched between Feb-Aug, 2016. The initial search led to more than 500 results. Following through inspection of the title of the paper and the abstract, the articles not meeting the inclusion criteria were excluded. Data were organized with regards to terminology, assessment and factors associated with service quality.

Results

A total of 125 research papers were identified from the literature search that met the initial inclusion criteria. However, 25 articles were excluded that either talked about patient ratings, satisfaction models, review of assessment tools etc.. The subsequent sections of the result analysis discuss the various conceptualizations of service quality. The dimensions, models and measurement of the service quality construct with special emphasis on healthcare services and finally the associated factors such as patient satisfaction, loyalty, revenue associated with delivering service quality.

What is Service Quality?

What is Service?

With the emergence of service economies around the world, many definitions of the term "service" have been coined. "An activity, benefit, or satisfaction offered for sale that is essentially intangible and does not result in the ownership of anything." (Kotler& Armstrong, 2011), p 224. "An act or performance that creates benefits for customers by bringing about a desired change in-or on behalf of the recipient." (Lovelock & Wright, 1999), p 2"Services are deeds, processes, and performances." (Zeithaml&Bitner, 1996), p.5.

Services encompass a wide gamut of industries ranging from education, consultancy, airlines, banking, defense, legal services, and healthcare services and so on. The companies are now recalibrating their strategies by moving from Ps Product, Price, Place and Promotion given by McCarthy in 1960 to addition of People, Process and Physical Evidence by Booms and Bitner in 1981. However, Lovelock & Wright in 1999 added the eighth element *Productivity and Quality* to services. As summarized below healthcare is different from other services (Berry & Bendapudi, 2007)

1. Customers have some combination of illness, pain, uncertainty, fear and perceived lack of control
2. Customer may be reluctant co producers because healthcare is a service that need but they may not want
3. Customers relish privacy physically, emotionally and spiritually
4. Customers need whole person service
5. Customers are at risk of being harmed
6. Clinicians are stresses physically and emotionally.

What is Quality?

Quality is not only meeting the standards but also performing as per the requirements of the customer. Quality has many definitions: "Quality is conformance to requirements." - Philip Crosby

Quality is fitness for purpose." – Dr. Juran

"Quality is a predictable degree of uniformity and dependability, as low cost and suited to the market." – Dr. Edward Fleming

"Quality does not only mean the quality of product, but also of after sales service, quality of management, the company itself and the human life." – Ishikawa. Karou

The quality can be quantified as:

Q = P/E, where,

Q is quality, P is performance and E is expectations.

Thus, it can be inferred that the quality can be measured against the standards. are various elements of quality are explained in Table 1:

Table 1: Elements of Quality Adapted from: Gravin, D.A., (1988). Managing Quality: The Strategic and Competitive Edge, New York: Free Press.

S. No	Elements	Explanation
1.	Performance	Primary product characteristics
2.	Features	Secondary characteristics
3.	Conformance	Meeting specifications or industry standards
4.	Reliability	Consistency of performance over time
5.	Durability	Useful life
6.	Service	Resolution of problems and complaints
7.	Response	Human to human interface
8.	Aesthetics	Sensory characteristics
9.	Reputation	Past performance and other intangibles

What is Service Quality?

The concept of service quality is envisioned not as a standard, rather presence or absence of gap in meeting the standard. *Service Quality* thus can be defined as the discrepancy between consumer's perceptions of services, and their expectations about that firm offering such services. However, *hospital service quality* is the discrepancy between patient's or patient's attendants' perceptions of services offered their expectations about that hospital offering such services (Agja&Garg, 2010). Nevertheless, Evans 2009, pg. 14.opined that quality in service industry is different from that of the manufacturing industry in the following ways:

1. Customer needs and performance standards are often difficult to identify and measure, primarily because the customer define what they are and each customer is different.
2. The production of services, typically require a higher degree of customization than does manufacturing.
3. Since the outputs of many services are intangible, thus, service quality can only be assessed against customer's subjective expectations and past experiences.
4. Services are produced and consumed simultaneously; therefore, they cannot be stored and inspected prior to delivery.
5. Customers often are involved in the service process and present while it is being performed
6. Services are labor intensive thus; quality of human interaction is a vital factor for services that involve human contact.
7. Many service organisations must handle very large number of customer transactions. Such a large volume of transactions increases the margin of error.

The concept of perceived service quality (Gronroos, 1984), is also a discrepancy which is measured as a gap between the prior expectations of the customer before receiving the service and the perception formed by the customer post receipt of the service. This concept gained momentum in early eighties which led to union of the technical aspects of quality with psychological aspects of consumer behavior.

Healthcare quality is mostly reported as *structural aspects of care, processes and outcomes* (Rothberg, Morsi, Benjamin, Pekow, & Lindenauer, 2008). Further, quality of care is defined as having three domains: *patient safety, clinical effectiveness and patient experience* (compassion, dignity and respect) (Black et.al., 2014). There is a distinction between evaluation of quality between service delivery professionals who

evaluate quality in terms of design and delivery and on the other hand service receivers who in turn evaluate it on their perception of the services consumed (Brown & Swartz, 1989). In contrast to other services healthcare customers are usually in a state of physical or psychological discomfort, or both (Duggirala, Rajendran, & Anantharaman, 2008) and hence are apprehensive and show anxiety. Further, in such a traumatic and hysterical situation patients and their attendants are less likely to form prior expectations. Table II summarizes the some of the significant work done in the field of service quality.

Table 2: Significant Researches in the field of Service Quality

Researchers	Year	Service Quality Findings
Gronroos, C.	1986	Classified the quality as technical and functional quality. Acceptable technical quality can be thought of as a prerequisite for a successful functional quality. Maintain good functional quality is a powerful marketing function.
Parsuraman A., Zeithaml Valerie A, Berry Leonard L.	1985, 1988, 1992	On the basis of disconfirmation paradigm proposed a model identified five GAPs in providing effective service quality. Perceived service quality is the degree and direction of discrepancy between consumers' perceptions and expectations
Cronin J.J, Taylor S. A.,	1992	Performance based measure of service quality may be an improved means of measuring service quality constructs.
Gotlieb, J.B., Grewal, D, Brown, S.W.	1994	Perceived quality affects satisfaction and behavioral intentions are affected by satisfaction.
Donabedian A	1997	Classified service quality under Structure: denotes the attributes of the settings in which care occurs Process: denotes what is actually done in giving and receiving care Outcome: denotes the effect of care on the health status of patients and populations
Andaleeb, S.S.	2001	If the system cannot be trusted to agaurantee threshold level of quality, it will remain underutilized, be bypassed, used only for minor ailments, or used as as a mesure of last resort.
Sureshchandar G.S., Rajendran C, Ananthraman R.N.	2002	Identified five factors of service quality a. Core service or service product, human element of service delivery, systemization of service delivery, tangibles of service-servicescapes, social responsibility.
Cronin Jr. J.J., Brady M.K.,	2002	Relative ability of performance only measures to effectively capture the service quality perceptions of consumers across a variety of service products.
Baltussen, RMPM, Ye, Y., Haddad, S., Sauerborn, R.S.	2002	Interpersonal skills have been overlooked in favour of technical skills.
Choi, K.S., Cho, W.H., Lee, S., Kim, C.	2004	Introduced the concept of value in evaluating healthcare services which is a tradeoff between the benefits and sacrifices made. Stressed that service quality and value are important concepts
Lehtinen U and Lehtinen J.R.	2006	Compared to both physical and interactive quality, corporate quality in usually more stable in nature. Corporate quality dimension is the only dimension which can be experienced by the customer before participating in the service.
Dagger, T.S., Sweeny, J.C.	2007	Customer's stage in the consumption process influences the importance of the service quality attributes in determining overall quality perceptions. Easy to evaluate attributes are likely to be more prominent for novice customers and more difficult to evaluate attributes are likely to be more prominent for longer term customers later in the consumption experience. the longer customers have been in the consumption process, then more likely that they are able t evaluate outcomes. Overall expertise is the most salient attribute to service quality perceptions. Search attribute of tangibles to be significantly more important to service quality perceptions among novice customers and expertise and outcome were significantly more salient to long term customers Importance of service attributes in developing service quality perceptions differs depending on the customer's status in terms of consumption experience
Piligrimiene, Z., Buciuniene, I.	2008	The concept of quality has many dimensions. Functional aspects of quality are more important for the patients. Technical aspects of quality are essential for health care professionals
Aagja, J.P., Garg, R.	2010	Development of PubHosQual scale on five dimensions of HSQ: admission, medical quality, overall quality, discharge process and social responsibility
Yee, R.W.Y., Yeung, A.C.L., Cheng, T.C.E.	2010	In high contact service the employee-customer exchange is high and so are their offering high levels of quality in their services.
Senic, V., Marinkovic, V.	2012	Patient's perceptions of the value of received medical services are a qualitative measure of clinic's competitiveness, as well as measure of the degree of development of a nation's healthcare system
Zarei, A, Arab, Md., Froushani, A.R., Tabatebaei, S.M.G.	2012	Highly competitive market in the private hospital industry has caused increasing pressure on them to provide services with higher quality.

How is Service Quality assessed?

Dimensions of Service Quality

Donabedian, (1997) proposed there are two elements in the performance of healthcare practitioners: *technical:* based upon the current knowledge and judgment utilized in deciding the right strategies, which is almost synonymous to *effectiveness*. The second one is the *interpersonal* element (privacy, confidentiality, informed choice, concern, empathy, honesty, tact and sensitivity) through which the information necessary for coming up with a diagnosis is taken via patient communication, as well as preferences necessary for selecting the appropriate procedures of care. The success of healthcare services to an great extent depends not only the technical quality of the service delivery professional but also their interpersonal effectiveness with patients and their attendants. Another element that consumer easily evaluates is *amenity* which includes healthcare service attributes like convenience, comfort, quietness, privacy. Most of the studies identifying dimensions of service quality, broadly classify them under "what is being provided" and "how it is being provided" (Purcărea, Gheorghe, & Petrescu, 2013) as shown in Fig. I. The assessment of service quality perhaps in healthcare services on either "what" or "how" may lead to ambiguity. It is likely that even a patient may get healthy but may not not satisfied with the services received and further, in spite of satisfaction with the services received may remain unhealthy even after the treatment. Dabholkar et.al (1996, p14) was of an opinion that a single measure of service quality across industries in not feasible. Therefore, industry-specific future research on service quality should be done. As summarized in Ganguli & Roy, (2010) various authors have studied service quality and their dimensions in some of the industries (Table III).

One of the pioneering efforts in service quality was done by Parsuraman et.al (1982), where they identified ten dimensions of service quality in five different industries. After initial identification of ten dimensions of service quality, they reduced them to five namely, responsiveness, assurance, tangibility, empathy and reliability (RATER). Various authors however identified other dimensions in healthcare services based upon the cultural context (race, country etc.), industry type (acute care, ambulatory care etc.), size of delivery facility (single vs. multispecialty), type of service (public vs. private), consumer

type (in-patient vs out-patient), etc. Table IV summarizes some salient work in the healthcare and related industries in identifying various dimensions of the service quality

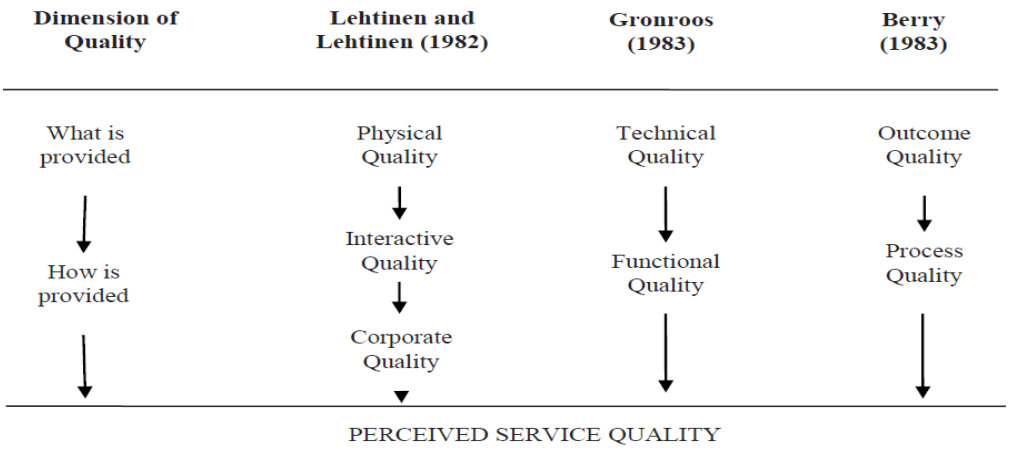

Figure 1: Classifiction of Service Quality Dimensions

Table 3: Some of the Industry Specific Service Quality Dimensions

Researcher (Year)	Industry	Service Quality Dimensions
Levesque and McDougall (1996)	Retail banking	Core Quality, Relational Quality and Tangibles
Caruana et.al. (2000)	Audit Firms	Reliability, Assurance and Responsiveness
Burke (2002); Dabholkar et.al.(1996)	Retail	Physical Aspects, Reliability, Personal Interaction, Problem Solving, Policy, Convenience, Product Quality and Selection
Hoffman et.a;. (1995); ; Voss et.al (1998)`	Hotels and Restaurants	Perceived Authenticity in the interaction, Mutual understanding, Provision of Extra attention of Person services, Meeting customer expectations, Service provider competence, Service settings, Recovery from failure, price and performance perception.
Fodness& Murray (2007)	Airport Services	Effectiveness, Efficiency, Productivity, Décor, Maintenance and Interaction
Santouridis&Trivellas (2010)	Telecom	Network, Value Added Services, Mobile Devices, Customer Service, Pricing structure, Billing system

Table 4: Dimensions of Service Quality

Researchers	Year	SQ Dimensions
Parsuraman A., Zeithaml Valerie A, Berry Leonard L.	1985	Access, communication, competence, courtesy, credibility, reliability, responsiveness, security, tangibles, and understanding: knowing the customer.
Donabedian A	1988	Interpersonal Dimensions: Privacy, Confidentiality, informed choice, concern, empathy, honesty, tact, sensitivity Structure: denotes the attributes of the settings in which care occurs, Process: what is actually done in giving and receiving care. Outcome: effects of care on the health status of patients and populations.
Parsuraman A., Zeithaml Valerie A, Berry Leonard L.	1988, 1991	Tangibility, Reliability, Responsiveness, Assurance, Empathy
Sohail, S.S,	2003	
Kheng, L.L., Mahamad, O., Ramayah, T., Mosahab, R.	2010	
Mosahab, R.Mahamad, O., Ramayah, T.,	2010	
Ramez, W.S.	2012	
Irfan, S.M., Ijaz, A., Farooq, M.M.	2012	
Thiakarajan, A., Krishnaraj, A.S.R.	2015	
Venkateshwarlu, P., Ranga, V., Sreedhar, A.	2015	
Izogo, E.E., Ogba, L.E.	2015	
Bahadori, M., Raadabadi, M., Ravangard, R., Baldacchino, d.	2015	
Jandavnath RKN, Byram, A.	2016	
Pramanik, A.	2016	
Haddad, S., Fourner, P., Potvin, L.	1998	Healthcare Delivery, Healthcare personnel, health facility
Andaleeb, S.S.	2001	Responsiveness, assurance, communication, discipline and baksheesh
Hasin, M.A.A., Seeluangsawat, R., Shareef, M.A.	2001	Cleanliness, Service of Doctors, Service of Nurses, Service of Officers, Other Services
Baltussen, RMPM, Ye, Y., Haddad, S., Sauerborn, R.S.	2002	Personnel Practices and Conduct, Adequacy of resources and services, Healthcare delivery, Financial and physical accessibility
Luk, S.T.K.W., Layton, R.	2004	Empathy & Responsiveness, Assurance & Tangibles, Outcome, Reliability, Need
Duong, D.V., Binns, C.V., Lee, A, H., Hipgrave, D.B.	2004	Healthcare Delivery, Health Facility Interpersonal Aspects of Care, Access to Care
Choi, K.S., Cho, W.H., Lee, S., Kim, C.	2004	Convenience of care process Healthcare provider's concern (other than physicians) Physician's concern Tangibles
Rajpoot, N.	2004	Tangibility, Reliability, Assurance, Sincerity, Personalization, Formality
Lehtinen U and Lehtinen J.R.	2006	Physical Quality (physical products and physical support like instruments and environment needed in service production), Interactive Quality (Interactive elements like interactive persons and interaction equipment) and Corporate Quality (is symbolic in nature and it concerns how customer and potential customers see the corporate entity, company or institution, its image or profile.) Process Quality (is the customer's personal and subjective judgment and is based on how they see production process and well they feel fitting into the process) and Output Quality (customer's evaluation concerning the result of the service production process and is also evaluated by the other persons around customer; the output can be tangible and intangible)
Akbaba, A.	2006	Tangibles, adequacy in service supply, understanding and caring, assurance and convenience.
Rao, K.D., Reters, D.H., Roche, K.D.	2006	Medicine availability, medical information, staff behaviour, doctor behaviour, hospital infrastructure
Mostafa, M.M.	2005	Human Performance Quality, Reliability Quality Facility Quality
Olorunniwo, F., Hsu,m M.K., Udo, G.F.	2006	Accessibility, flexibility and reliability dimensions can be downplayed in service factory setting. Other dimensions important to SQ were tangibles, knowledge, recovery and responsiveness
Teng, C.I., Ing, C.K., Chang, H.Y., Chung, K.P.	2007	Needs management Assurance Sanitation Customization Convenience and quiet Attention

Dagger, T.S., Sweeny, J.C.	2007	Interaction, Atmosphere, Tangibles, Outcome, Expertise, Timeliness, Operation
Piligrimiene, Z., Buciuniene, I.	2008	1. Interpersonal Relations- refers to the interaction between service providers and recipients through establishing trust, credibility, demonstration of respect, confidentiality, courtesy, responsiveness, empathy and effective communication (2) Tangibles-refers to the features of health services theat do not directly relate to clinical effectiveness but may enhance the patient's satisfaction and willingness to return to the facility for subsequent health care needs. Tangibles relate to the physical appearance for facilities, personnel and materials as well as to comfort, cleanliness and privacy. (3) Technical competence refers to the skills, knowledge, capability and actual performance of health care providers, managers and support staff. i.e. must be features of health care services. (4) Accessibility - the ease with which health services are reached, i.e. clinic hours, waiting time etc. (5) Safety- minimizing the risks of injury, infection, harmful side effects or other dangers related to service delivery. Safety involves the provider as well as patient. (6) Effectiveness is the extent ot which the attainable improvements in the health are in fact attained (7) Efficiency is the system's optimal use of available resources to yield maximum results. (8) Outcomes sub-had defined as the change in a patient's health status that may be attributed to the medical
Fowdar, R.R.R.	2008	7 dimensions 1. Tangibility/Image 2. Reliability/fair and equitable treatment 3. Responsiveness 4. Assurance/empathy 5. Core medical services/professionalism/skill/competence 6. Equipment and records 7. Information dissemination
Duggirala, M., Rajendran, C., Ananthraman, R.N.	2008	Infrastructure, Personal Quality: Doctor's care, Nursing care, Paramedical and support staff quality, quality communication Process of Clinical Care Administrative Procedures Safety Indicators Overall experience of medical care received Social Responsibility
Aagja, J.P., Garg, R.	2010	Admission, medical quality, overall quality, discharge process and social responsibility
Otani, K.	2010	Admission Process, Nursing Care, Physician Care, Staff Care, food and room
Ravichandran, K., Mani R.T., Kumar, S.A., Prabhakaran, S.,	2010	Employees respond to customer request, Consistently courteous employee, promises to do something, modern looking equipment, service at the time they promise, willing to help customer
Brahmbhatt, M, Baser, N., Joshi, N.	2011	RATER, Process and Policy
Prakash A., Mohanty R.	2012	8 dimensions based questionnaire: Prevention, Personnel, Research, Treatment, Diagnosis, Administration, Trust and Education
Arun Kumar, G., Manjunath, S.J., Chethan, K.C.	2012	Reliability, Responsiveness, Empathy, Tangibles
Senic, V., Marinkovic, V.	2012	Personal Relationships, Promptness and Tangibility
Zarei, A, Arab, Md., Froushani, A.R., Tabatebaei, S.M.G.	2012	Reliability, Responsiveness, Empathy, Tangibles.
Chahal, H, Kumari, N.	2012	Primary Dimensions: Interaction Quality (attitude &behaviour, expertise, process quality), Physical Environment quality (ambient condition, design and social factors), Outcome Quality (waiting time, patient satisfaction, patient loyalty, Image)
Chang, C.S., Chen, S.Y., Lan, Y.T.	2013	Reliability, Responsiveness, Assurance Further Interpersonal Based Medical Service encounter construct has variables on: Professional Personnel, General Administrative Personnel, Environment and Space (physical symbol)
Amin, M., Nasharuddin, S.Z.	2013	Admission, Medical Service, Overall Service, Discharge, Social Responsibility
Pai, Y.P., Chary, S.T.	2013	Physical Environment and Infrastructure, Personnel Quality, Image, Trustworthiness, Support, Process of Clinical Care, Communication, Relationship, Personalization, Administrative Procedures
Krishnamoorthy, V., Srinivasan, R.	2014	Medical Service, Empathy, Admission, Discharge, Physical Ambience, Equality, infrastructure, Tangibility, Medical Care, Availability of Medicine
Makarem, S.C., Al Amin, M.	2014	Service Process Dimensions: Nurse Communication, Physician Communication, Responsiveness of Staff, Pain Management, Medication Communication, Room and Bathroom Cleanliness, Room Quietness, Discharge Information
Dheepa, T., Gayathri, N., Karthikeyan, P.	2015	Reliability, Responsiveness, Assurance, Empathy, Tangibles
Satsanguan, L., Fongsuwan, W., Trimentsoontron, J.	2015	Personnel Quality, Service of Supportive Task, Reliability, Infrastructure
Mohamed, B., Azizan, N.A.	2015	Infrastructure, Interaction, Administrative Procedure, Medical Care, Nursing Care
Panda, R.K., Kondasani, R.K.R.,	2015	Physical Environment, Reliability, Customer Friendly Staff, Communication, Responsiveness, Privacy & Safety, Customer Satisfaction, Loyalty
Thiakarajan, A., Krishnaraj, A.S.R.	2015	Patient Decisions for visiting a hospital include: Prefernce of Place, Product/Service Considerations, Hospital Charges, Safety Consideration
Sims, T., Tsai, J.L.	2015	High Arousal (Excitement), Low Arousal (Calm)
Pai, Y.P., Chary, S.T.	2016	Healthscape, Personnel, Hospital Image, Trustworthiness, Clinical Care Process, Communication, Relationship, Personalization, Administrative Procedure.
Pramanik, A.	2016	Urban patients preferred tangibility and responsiveness as compared to rural patients who preferred responsiveness and empathy as compared to other dimensions of service quality.

Models of Service Quality

Service quality assessment nowadays is used as a tool by various companies having customer centric views (Bolton and Drew, 2016). Various models for evaluation of service quality are available for such an assessment. However, the most extensively researched upon service quality measurement model is the GAP model proposed Parasuraman et.al (1985) which is tested in various types of service settings. Further, this model not only quantifies the service quality dimensions but also work as an analytical tool in identifying the gaps in service delivery process. The model is based on the expectancy/disconfirmation theory which Proposes that perceived quality is a results of the comparison that customer make between expected quality and experienced quality (PZB, 1985, 1988, 1994) and the outcome. Thus, the model focuses more on the functional aspects of service quality rather than technical ones (Gronroos, 1984). Thus, service quality is measured as gap between the expectations of what consumers feel that a service should over and the perceptions of the actual performance of the service (Fig. II) (Parsuraman et al,1985). They proposed a *Service Quality Model* (Fig. III) with five gaps which were major hurdles in attempting to deliver a service which consumers would perceive as being of high quality

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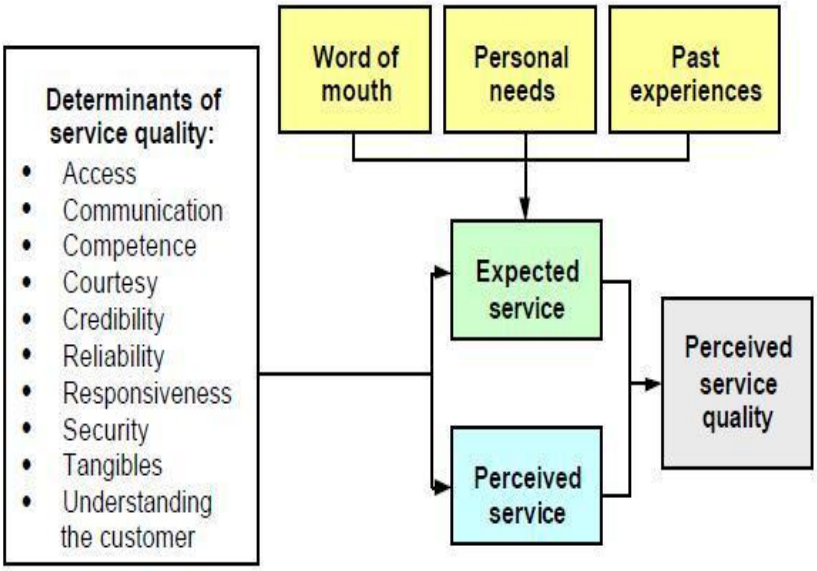

Fig. 2: Perceived Service Quality

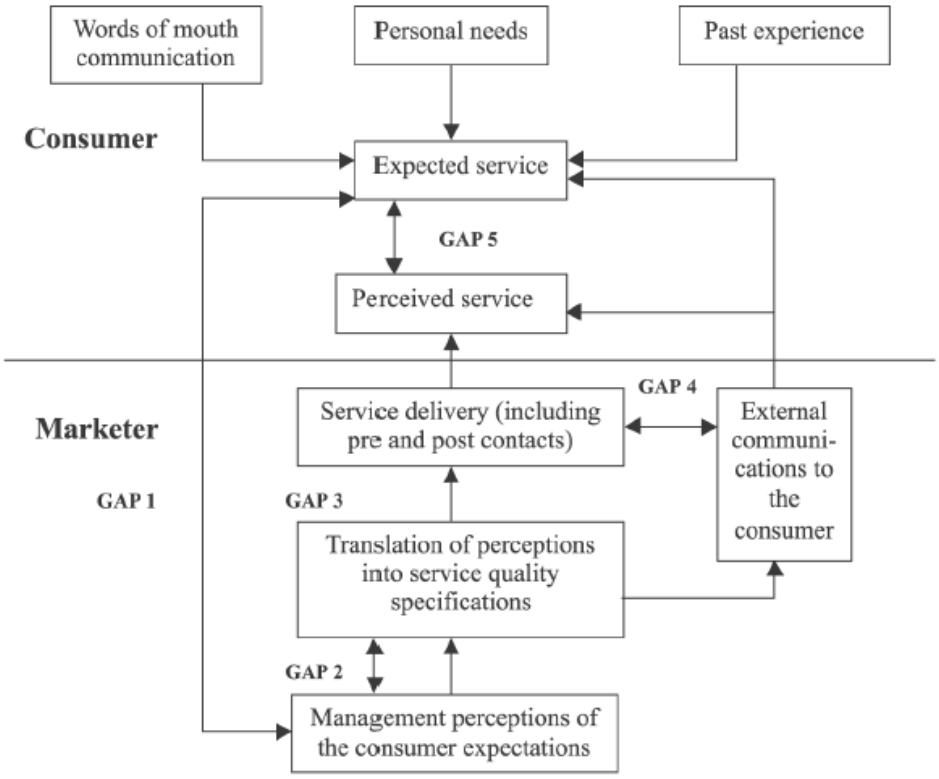

Fig 3: Service Quality Model

Further Parasuraman, Zeithaml and Berry (1988) developed *SERVQUAL,* an instrument for measurement of customer perceptions of service quality on a seven point likert scale. The instrument measures five dimensions of service quality viz., *tangiblity, reliability, responsiveness, assurance and empathy.* The measurement is done on twenty questions on consumer perceptions and similar number of questions on the expectations section of SERVQUAL instrument. It helps in not only tracking performance on service quality over the period of time but also compares it with the performance of the competitors (PZB, 1991). The scale has also been used to measure the opinion of hospital managers and employees about their perception of how patients perceive service quality by changing the instruction portion of the scale (Babakus and Mangold, 1992).

Since inception of SERVQUAL scale it has been criticized in many studies (Babakus & Mangold, 1992; Cronin Jr. & Taylor, 1994; Cronin & Taylor, 1992; Teas & Kenneth, 1993; Teas, 1994). Many marketing researchers have argued that neither disconfirmation theory or expectations score have any effect of customer satisfaction (Cronin Jr. & Taylor, 1994; Teas, 1994), Instead the perceptions score (SERVPERF) have been mainly suggested for measuring service quality as it argued that this scale provided higher predictive validity of customer's satisfaction (Babakus & Mangold, 1992; Cronin Jr. & Taylor, 1994; Lee, Lee, & Yoo, 2000; Prakash & Mohanty, 2012; Ramez, 2012; Ting-Kwong Luk & Layton, 2004). Further some researchers argued that the SERVQUAL is a context specific and challenged the universality of the instrument. Further, SERVQUAL needs to be modified to fit the nature of service setting in which the it is administered (Andaleeb, 2001; Babakus & Mangold, 1992). As recommended by Jain & Gupta (2004) for conducting service quality comparison SERFPERF should be a preferred and for diagnosis of area of improvement SERVQUAL scale can be preferred over the SERVPERF.

Parasuraman et.al., 1985, postulated that experience properties of the services are mostly evaluated by consumers for arriving at their perception of service. However, patients can easily discriminate domains of quality between effectiveness an experience of a service, where experience aspect is more strongly associated with level of communication and trust with their doctor (Black et.al., 2014).

Based on the experience that a consumer gets through the individual processes of the service delivery a *Seven Gap Model* (Fig. IV) was proposed by Lovelock and Wright (1999) to measure the service gap. However, Table V provides the various service quality models as summarized by Deshmukh and Vrat (2005).

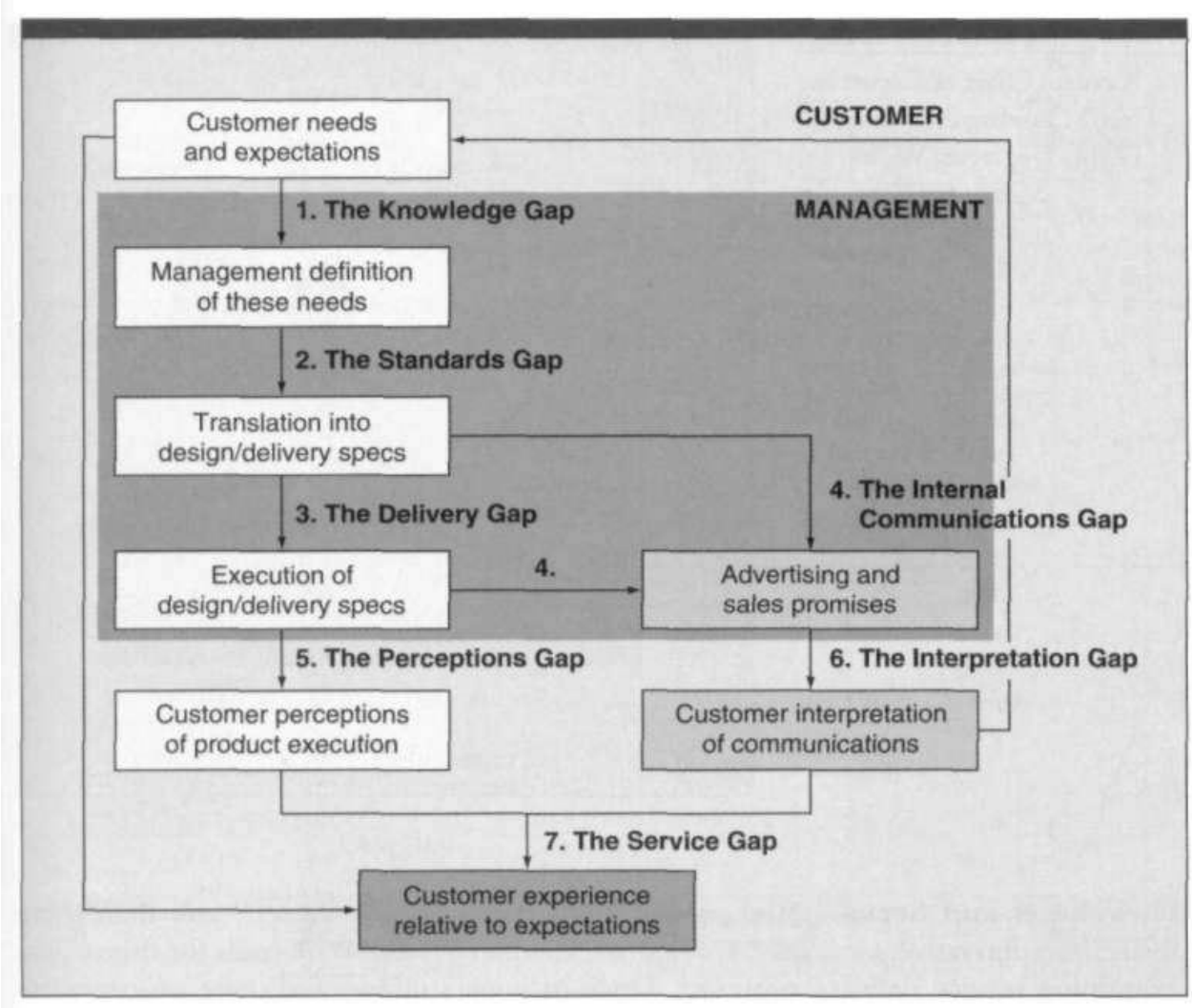

Fig 4: Seven Gap Model of Service Quality

Table 5: Models of Service Quality

Type of Model (Author/Year)	Key findings/applications	Select Weakness/limitations
Technical and Functional Quality Model (Gronroos, 1984)	Service Quality depends upon technical quality, functional quality and corporate image of the organisation. Functional quality is more important than the technical quality.	The model does not offer an explanation on how to measure functional and technical quality.
Gap Model (Parsuraman et. al. 1985)	The model is analytical tool. It enables the organisation to identify the systematically service quality gaps between the number of variables affecting the quality of offering. This	The model does not explain the clear measurement procedure for the measurement of gaps in different levels
Attribute Service Quality Model (Haywood-Farmer, 1988)	This model provides base of segregating service organizational three dimensions for better management of quality. The model has the potential to enhance understanding of the concepts of service quality and hel to	It does not offer measurement of service quality. It does not offer a practical procedure capable of helping management to identify ser4vice quality problems or practical means of improving service quality
Synthesized Model of Service Quality (Brogowicz et.al., 1990)	Th use of this model and related managerial tasks can help managers to improve the success of their service offerings in any industry. This model identifies key variable that require systematic management attention in planning,	Need empirical validation. Need to review for different type of service settings.
Performance Only Model (Cronin and Taylor, 1992)	Service quality should be conceptualized and measured as an attitude. The performance based SERVPERF is efficient in comparison with SERVQUAL, as it directly reduces the number of items by 50 % and the results are better. Service	Need to be generalized for all types of service settings. Does not address the gap in the individual dimensions and hence can be used for evaluation of service quality but not as an analytical tool
Ideal value model of service quality (Mattsson, 1992)	This model incorporates and defines the importance of diverse components of service encounter to be studied. This model provides a new learning perspective on how an ideal	Fewer number of items used for value and customer satisfaction. Need to be defined for all types of service settings.
EP and NQ Model (Teas, 1993)	The model raised a number of issues pertaining to conceptual and operational definitions of expectation and	This model was tested for limited sample size and for narrow service setting (discount store)
Model of Perceived Quality and Satisfaction (Spreng and Mackoy, 1996)	This model shows that service quality and satisfaction are distinct and desires congruency does influence satisfaction. Rising expectations have a positive effect on customer satisfaction perceptions of performance, but they also have negative effect on satisfaction through disconfirmation	The model does not highlight how the service quality is achieved and operationalized. The model is weak in providing directions for improvements in service quality.
PCP attribute model (Philip and Hazlett, 1997)	Provides a simple, effective and general framework for assessing service quality for any service sector. Highlights the area of service improvements for service quality	The model is lacking in providing general dimensions to three levels of attributes. Lack empirical validation
Retail Service Quality and Perceived Quality (Sweeny et.al. 1997)	The technical quality is an important contributor to product quality and value perceptions and hence influences willingness to buy. Functional service quality has indirect influence on willingness to buy through product quality and	The model considers only one value construct. i.e. value for money. Fewer members of items per construct are taken in this study.
Service Quality, customer value and customer satisfaction model (Oh, 1999)	The model can be used as a framework for understanding consumer decision making process as well as evaluating company performance. This model provides directions and targets for customer oriented company efforts	Model needs to be generalized for different types of service settings. Model variables are measured through relatively fewer items.
Antecedents and mediator model (Dabholkar et.al. 2000)	Consumers evaluate different factors related to the service but also form a separate overall evaluation of service quality. The antecedent's model can provide complete understanding of service quality and how evaluations are	Antecedents of customer satisfaction have not be explored. The model measures behavioural intentions rather than actual behaviour. Need to generalized for different service settings
Internal Service Quality Model (Frost and Kumar, 2000)	The perceptions and expectations of internal customers and internal suppliers play a major role in recognizing the level of internal service quality perceived	Need to be generalized for all types of internal environments. Effect of changes in the external environment on model is not been considered.
Internal Service Quality DEA Model (Soteriou and Stavrinides, 2000)	Indicates the resources which can be better utilized to produce higher service quality levels.	Does not provide the measurement of service quality. Model ignores other bank performance measures.

Measurement of Service Quality

Plentiful academic literature is available on how service quality dimensions have been measured over the period of time. It is measured both qualitatively and quantitatively. There is no dearth of studies measuring service quality in healthcare industries in various settings as well. Most of the service quality measurement in the hospital industry has been done on either in patients or out patients or both. Both admitted and discharged patients within an year and at times their attendants have also been surveyed. Most of the quantitative studies measuring service quality, used questionnaire as the tool for data collection. Although there were a minimum of 15 and a maximum of 86 items were measured in the questionnaire yet, almost all studies used likert type scale. There was no commonality in how the data was being analyzed. Techniques like Gap score, Regression, Factor Analysis, SEM etc were used.

Table 6: Measurement of Service Quality

S no.	Researcher	Year	Industry	Research Approach	Type of Respondents	Sample Size	Method of data Collection	No. of Items Used	Scale	Analytical Technique
1	Gronroos, C.	1986	Multiple industries	Quantitative		219	Mail based questionnaire		5 point likert type scale (5=strongly agree, 1= strongly disagree)	
2	Parsuraman A., Zeithaml Valerie A, Berry Leonard L.	1985	Retail Banking, credit card, securities brokerage and product repair and maintenance.	Qualitative			Focus Groups and In depth executive interviews		7 point likert scale (1= strongly disagree, 7= strongly agree	Regression and Factor analysis
3	BabakusEmin and Mangold W.G	1992	Healthcare		discharged in 13 months	443	Mail based questionnaire		5 point likert scale (5= strongly agree and 1= strongly disagree)	EFA and CFA
4	Haddad, S., Fourner, P., Potvin, L.	1998	Healthcare			241	Questionnaire	20 item		
5	Andaleeb, S.S.	2001	Healthcare	Quantitative	patient who utilized health services in 12 months	207	Questionnaire	25	7 point likert scale (1= strongly disagree, 7= strongly agree	Factor Analysis and Regression
6	Hasin, M.A.A., Seeluangsawat, R., Shareef, M.A.	2001	Healthcare	Quantitative	IPD and OPD	IPD=138, OPD=255	Questionnaire	18		ANOVA
7	Cronin Jr. J.J., Brady M.K.,	2002	Fast Food, Banking, Pest Control, Dry Cleaning, Spectator Sport, Entertainment, Healthcare. Long distanc Carriers, Fast food	Quantitative		2278		10		CFA
8	Caruana, A.	2002	Retail Banking		Quantitative	200	Postal questionnaire	21	3 point scale for perception (worse than expected, about as expected, better than expected)	CHAID
9	Baltussen, RMPM, Ye, Y., Haddad, S., Sauerborn, R.S.	2002	Healthcare	Quantitative		1081	Questionnaire	20	5 point likert scale (-2 very unfavorable+2 very favorable)	Factor Analysis
10	Sohail, S.S,	2003	Healthcare	Quantitative	Discharged patients within 6 months	150	Mail based questionnaire	15	5 point Likert scale (1= strongly agree and 2= strongly disagree)	CFA GAP score
11	Jain, S.K., Gupta, G.	2004	Restraunts	Quantitative		400	Questionnaire	22	5 point Likert scale	GAP score and outcome score
12	Kilbourne, W.E., Duffy, J.A., Duffy, M., Giarchi, G,	2004	Healthcare	Quantitative	Nursing Home residents in long term care	294	Questionnaire	22	7 point Likert scale (1=disagree very strongly and 7 = agree very strongly)	SEM
13	Luk, S.T.K.W., Layton, R.	2004	Hospitality (room service)	Quantitative		294 (288)	Questionnaire	24		EFA
14	Duong, D.V., Binns, C.V., Lee, A, H., Hipgrave, D.B.	2004	Healthcare	Quantitative	Prenatal and postpartum women	396	Interview	20	3 point scale (favorable, neutral, unfavorable)	PCA
15	Choi, K.S., Cho, W.H., Lee, S., Kim, C.	2004	Healthcare	Quantitative	Out patients	557 (537)	Sel Administered Questionnaire	30	7 point likert scale (1= stronglydisagree and 7= strongly agree)	Factor analysis
16	Verhoef, P.C., Antonides, G., DeHoog. A.N.	2004	Call Center	Quantitative	Inbond calls		telephonic questionnaire		5 point likert scale (very unpleasant-pleasant, very dissatisfied-satisfied)	Regression analysis
17	Rajpoot, N.	2004	12 different service industries	Quantitative		400 (222)	Focus Group and then mail survey	24 itmes		Item Response Theory, EFA, CFA and Conjoint analysis
18	Pakdil, F., Harwood, T.N.	2005	Healthcare	Quantitative	Pre operative patients and their family members	669	Questionnaires	22	3 for expectations (very important, important, not important), perceptions on 5 point liker scale (1=excellent, 2= very good, 3= good, 4=fair, 5=poor)	

19	Lehtinen U and Lehtinen J.R.	2006	Restraunt	Qualitative and Quantitative	Disco: Dancers, bar people, medium participants Lunch Restaurant: Heavy and light users Pub type restraunt: Eaters, Drinkers, Occasional customers	Disco 15 Lunch Restaurant 15, Pub Type Restaurant: 3	In Depth Interview			Hermeneutical learning process, , Factor analysis
20	Akbaba, A.	2006	Hotel	Quantitative	Checked out patients	250 (234)	Questionnaire	29	5 point likert scale (1 very low and 5 very high)	Factor analysis, t test
21	Rao, K.D., Reters, D.H., Roche, K.D.	2006	Healthcare	Quantitative	In patient and Out patient	1837 outpatients and 611 in patients	Questionnaires	16	5 point Likert type scale (Pictorial money scale one rupee=completely agree, 75 p =agree, 50 p = neither agree nor disagree, 25p disagree, zero paise= completely disagree)	PCA and regression
22	Mostafa, M.M.	2006	Healthcare	Quantitative	About to be discharged patients	332	Questionnaires	22	5 point likert type scale (strongly disagree to strongly agree)	PCA, discriminat analysis, ANOVA
23	Olorunniwo, F., Hsu,m M.K., Udo, G.F.	2006	Hotel	Quantitative	Employees of major corporations, state and federal government establishments and MBA students	311	Questinnaire	29	7 point likert scale (1 strongly disagree to 7 strongly disagree)	Focus group and WTA, EFA and CFA
24	Rohini, R., Mahadevappa, B.,	2006	Healthcare	Quantitative	Patients and Management	500 patient (100 from each hospital), 75 (40) responses from management	Questionnaires	22	7 point lokert scale	GAP score
25	Teng, C.I., Ing, C.K., Chang, H.Y., Chung, K.P.	2007	Healthcare	Quantitative	patients admitted in surgical wards	271 (253)	Questionnaire	47	5 point likert scale (strongly disagree to strongly agree)	Factor analysis
26	Dagger, T.S., Sweeny, J.C.	2007		Qualitative and Quantitative				800 (635)		Four Focus Group interviews, Mail survey, standard Content analysis Procedure
27	Piligrimiene, Z., Buciuniene, I.	2008	Health	Qualitative						
28	Chowdhury Md. M.U	2008	Health	Qualitative	Patients and their gaurdians. Management personnel	1100 patients. 800 management personnel	Questionnaire	21	7 point likert scale	GAP score

29	Fowdar, R.R.R.	2008	Healthcare	Quantitative	Patients and family members having visited GP in one year	750 (260)	Questionnaire	47	7 point likert scale	Factor analysis and linear regression
30	Duggirala, M., Rajendran, C., Ananthraman, R.N.	2008	Healthcare	Quantitative	Patients undergone medical treatment and hospital stay in the recent past	300 (100)	Questionnaire	86	7 point likert scale	Confirmatory Factor Analysis. Bivariate Correlations. Multiple Regression Analysis
31	Aagja, J.P., Garg, R.	2010	Hospitals	Quantitative	Patients and attendants	200	Questionnaire	24		CFA
32	Kheng, L.L., Mahamad, O., Ramayah, T., Mosahab, R.	2010	Banking	Quantitative	Customers of 10 banks	238	Questionnaires		7 point likert scale (1= strongly disagree, 7= strongly agree)	Regression
33	Mosahab, R.Mahamad, O., Ramayah, T.,	2010	Banking	Quantitative		250 (147)	Questionnaire			Linear Regression
34	Otani, K.	2010	Healthcare	Quantitative	discharged (7-14 days)	11432 (4230)	Telephonic Interview		5 point Likert Scale	Regression
35	Ravichandran, K., Mani R.T., Kumar, S.A., Prabhakaran, S.,	2010	Retail Banking	Quantitative		350 (300)	Questionnaire			Regression
36	Santouridis, I., Trivellas, P.	2010	Mobile Telephony		Random intercepts on streets and shopping centers	205	Interviewer administered questionnaire			Multiple Regression
37	Sivakumar, C.P., Srinivasan, P.T.	2010	Healthcare	Quantitaive	Patients and Patient's attendants	472		22	7 point Likert (strongly agree to strongly disagree)	Multiple Regression
38	Brahmbhatt, M, Baser, N., Joshi, N.	2011	Healthcare	Quantitative		246	Questionnaire	41	Modified SERVQUAL scale	
39	Prakash A., Mohanty R.	2012	Healthcare	Quantitative	Discharged Patients and Attendants	300 (169)	Questionnaire	26	7 point likert scale (1 very low 7 very high)	Factor Analysis and Artificial Neural Networks
40	Altuntas, S, Dareli, T., Yilmaz, M.K.	2012	Healthcare	Quantitative	Discharged (IPD)	385 (281)	Questionnaire		5 point	AHP and ANP
41	Arun Kumar, G., Manjunath, S.J., Chethan, K.C.	2012	Healthcare	Quantitative	Discharged	185	Questionnaire		5 point	t test, regression analysis
42	Senic, V., Marinkovic, V.	2012	Healthcare	Quantitative	OPD patients	152	Questionnaire	18	7 point (1 completely disagree 7 completely agree)	PCA, SEM
43	Zarei, A, Arab, Md., Froushani, A.R., Tabatebaei, S.M.G.	2012	Healthcare	Quantitative	Discharged	1100 (983)	Questionnaire	21		Factor Analysis
44	Ramez, W.S.	2012	Healthcare	Quantitative	Discharged (within 1 year)	250 (235)	Questionnaire			Factor Analysis, Regression and Correlation
45	Chahal, H, Kumari, N.	2012	Healthcare	Quantitative	Discharges (IPD)	400	Schedule	62	5 point (5 strongly agree 1 strongly disagree)	HeirarchialApproache
46	Irfan, S.M., Ijaz, A., Farooq, M.M.	2012	Healthcare	Quantitative	Discharged and OPD	500 (369)	Questionnaire	22		SEM
47	Chang, C.S., Chen, S.Y., Lan, Y.T.	2013	Healthcare	Quantitative		350 (285)	Questionnaire		5 point (5 strongly agree 1 strongly disagree)	SEM
48	Purcarea V.L., Gheorghe, I.R., Petrescu, C.M.	2013	Healthcare	Quantitative	Discharged Patient	1000 (valid 183)	Questinnaire (e-mail)	22	5 point (5 strongly agree 1 strongly disagree)	

49	Naik, J.R.K., Anand, B., Bashir, I.	2013	Healthcare	Quantitative	Admitted Patients for more than 2 days	145	Questionnaire	24 (16 SERV QUAL and others)	5 point Likert Scale	Regression and Correlation
50	Amin, M., Nasharuddin, S.Z.	2013	Healthcare	Quantitative	Admitted Patients for more than 1 day	350 (216)	Questionnaire		7 pointLikert scale (1 strongly agree, 7 strongly disagree)	CFA, SEM
51	Krishnamoorthy, V., Srinivasan, R.	2014	Healthcare	Quantitative	Discharged	270 (197)	Questionnaire through (e-mail or by post)	30		EFA, Multiple Regression
52	Dheepa, T., Gayathri, N., Karthikeyan, P.	2015	Healthcare	Quantitative		286	Interview Schedule	23		Factor Analysis and Multiple Regression
53	Satsanguan, L., Fongsuwan, W., Trimentsoontron, J.	2015	Healthcare	Quantitative	Discharged Patients and their relatives	219	Questionnaire	20	7 point Likert scale (1 strongly agree to 7 strongly disagree)	EFA, CFA, SEM
54	Thiakarajan, A., Krishnaraj, A.S.R.	2015		Qualitative						
55	Venkateshwarlu, P., Ranga, V., Sreedhar, A.	2015	Healthcare	Quantitative	Patients and Visitors	300	Questionnaire	22	5 pointLikert scale (Very Important, Important, Moderately Important, Less Important, Unimportant)	Regression and Correlation
56	Izogo, E.E., Ogba, L.E.	2015	Automobile Repair	Quantitative		384	Questionnaire	32 (22 Service Quality, 5 Customer Satisfactio, 5 Loyalty)	7 point (7 very strongly agree, 1 very strongly disagree)	PCA
57	Mohamed, B., Azizan, N.A.	2015	Healthcare	Quantitative	Discharged Patients (not more than 12 months)	235	Questionnaire	35	5 pointLikert (1 strongly disagree to 5 strongly agree)	PLS-SEM
58	Kondasani, R.K.R., Panda, R.K.	2015	Healthcare	Quantitative	Patients Visited	475	Questionnaire	55	5 point Likert(5 strongly agree to 1 strongly disagree)	Focus Group (for questionnaire design) Factor Analysis, Regression and Correlation
59	Bahadori, M., Raadabadi, M., Ravangard, R., Baldacchino, d.	2015	Healthcare	Quantitative	Admitted Patients	385	Questionnaire	30	5 pointLikert scale (1 strongly disagree 5 strongly agree)	CFA
60	Jandavnath RKN, Byram, A.	2016	Healthcare	Quantitative	Admitted Patients	500 (493)		28		SEM
61	Pai, Y.P., Chary, S.T.	2016	Healthcare	Qualitative	Family, relatives and friends who had visited the hospital known to reseracher		Focus Group followed by questionnaire	66	10 pointlikert scale (1, not relevant at all and 10 very relevant)	
62	Pramanik, A.	2016	Healthcare	Quantitative	Admitted and Discharged	368	Questionnaire	22		

Associated factors of Service Quality

Satisfaction

Service quality is primarily cognitive whereas satisfaction comprises not only cognitive but also emotional aspects derived from consumption (Dagger and Sweeney, 2007). Satisfaction can be defined as an attitude-like judgment following a purchase act or a series of consumer product interactions (Lovelock and Writz, 2011, p40). In a service setting, C*ustomer Satisfaction* is a short term emotional reaction to a specific service performance (Lovelock & Wright, 1999). When service outcome either meets or exceeds the customers' expectations the resultant is a customer satisfaction. On the contrary when the the actual outcome of service falls short of the client's anticipated outcome the resultant is called dissatisfaction (Brown & Swartz, 1989).

Patient satisfaction reveal the level to which expectations of service standards have been met and is usually measured by asking patients about general satisfaction with care that they have received (Rao, Peters, & Bandeen-Roche, 2006). Ware and Synder (1975) identified four key satisfaction dimensions: Humanness and quality, service availability, convenience of care, and access mechanisms in healthcare settings. For hospitals and health systems, sales, profit and loyalty, lower cost to serve and more engaged employees is linked to patient satisfaction (McKinsey & Co., 2015, 2016). However, overemphasis on patient satisfaction may lead to unintentional neglect or mismanagement of the technical aspects of care resulting in adverse effects on healthcare consumption (Fenton et.al., 2010). Measuring customer satisfaction can tell the extent of satisfaction but it definitely does not tell how to achieve it (Meyer and Schwager, 2007). Satisfaction ratings are however similar to evaluating how service has been performed on the personal preferences rather than specific and at times predefined procedural aspects of service quality (Rao et al., 2006).

Sales, reduction in price elasticity, and increase in reputation of the service provider are linked to satisfied customer (Yee et al., 2010). Further, satisfied customer leads to reduction of the perceived benefits of alternative suppliers and hence to higher repurchase intention (Anderson and Sullivan, 1993). Loyalty in a highly competitive market, with abundant alternative products and services where the cost of switching is low, is a function of satisfaction (Yee et al., 2010).

Satisfaction and Service Quality findings are summarized in the table VII.

Table 7: Service & Quality and Satisfaction

Researcher	Year	Service Quality and Satisfaction Findings
Bolton R. N., Drew J. H.	1991	Customer's assessment of quality and value are primarily a function of disconfirmation arising from discrepancies between anticipated and perceived performance level.
McAlexaner, J.H., Kaldenberg, D.O., Koeing, H.F.	1994	The relationships between satisfaction and service quality are strong when examined from either direction.
Gotlieb, J.B., Grewal, D, Brown, S.W.	1994	Perceived quality affects satisfaction and behavioral intentions are affected by satisfaction.
Andaleeb, S.S.	2001	Healthcare Satisfaction index should be constructed to periodically compare services of different hospitals having weighted factors such as cost, access, technical quality and patient centered service factors.
Sureshchandar G.S., Rajendran C, AnanthramanR.N.	2002	Service Quality and Customer Satisfaction are independent constructs. Increase in one is likely to lead to increase in other.
Cronin Jr. J.J., Brady M.K.,	2002	Consumer satisfaction has more affect on consumer purchase intention that service quality.
Caruana, A.	2002	Service Quality is found to act on service loyalty via customer satisfaction.
Choi, K.S., Cho, W.H., Lee, S., Kim, C.	2004	Cognition (Service quality and Value)-> affect (satisfaction)->conation (behavioral intention) model stands robust across national boundaries
Verhoef, P.C., Antonides, G., DeHoog. A.N.	2004	Satisfaction is not created solely by the average quality of the events in the service process. Satisfaction can be further enhanced with the provision of positive peak experience.
Olorunniwo, F., Hsu,m M.K., Udo, G.F.	2006	The indirect effect of Service Quality through customer satisfaction is overwhelmingly larger than the direct effect in generating favorable behavioral intentions
Kheng, L.L., Mahamad, O., Ramayah, T., Mosahab, R.	2010	Satisfaction has mediating effect on the relationships between service quality dimensions and customer loyalty.
Mosahab, R.Mahamad, O., Ramayah, T.,	2010	43 percent of the customer's satisfaction change is explained by service quality. Satisfaction plays a more important role for building loyalty.
Santouridis, I., Trivellas, P.	2010	Service Quality is a major predictor of both customer satisfaction and loyalty.
Sivakumar, C.P., Sri	2010	Assurance dimension of service quality was found to be the most important predictor of satisfaction.
Yee, R.W.Y., Yeung, A.C.L., Cheng, T.C.E.	2010	Employee Loyalty is significantly related to service quality, which in turn impacts customer satisfaction and customer loyalty, ultimately leading to firm profitability in high contact service industries.
Kessler, D.P., Mylod, D.	2011	The most effective way to increase satisfaction is by targeting key quality improvement process.
Senic, V., Marinkovic, V.	2012	Technical and functional quality has considerable impact on overall client satisfaction with the delivered service and on shaping corporate image (i.e. health provider's image).
Ramez, W.S.	2012	There is relationship between overall service quality and overall patient satisfaction.
Chang, C.S., Chen, S.Y., Lan, Y.T.	2013	Service encounter directly affect patient satisfaction.
Naik, J.R.K., Anand, B., Bashir, I.	2013	Service Quality influence customer satisfaction in hospital industry.
Amin, M., Nasharuddin, S.Z.	2013	Hospital Service Quality has a significant relationship with customer satisfaction.
Krishnamoorthy, V., Srinivasan, R.	2014	Only Tangibility, Admission, Equality, Medical Service, Medical Care has a significant impact on inpatient satisfaction
Dheepa, T., Gayathri, N., Karthikeyan, P.	2015	Customer Satisfaction is influenced by the service quality dimensions
Satsanguan, L., Fongsuwan, W., Trimentsoontron, J.	2015	Significant direct effect of service quality on customer satisfaction.
Venkateshwarlu, P., Ranga, V., Sreedhar, A.	2015	Service Quality Dimensions will have positive effect on customer Satisfaction
Mohamed, B., Azizan, N.A.	2015	Perceived Service Quality via Patient Satisfaction and its direct impact has strong influence on Behavioral Compliance
Jandavnath RKN, Byram, A.	2016	Healthcare Service Quality has a significant relationship with customer satisfaction.

Behavioural Intention

Customer satisfaction leads to customer loyalty which further leads to profitability (Hallowell, 1996). Highly satisfied customer will not look towards alternative suppliers of similar products or services and hence will have higher repurchase intention (Anderson and Sullivan, 1993). Heskett et.al, (1994) were of a opinion that profit and growth are churned primarily by customer loyalty.

They further propounded that the loyalty is a direct result of satisfaction (Caruana, 2016; Panda, 2015) and is largely influenced by how customer values the service. It has been measured that approximately five percent improvement of customer retention leads to profitability increase in a range of twenty five to eighty five percent. Further, loyal customers tend to recommend the business to others (Reichheld & Sasser, 1990). Likewise, in healthcare services, overall patient satisfaction and tendency of patients to recommend the health services to others is significant. Further, positive word of mouth is propagated by satisfied patient about hospital's service (Choi, Cho, Lee, Lee, & Kim, 2004; Ramez, 2012). Zeithaml (2000), studied the behavioral and financial consequences of the service quality and postulated that superior service quality leads to favorable behavioral intentions which leads to ongoing revenue, increased spending, price premium and referred customers summing upto positive financial consequences. On the contrary, negative financial consequences in terms of decreased spending, low customers and higher costs to attract the customers are incurred by the company due to inferior service quality. Adapted from: Zeithaml, V. A. (2000). Service quality, profitability, and the economic worth of customers: what we know and what we need to learn. *Journal of the academy of marketing science*, *28*(1), 67-85

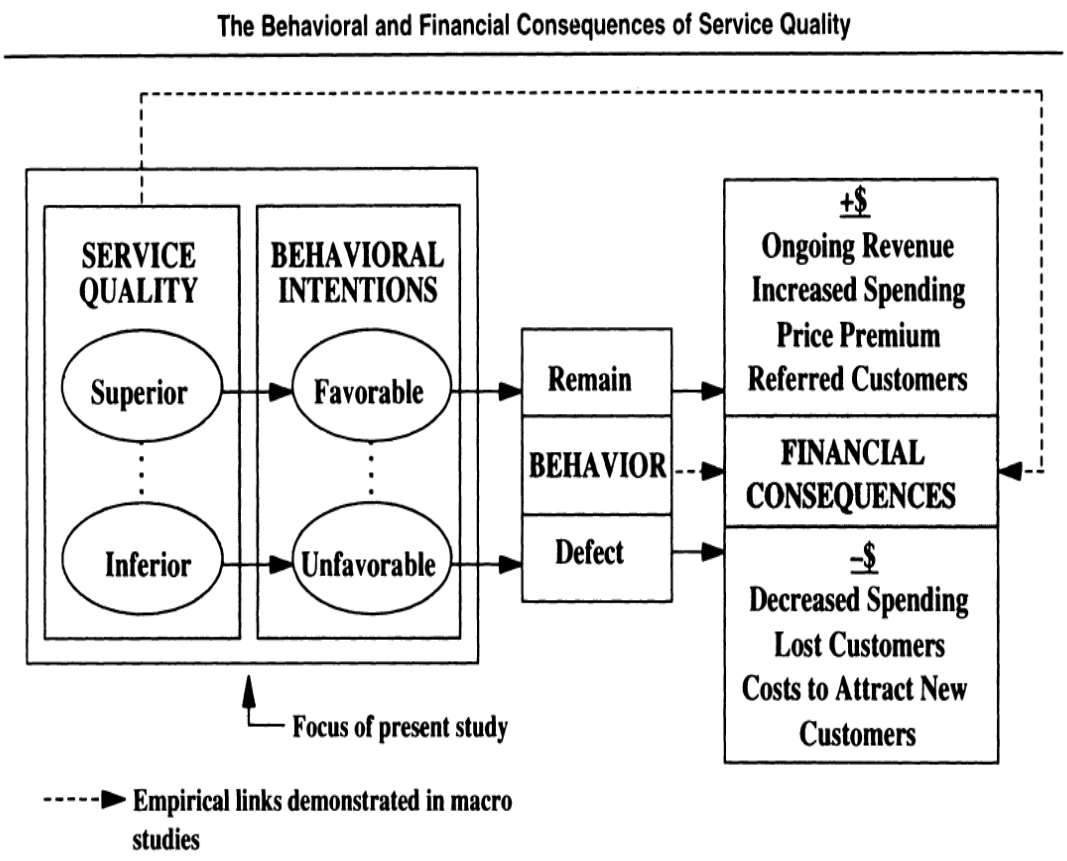

Fig 5:the behavioral and financial consequences of service quality

Table 8: Service & Quality and Satisfaction

Author	Year	Service Quality and Behavioural Intentions Findings
McAlexaner, J.H., Kaldenberg, D.O., Koeing, H.F.	1994	Service quality has stronger effects on purchase intentions than does patient satisfaction.
Gotlieb, J.B., Grewal, D, Brown, S.W.	1994	Perceived quality affects satisfaction and behavioral intentions are affected by satisfaction.
Zeithaml V.A., Berry, L.L., Parasuraman, A.	1996	Behavioral intentions are strongly influenced by the service quality
Hallowell R	1997	Customer satisfaction leads to customer loyalty which further leads to profitability
Bloemer, J., Ruyter, K., Wetzels, M.	1999	Service quality-loyalty relationships varies with the four dimensions (WOM, purchase intention, price sensitivity and complaining behaviour) of service loyalty across industries
Mittal V and Kamakura, W.A.	2001	There may be non linear relationship between the satisfaction ratings and repurchase behavior due to consumer characteristics.
Cronin Jr. J.J., Brady M.K.,	2002	Consumer satisfaction has more affect on consumer purchase intention that service quality.
Caruana, A.	2002	Customer satisfaction has a direct impact on the customer loyalty
Keiningham, T.L., Munn, T.P.	2003	Satisfaction is positively related to the share of business a customer conducts with a particular service provider (share of wallet) and opposed to simply repurchasing a product or service
Choi, K.S., Cho, W.H., Lee, S., Kim, C.	2004	Cognition (Service quality and Value)-> affect (satisfaction)->conation (behavioral intention) model stands robust across national boundaries
Olorunniwo, F., Hsu,m M.K., Udo, G.F.	2006	The indirect effect of Service Quality through customer satisfaction is overwhelmingly larger than the direct effect in generating favorable behavioral intentions
Kheng, L.L., Mahamad, O., Ramayah, T., Mosahab, R.	2010	Improvement in service quality can increase the loyalty. Satisfaction has mediating effect on the relationships between service quality dimensions and customer loyalty.
Mosahab, R.Mahamad, O., Ramayah, T.,	2010	Nearly 45 percent of the loyalty changes can be explained by service quality changes Satisfaction plays a more important role for building loyalty.
Otani, K.	2010	Willingness to Return was significantly and positively related to attribute reaction variables: admission process, nursing care, physician care, staff care and room. Willingness to Recommend has the same results as above Physician care was third highest influencer of willingness to return and recommend, however, it stood at fourth level in overall evaluation of quality of care.
Santouridis, I., Trivellas, P.	2010	Customer satisfaction mediates the service quality and customer loyalty relationship. Service Quality is a major predictor of both customer satisfaction and loyalty. Satisfaction has a very significant positive effect on loyalty
Sivakumar, C.P., Srinivasan, P.T.	2010	Repatronage intention is significantly determined by only two service quality dimensions reliability and assurance.
Yee, R.W.Y., Yeung, A.C.L., Cheng, T.C.E.	2010	Employee Loyalty is significantly related to service quality, which in turn impacts customer satisfaction and customer loyalty, ultimately leading to firm profitability in high contact service industries.
Kessler, D.P., Mylod, D.	2011	Satisfaction with process is the most important patient care experience for determining loyalty.
Arun Kumar, G., Manjunath, S.J., Chethan, K.C.	2012	Reliability, responsiveness, assurance and empathy dimensions of service quality are positively related to patient's loyalty
Amin, M., Nasharuddin, S.Z.	2013	Favorable Behavioral Intention Include: Positive Word of Mouth, Repurchase Intention and loyalty Unfavorable Behavioral Intention include: Negative WOM and conveys their negative experiences to others and intention to switch to competitors. Patient Satisfaction has significant relationship with behavioral intention.
Kumar, V, Pozza, I.D., Ganesh, J.	2013	Overall there is positive relationship between satisfaction and loyalty. Other moderating, mediating and antecedent variables are better predictors of loyalty and variance explained by them on an average is 34 percent (54 % on attitudinal loyalty and 15% on behavioral loyalty). Satisfaction-loyalty relationship has the potential to change over the customer lifetime. While Customer Satisfaction has a positive relationship with WOM, other related variables such as commitment, trust and product involvement serve as better predictors of WOM.
Mullins, R.R., Ahearme, M., Lam, S.K., Hall, Z.R., Boichuk, J.P.	2014	Inaccuracy in perceiving customer relationship quality by salespersons greatly affects customer profitability.
Venkateshwarlu, P., Ranga, V., Sreedhar, A.	2015	Service Quality Dimensions will have positive effect on customer loyalty Customer Satisfaction will have a positive effect on customer loyalty Customer loyalty is impacted by satisfaction towards quality of service.
Izogo, E.E., Ogba, L.E.	2015	In Non Western environment, distinct efforts to measure customer satisfaction and customer loyalty is less useful as they are perceived to be same.
Kondasani, R.K.R., Panda, R.K.	2015	Customer Satisfaction correlates with Loyalty,
Jandavnath RKN, Byram, A.	2016	Patient Satisfaction has significant relationship with behavioral intention (Willingness to recommend, Willingness to inform the advantages of the hospital, and considering the same hospital as a first choice in future medical treatment)

Service as an Experience

In the process of delivery of service a customer passes through various touch points. The service encounter received at the each point sums up to the customer journey. These touch points are termed as "customer corridors" (Meyer and Schwager, 2007) and generally do not have equal weightage in the customer journey. An experience occurs when a company intentionally uses services as a stage, and goods as props, to engage individual customers in a way that creates a *memorable* event (Pine and Gilmore, 1998). *Customer Experience* is the internal and subjective response customers have to any direct or indirect contact with the company (Meyer and Schwager, 2007). The summation of all good and bad customer service experiences that the customer receives at all the touch points is the wrap up of the customer satisfaction with the total process. Patient experience spreads across the entire *clinical journey* from scheduling an appointment to follow up and it includes all clinical and non clinical touch points during the delivery of care, and follow-up thereafter. Rather than touch points the outcome of the entire journey is more linked to economic outcomes like financial performance (McKinsey & Co, 2015, 2016), malpractice risk, patient loyalty and employee satisfaction (Browne e.al. 2010). Overall poor customer satisfaction leads to customer defection, lost sales and lower employee morale. It must be noted that the satisfaction decisions are taken post customer experience contrary to quality decisions which are framed prior to the delivery of the service i.e. at the time of setting expectations (Bolton & Drew 1991, Boulding et.al.,1993, Cronin and Taylor, 1994, Caruana, 2002). In a credence based service like healthcare the clinical quality is usually difficult for the patient to judge even after the service is performed (Berry & Bendapudi, 2007).

The evaluation of the healthcare service of the first time user and a repeat patient is also different and is based upon the longevity of their consumption experience (Dagger and Sweeny, 2007). Patient's engagement with and adherence to provider's instructions, and clinical processes and outcomes are positively related to the good patient experience (Browne et.al. 2010). Companies that could not provide engaging customer experiences, overprice their experiences relative to value perceived by the customer, or overbuild their capacity usually see pressure on demand, pricing or both (Pine and Gilmore, 1998).

Discussion

The aim of this paper was to review and describe the research on service quality with reference to healthcare services. The conceptualization of service quality was assessed through various researches taken place over the period of time. The related dimensions, measurement and models for assessment of service quality in healthcare and elsewhere were also assessed. In recent times many companies have started service quality measurement programs. These programs help them to assessment and bringing out modifications in their process of service delivery (Bolton, R.N. and Drew, 1991). Service Quality is a major forecaster of both customer satisfaction and loyalty (Olorunniwo, Hsu, & Udo, 2006; Santouridis & Trivellas, 2004; Sivakumar & Srinivasan, 2009). However, Overall literature review was indicative of the fact that there are no clear cut dimensions and assessment tool available for healthcare industry.

Inspite of large number of service quality dimensions available in the literature yet they vary according to country, culture, government vs. private facility, type of healthcare needs, urban vs rural patients etc. However, there is unanimity as these dimensions have only been identified from the demand side of the service. Further, in a service like healthcare with high experience and credence properties the provider's perspective on the expectations and perceptions should be looked upon(Choi et al., 2004).

In the literature review it has been found that the SERVQUAL and SERVPERF have widely been used as the measurement tools. However, SERVQUAL is preferred over the other because of inherent ability to calculate the gap in the various dimensions. The measurement thus provides not only the state of the service quality being provided but also the dimensions requiring priority for closure of gaps. Despite of the SERVQUAL tool being used and tested in various service settings, the authors themselves have called for adaptation of scale in various other service setting. Hence, modified SERVQUAL scale have been used in various industries with various necessary adaptation of industry specific dimensions.

Service gap which is the difference between what customers expect to receive and their perception of the service (Lovelock & Wright, 1999), *GAP 5* as proposed by (Parasuraman et al., 1985), which is actually delivered can be closed by closing the other six gaps. It is being

proposed that the service gap can be closed by closing all other gaps in the process. However, healthcare being high credence and experience based professional service.Thus, it becomes equally essential to understand and close the *Knowledge Gap*: the difference between what service providers believe customers expect and customer's actual needs and expectations (Lovelock and Writz, 1994), which is also *GAP 1* as proposed by (Parasuraman et al., 1985). Further, (Lovelock & Wright, 1999) extended the Service Quality Model (Parasuraman et al., 1985) by introducing *Perceptions Gap* which is the difference between what is actually delivered (as perceived by the provider) and what customers perceive they have received (because they are unable to accurately evaluate service quality). Dyadic view (i.e. the examination of both the parties namely, the service provider and the service receiver) (Brown and Swartz, 1989) of evaluation of service quality and satisfaction of the service encounter is necessary for gaining understanding of the evaluation process.

Limitations and Suggestions for Future Research:

The inclusion criteria itself is a limitation of the research as it restricted the chances of some relevant articles that may have been selected in the study. Further, articles relating to the patient satisfaction ratings and pay for performance for the hospitals elsewhere in various countries have not been included. This limits the evaluation of effectiveness of such rating scales for healthcare service quality improvement. The feasibility of such rating scales in populous countries like ours can well be studied. There is need for evaluation of the service quality not only from the demand side but also from the supply side.

Conclusion

In totality, the present literature review of service quality in healthcare has shown that there are problems in the assessment of service quality. No unanimous standards exists based on which the quality of service in healthcare can be evaluated and neither is the availability of a instrument which incorporate s both the service receiver's and service provider's point of the view regarding healthcare service quality. In light of this it is recommended firstly to identify the significant attributes for evaluation of service quality by customers and providers of healthcare services. Secondly, to develop an instrument to measure the knowledge and perception gap in healthcare service quality and thirdly, to create a dyadic approach of customer's

evaluation and provider's perspective of customer evaluation of healthcare services.

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Financial inclusion in India: a study of determinants and drivers

Dr. Rajesh Tripathi*, Swati Gupta**

**Assistant Professor (SS), CoMES, University of Petroleum and Energy Studies*

***Faculty, CoMES, University of Petroleum and Energy Studies*

Abstract

This paper collects the reviews of financial inclusion (FI) in India to point out how it serves the growth and development of an economy. The primary role played by financial inclusion policy for inclusive growth globally is to transform financially excluded population which is numbered as 2.5 billion plus, of which one-third is populated in India. FI is the direct initiative of UN, which reports key goals of the policy to access the wide range of financial services to all at an affordable cost. Its operation started effectively in India from the year 2005. Indian economy is predominately based on rural sector and to support that it is mandated to provide suitable financial services to economic growth which will increase the per capita income and vis a vis living standard of citizens. FI is crucial for the rural segment; however, focus on urban and suburban is also needed. The core aim of this study is to review the literature on FI in the Indian perspective, discussed by different researchers globally. And also to highlight the awareness level of FI, digital FI and barriers confronted to financial access.

Keywords: Financial Inclusion, Financial Literacy, Digital Finance, Economic development.

Introduction

Information based on literature estimates, almost 10-15% households in the US, 8-10% in the UK, 7-10% in France, do not even have a basic saving bank account. However, the problem is bigger in developing countries like India where the extent of exclusion is 25-65%. At present, in India, the aim of FI is to confine and in ensuring a bare minimum access to saving bank account to all. It is seen that on one hand, the poor section of society have been restricted to access the financial system and they are not benefitting the financial system and on the other hand, the rich section who have accessibility to financial system hesitate because of security concern and outreach. This study reviews the literature

on FI in the Indian perspective, discussed by different researchers globally. And also to highlight the awareness level of FI, digital FI and barriers confronted to financial access.

Literature Review

Starting post offices, to banking and insurance companies or any other formal financial institutions have become essential for an individual to deposit, save, invest and avail any other financial service. Banking sector and other financial sectors were providing loads of financial services for decades to all. Reference also suggests that due to poverty and illiteracy many people were unable to access the financial services available to all. Beside this banks and other financial providers were unable to provide the product and services required as well due to above mention factors. Various initiatives were taken by government and RBI time to time to include the financially excluded regions so that citizens especially the poor society or any disadvantage region can avail all the financial products and services rendered by financial institutions. The focal point of any financial-economic system is based on income, expenditure, saving and investment. Based on this people buys and sells any services to products to amenities, borrow, transfer and invest their income in the economy to gain. Such all transaction has its own attached time, cost, and user friendliness which is needed by a financial institution while providing such services to the society.

Financial awareness

According to the Committee for Financial Inclusion, India (2008) "Financial Inclusion is the process of ensuring access to financial services and timely, adequate credit where needed, to vulnerable groups such as weaker sections and low-income groups, at an affordable cost". Thus, the need for FI in India was to include the financially excluded people and regions that were unable to access the financial services rendered by banking and other financial institutions. Due to the less awareness of financial products and services, weaker section of the society was unable to avail the provided products and services by banks and other financial institutions. Also the technological reforms in form of plastic money, virtual transactions and ATMs, etc., restricted rural sector to enjoy such benefits as these were only available at urban locations, which lead to limited access to financial products and

services in all remote regions. Past studies highlight level of awareness is based on financial literacy, contributions by various financial intermediaries towards encouraging and aiding FI to rural section and the level of FI through Information and Technologies (ICT). Financial institutions require an integrated approach towards the awareness among the rural section on financial products and services. They need to be educated towards the usage and the benefits served by financial products and services. The rural section should be advice on money management, debt counseling and aware about available credit facilities in the financial market.

Investigation of Ramji (2009) led to gauge results of the financial inclusion drive to comprehend forms and reveal the point of view and element behind finance related consideration, likewise watched that the household bank account has expanded significantly (multiplied) amid the financial inclusion drive period. These accounts had been opened to get government help. Be that as it may, the utilizations and awareness with accounts stay low, as individuals pull back cash when this comes in the account. As indicated by this review Self-Help groups in rural ranges were extremely famous for investment funds. The review finishes up, that however government help projects regard incorporate enormous family populace with low-pay in finance related framework yet do not regularly prompt to employments. The review worried after improving financial proficiency and promoting for ideal usage of bank accounts.
For successful FI drive, Bagli & Dutta (2012) have identified two areas of unbanked distinction and underutilizing bank accounts, which need loads of attention by financial institutions. Balakrishnan (2015) have discussed active commitment towards the usage of financial products and services rather focusing on accessibility of the same.

Research demonstrates the success of FI can be achieved through bridging microfinance institutions and local communities. Financial institutes should market zero balance account, should improve the technological barriers like having voice ATMs enabling regional languages and video tutorial to operate such ATMs by any illiterate person. Financial institutes need to redefine their marketing strategies to promote FI to weaker section and consider as a business

opportunity, also the corporate social responsibility.

Digital FI

Compared to weak society, affluent class enjoy digital financial system facilities at ease to remit or receive money, just by the click of the button, whereas weak section is not in a position to avail such system, hence, they store their valuables by means of physical assets like cash, precious metal and livestock.

Mas (2012) have expressed FI prepare in three perspectives. The primary viewpoint being physical money, second, virtual record, and last psychological perspective. Physical money is only customary money inclusion framework worked by all segment of the general public from ages. The virtual viewpoint is the present day mechanical money inclusion where all monetary exchange is overseen by the machine (PC, web, and portable). What's more, the psychological angle is neither physical nor virtual; it is a mix of mental making arrangements for future with the utilization of customary and innovative means.

Innovation has changed the keeping money and monetary inclusions from client to supplier end, where a client can get to his finance exchange for any reason and any need from any area at only a single click which makes his work simple, easy to understand and practical. Likewise, because of the straightforwardness, it gives an upper edge to the client to pick up in his pay, reserve funds and venture and to diminish acquiring and spending. Similarly, suppliers, banks, money related organizations like a post office, insurance agencies, and so on., have additionally profited in many grounds by utilizing innovation headway, which has helped them to draw in more exchanges, more customers, all the more effortlessly with no line for trade and growing of entire economy framework.

With mobility enhancement in the whole country by mobile producers and telecom providers, the government has taken along with RBI and other financial institutions number of initiatives such as payment gateways and also online banking gateways, to reach out all weaker section and disadvantaged regions with a pool of services and products. Such initiatives have come as very handy and useful for weaker section.

Barriers of FI

Gallardor (2006) watched that, there are a few issues of the finance related inclusions in country ranges. Request of finance related inclusions in provincial regions has expanded yet little populace estimate brings about the high cost and makes financial inclusions less appealing to individuals in these ranges. The limit of the financial establishment is powerless to give fitting finance-related support in the country society. Subsequently, there is a need of savvy collusions of financial organizations with society. Financial organizations think that it's hard to give credit in the provincial territories as a result of restricted capital assets; subsequently, they simply focus on non-credit benefits just, for example, installment, cash exchange and defending sparing. InfoResources (2008) likewise highlighted different difficulties to country financial inclusions; the most critical of these difficulties is the high exchange cost. Finance related inclusions are not accessible in country part for the most part in light of troublesome geography and powerless arrangement of the framework. Inaccessibility of monetary establishments, banks, and ATMs, compels the inhabitants of rustic regions to make trip long separations to urban communities for getting money related inclusions. Another test of provincial finance related inclusions is high credit chance because of reliance of salary on the agricultural generation which depends on fluctuating climate conditions and vacillation of costs in agribusinesses area (Swati, RK Sharma et, 2014). Cressy (2002) have identified major constraints about FI such as less education, illiteracy, high proximity from their living area to the service provider, low density of population, poor channel design and low product quality. These constraints are not only faced in accessing financial services by weaker section but also by service providers to render financial services. The main source of income in the rural area is agriculture and livestock. The geographic condition of rural India is very challenging. The rural population is scattered all over India with thin density. Hence supplying appropriate financial services to rural population is a challenge to financial institutions.

Beck and de la Torre (2006) recognized distinctive request and supply limitations in access to finance related inclusions. They created refinement amongst installment and funds benefits and settled intermediation expenses and loaning inclusions and diverse

wellsprings of credit hazard. The review highlights both free market activity side contacts that can prompt to lower get to. Settled part of transaction cost and loaning danger are a hindrance at the supply side. On supply side legally binding and enlightening systems, the microeconomic environment, innovation and other nation qualities require consideration. Think about likewise recognizes potential request and genuine request. Willful self-prohibition brings about restricted or no utilization of financial inclusions by a few clients. Three get to issues are first the absence of interest because of willful self-prohibition; second, the supply of financial inclusions beneath the potential because of the absence of rivalry or other supply side requirements and third, outskirts that are too low in universal examinations and clarified by the state factors. Ghatak (2013) understood that in spite of endeavors to enhance supply side of getting to i.e. keeping money extension, change in financial execution, more prominent rivalry and broadening of responsibility for, by the government and national bank of creating nations the current managing an account homes have a tendency to bar unfathomable area of populace. The review watched that the most vital components affecting interest side incorporate Income, Accessibility, Culture, Literacy and Assets (Swati and Anubhav, 2014). Finance related Inclusion in the inverse sense might be clarified as 'Financial Exclusion'. The absence of accessibility of proper, minimal effort, reasonable and safe budgetary item and inclusions to specific fragments of society, provided by standard providers is financial avoidance. Running a miniaturized scale or little undertaking or a family unit spending plan, without standard financial inclusions can frequently be a costly attempt (Mohan, 2006). Monetary prohibition centers upon the inescapable blending of social and financial relations (Leyshon and Thrift, 1996). The impacts of financial rejection are broad and limiting, particularly when financial related inclusions have turned into a basic segment of life in a modem society (Conaty and Mayo, 1997). The rejection, as a rule, is huge. The rejection increments with neediness.

Conclusion

Comprehensive development is unrealistic for any economy without including the most venerable segment of society in standard financial exercises. FI for financial

improvement will prompt to the development of the economy, is an unmistakable comprehension by all fragment, regardless of whether it is a supplier, client, and controllers. With the parcel of opinions on the accessible writing about FI, the paper has distinguished a few holes to be enhanced for a dynamic worldwide scenario. For FI, suppliers need to achieve all segments and fragments of the general public for that innovation is the best medium. Be that as it may, instructing each avoided portion additionally innovation progressions in view of the crevices are one of the two essential discoveries. With the developing sympathy toward financial consideration in an economy, money related controllers need to venture forward with real changes in building a domain of straightforwardness access of minimal effort financial inclusions with better innovations, particularly for the weaker segment.

Arrangements reach ought to be of fundamental finance-related support of the masses gets manageability the financial development. Improving the entrance to quality inclusions, for example, preparation of funds, accessibility of credit, protection and hazard inclusion, will attract a way to development. Subsequently, comprehensive finance related framework will permit access to financial inclusions, offering advantages to low salary amass, particularly MSMEs (Micro, Small and Medium Enterprises). Without the framework, needy individuals will imperative themselves to their own particular funds to expand and put resources into organizations. Likewise, shameful credit openness will manufacture deterrent to the development of MSMEs, adding to steady pay disparity and slower financial development.

Such all changes will take time for FI and it will not happen overnight. Some optimum plan and quick action will be required by banking and financial institutes to reach the bottom of the pyramid section which may not be a profitable plan initially, however, the number of beneficiaries will gradually increase the possibility of profitable proportion in coming times.

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Growth of Solar Pv Sector For Germany, China And India – A Policy Overview

Nishant Rohankar[*], Dr. Prasoom Dwivedi[**], Dr. Aravind Kumar Jain[***], Dr. Om P. Nangia[****]

[*] *Research Scholar, CoMES, University of Petroleum Energy Studies, Dehradun 248007, India*
Email: rnishant@rediffmail.com
[**] *Senior Associate Professor, CoMES, University of Petroleum Energy Studies, Dehradun 248007, India*
Email: pdwivedi@ddn.upes.ac.in
[***] *Associate Professor, CoMES, University of Petroleum Energy Studies, Dehradun 248007, India*
Email: akjain@ddn.upes.ac.iN
[****] *Director, New Era Solar Solutions Pvt. Ltd., Ex-Solar Plant Head- BHEL, India*
Email: om.p.nangia@gmail.com

Abstract

Multiple Solar PV policies framework in India is showing considerable growth in terms of solar PV capacity addition in India. However it has not taken that momentum as it was anticipated with respect to target of solar PV capacity addition of 20 GW by 2022 and revised target (in 2015) is of 100 GW by 2022. Besides India, there are several countries which have already taken similar initiatives to increase solar power share in the total power generation of the country.

From literature survey it is observed that Germany (developed nation) stands 1st with 35,500 MW installed capacity and China (developing nation) stands 2nd with 18,300 MW [1] India stands 12th in this ranking (based on 2014 data). From year 2015, scenario has changed and now China is the only country specifically from developing nations which has secured 1st position in Solar PV installation compare with developed nation in the world including Germany. Further, China is presently world leader in supply of PV cells / modules as well and it has more than 55% of the market share [2]. This paper aims to identify the aspects which are contributed for differences in growth rate of solar PV sector in Germany, China and India.

*Keywords***:** Solar PV policies, FIT for Solar power, degression rate

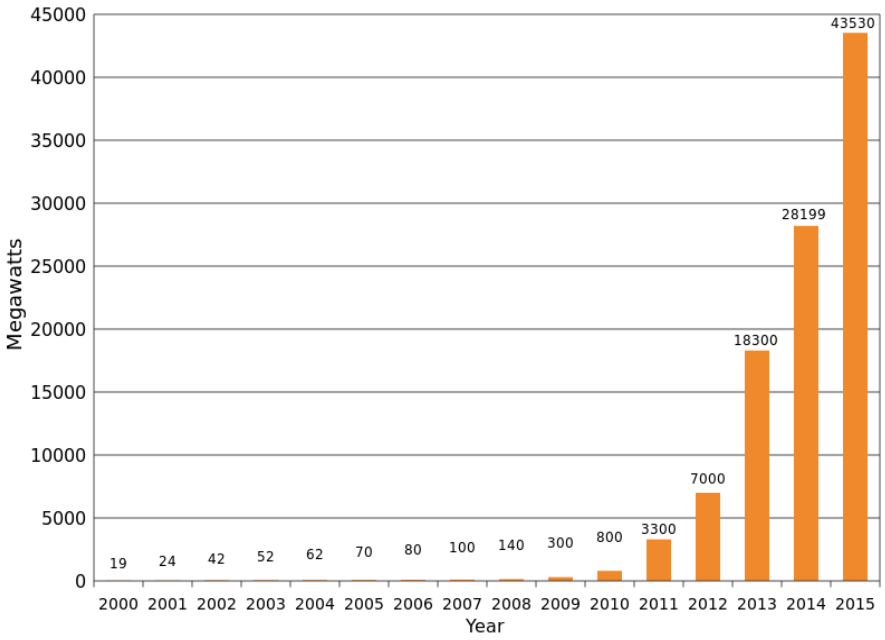
Introduction

Concerns over energy security, climate change and increase of access of modern energy services by underprivileged population, has led countries across the globe to pursue policy instruments that can cherish the uptake of renewable energy within their economies [3] Policy instruments used, such as feed-in-tariffs (FiTs), tax holidays/credits, renewable purchase obligation system (RPOs), competitive bidding, investment support like Viability Gap Funding (VGF), and net metering have largely been similar across the world. However, a few countries like Germany, Italy, the United States, and China dominate the market. They together constitute more than 62% of the global 100 GW of solar PV capacity installed [4]. China has added 15.2 GW new solar PV installation capacity of year 2015. With this the total PV installation capacity reached above 43 GW, overtaking Germany to become the world's no. 1 country in terms of the PV installation capacity [5] (Table 1 and fig 1).

Table 1- Installed capacity of top 10 countries in the world – 2015

Rank	Country	Total capacity (MW)
1.	China	43,060
2.	Germany	39,640
3.	Japan	33,300
4.	United States	27,320
5.	Italy	18,920
6.	UK	9,080
7.	France	6,550
8.	India	5,170
9.	Spain	4,832
10.	Australia	4,100

Source:[irena] [6]



Source:[7], [8], [9]

Fig 1 - China's cumulative installed capacity

On other hand the Germany, an apex country since year 2005 for solar PV installation has continued to decline in 2014 and is expected to remain unchanged or even decline to 1.3 GW for 2015 [10]. In 2014, Germany installed 1.9 GW, down 36 percent from 3.3 GW deployed in 2013. During the period of 2010–2012, the country was the world's leader installing more than 7 GW annually. New cumulative capacity of 39 GW corresponds to 475 watts per inhabitant.

In contrast, country like India which has multiple policy environment with an ambitious target of 100 GW capacity addition by 2022, have only been moderately successful in driving the solar PV sector within their economies. Quite old one but lately recognized solar PV industry relies heavily on both technological momentum and market demand to ensure that the overall cost of generation of energy is comparable to other conventional power generation technologies. This paper aims to identify the key aspects which are contributed to the success and failures of the government policies aimed at driving the up-take of solar PV sector in Germany, China and India.

Source of Data for review and analysis

Literature survey and analysis would be relying upon standard material of sources for secondary information from the following source:

- Documents released by Government bodies like MNRE, Central Electricity Authority, CERC, planning commission, forum of regulators, state regulatory commissions, State nodal agencies, etc
- Apart from this literature also be reviewed from work of distinguished research scholer's work on energy policies, energy economics, documents published by world bank documents, International renewable energy agencies, Solar Energy associations, TERI, International Finance Corporations, ADB, KfW etc

Country-wise review for Solar PV Policy framework for Germany, China and India

***Germany*:**

Germany is the leading pioneer in the sectors of renewable energy development. The renewable energy policy was pioneered in Germany after the oil crisis that occurred in 1974. In 1979, a significant RES-E policy was introduced in renewable energy sectors, which mainly emphasizes on two features. Firstly, regulation of quantity produced or their prices and secondly, support of funding to renewable energy sectors. German government aims to evolve the renewable sector and ensure a secured and eco-friendly energy source [11]. Complimentary laws were introduced by German government to compound the growth of renewable energy sector. In 1990, Electricity Feed Law and in 2000 Renewable Energy Law were introduced as complimentary laws. These laws make it mandatory for electrical utilities to purchase the electricity produced by renewable source. They also offer large subsidies and government loans to the renewable electricity producers. In 2002, National Sustainable Strategy was adopted by Germany. The strategy aims to tap energy source targets for different energy sources. Accordingly, climate gas emissions will achieve 40% reduction till 2020 and will continue to reduce upto 80% by 2050 as compared with 1990 emission levels [12]. It also aims to increase the renewable energies share to 18% in the total energy consumption by 2020 and up to 60% by the year 2050. The strategy also aims to contribute to renewable source generated electricity at least 35% by the year 2020 to a significant raise of contribution of 80% by year 2050. As per the study made by Reuters, Germany targets to bring down gas emissions from greenhouse by 40% from 1990 levels to 2020 levels [13]. This renewable policy

environment has aced many leading companies in Germany to enter in the renewable energy business. Innovative development has also taken pace to expand the renewable energy sectors' scale. In Germany, National Renewable Energy Action Plan (NREAP) of 2010 has projected the renewable energy share of 38% by 2020, which will continue to increase up to 50% by 2030, and an increased share of 65% by 2040 and further increase to 80% by 2050. Also, the cumulative capacity of solar PV is aimed to increase up to 51.75 GW with a cumulative addition of solar power of 3.5 GW per year. Germany has contributed the largest capacities of solar PV in the previous decade as referred in [14].

Erneuerbare–Energien Gesetz (EEG) amendment was introduced later in 2008 to kindle significant price reduction in solar PV sector. FIT's values degression rate was then introduced for new PV systems [15]. Table 2 presents a summary of degression rates and FITs' values in Germany for the year 2009, year 2010 and year 2011. Further, degression rates were adapted as per PV market growth. This means, if new installations in PV market in one year accounted to grow higher or lower than defined PV growth corridor, then the degression rate respectively will get 1% increased or decreased for the subsequent year. Table 3 shows the growth corridor and degression rate variations for years 2009, 2010 and 2011. As shown, the growth corridor was set to 1000MW and 1500MW. The degression rates were guaranteed based on operation period of 20 years.

For systems that have installed capacity of <30kW in the year 2009, there is a possibility that the producers may auto-consume the electricity generated. These power producers were given a reduced premium FIT from 0.4301 to 0.2501 €/kWh for year 2009 for self-consumed PV generated power. Government has introduced several benefits to PV sectors like taxing holidays and introducing credits terminology as well. The scheme also separated the PV installations done by Private Sector Company and by commercial investors. VAT exemption has been introduced for commercial investors where VAT in Germany is about 19%. In addition to this various venture capital-grants in different parts of Germany also exists.

Policy analysis in details for Germany:

In 2012, around 1.28 million PVs were installed. In 2011 year, in Germany a rapid growth in its solar PV capacity was seen. The total PV capacity was increased by 40% in December 2011. This was because the weather conditions were not good at the beginning of the year and also FITs were slow

Table 2: FITs' values and digression rate for electricity generated from PV systems in Germany [16].

FIT	Rooftop								Ground-mounted installations	
	≤30 kW		>30 kW		>100 kW		>1000 kW		All sizes	
	Digression rate (%)	€ /kWh	Digression rate (%)	€ /kWh	Digression rate (%)	€ /kWh	Digression rate (%)	€ /kWh	Digression rate (%)	€ /kWh
2009	8	0.43013	8	0.40913	10	0.39583	25	0.333	10	0.3194
2010	8	0.39573	8	0.37683	10	0.35623	10	0.29970	10	0.2875
2011	9	0.36013	9	0.34253	9	0.32423	9	0.27033	9	0.2616

Table 3: Upper and lower limits of the growth corridor of the PV market from 2009 to 2011 [17].

Growth corridor	Digression	2009	2010	2011
Upper limit in MWp	Above: +1%	1500	1700	1900
Lower limit in MWp	Below: −1%	1000	1100	1200

The study report of Prognos AG shows that solar electricity generation shares will get doubled till 2016 and electricity price at consumer end will get increased almost by 2.5 times. Stuttgart based world's leading car parts supplier Robert Bosch GmbH (RBOS), has purchased solar companies and build new solar plants in 2011, thus making investment around 1.5 billion Euros in the solar energy sector. Photovoltaics usage in the country has been forecast around 56–75 billion € by year 2030. The share of solar PV produced electricity is set on high targets by German solar industry. Solar PV demands are increased by 10% by year 2020 and 20% by year 2030 [18]. Additionally, the promotions made through EEG of research and development in solar energy sectors plays vital role globally.

Number of research institutes that have done work on solar PV have gone up to fifty. EuPD research report quotes an investment of 300 million euros in solar PV R&D industry in year 2010. Also, 290 German patents were registered in solar technologies only in German Patent and Trademark Office in year 2010 [19]. "Act on the amendment of the legal framework for the promotion of electricity generation from renewable energies" (Gesetz zur Neuregelung des Rechtsrahmens für die Förderung der Stromerzeugung aus erneuerbaren Energien) was adopted by German Bundestag in June 2011. Due to introduction of the act EEG was completely revised and also tariff degression got

introduced [20], [21]. Federal Law Gazette published the revised version of the act in August 2011 [22] and it came into force only in January 2012. Through tariff degression mechanism tariff can be brought down over a fixed period of time. This mechanism is used to track [23] and reduce the cost through technological development [24]. Through degression mechanism FIT aims to offer compensation in total cost of renewable energy production, provide solar power price certainty and introduce long term contracts with perspective of financing renewable energy investments [25], [26]. This required minimum tariff payments for 20 year period from time of commissioning of plant and additionally it includes the year during which the installation commissioned. The tariffs described in Table 4 below refer to the solar PV installations commissioned on or after 1st January 2012. As per the degression rate, a fixed percentage of tariff is lowered for installations that are newly commissioned on 1st January of the following year.

German Solar Industry Association (BSW-Solar) has studied that the renewable energy sources development adds just 0.15 cents i.e. 15% increase in the EEG surcharge, out of which 0.08 cents attributes to photovoltaics energy sources development. Federal Ministry for the Environment has stated that the costs of setting up new solar systems have reduced almost by 85% since year 2010. The German Solar Industry Association has recently published calculations of an increase of 70% in (Erneuerbare-Energien-Gesetz) EEG surcharge. This increase is not due to parallel increase of wind and solar power plants construction, but due to the reduction in electricity exchange prices mainly by 36% which are not levied on electricity consumers. Also, there is an increase in industrial trend of renewable power consumption which alone contributes to 33% of the Energiewende costs [27]. The household electricity billings in Germany are highest among EU, the rates which further increases every year. The energy intensive sectors have to pay heavily around € 4 billion every year although there is an EEG surcharge exemptions [28]. Germany has introduced significant long term policies to reduce the soft cost which are associated with the installation of solar producers. These costs involve permission cost, inspection cost, interconnection cost, financial incurs and more importantly customer acquisition.

The EEG law Amendment was done in June 2012. Accordingly, the major policy change that was brought under PV amendment was the compensation in amount of electricity under FIT was introduced with a limit to 90% of the output of the solar PV system. These systems were of

10 kW– 1 MW installed capacity size. The remaining 10% of the output can be added to that consumed on site, or may be sold in wholesale markets or can be compensated in spot price markets at the average daytime which was approximately 3–5€ cents/kWh. On the other hand, EEG did not set any upper limits or defined any quota on the capacity of wind or solar installations, for the given year or even on the cumulative basis. The cumulative solar PV capacity limit was modified by EEG to 52,000 MW. Simultaneously, FIT incentives will not be available any longer for new solar projects. FIT reductions were preferably used by Germany for policy adjustments. It also allowed a federal project registry for monitoring and managing renewable electricity source capacity accompaniments.

Prior to 1995, the solar PV capacity in China, like other developing countries, suffered from common issues such as high manufacturing costs, short of CAPEX availability in both manufacturing and R&D funding and lack of policy initiatives from govt for creating market - formation support (Gallagher 2014). Initial programs for Solar PV deployment in China was focused on rural electrification. The Brightness Program (1996) and the Township Electrification Program (2002) helped in the establishment of 1,780,000 [29] and 350,000 [30] small-scale solar home systems (SHS) respectively. After successful implementation and acceptance of policies like 'FIT and Renewable Portfolio Obligations (RPOs) in a developed nations for demand solar PV modules and panels raised has been steeply.

China:

Table 4

Germany's solar PV tariffs for electricity fed into the public grid plan.

Sl. no.	Types	€cent/kWh
Free standing installations		
1	Not buildings	17.94
2	Sealed or converted land	18.76
Installations in, attached to, or on top of buildings		

3	Up to 30 kW	24.43
4	30–100 kW	23.23
5	100 kW to 1 MW	21.98
6	Over 1 MW	18.33

Source: German, EEG

China Policy analysis in detail

The "Medium and Long-Term Development Plan for Renewable Energy in China" was established by the Chinese government in year 2007. The plan projected that energy consumption from renewable sources will go up to 15% by year 2020. Accordingly, China has three tiers of policy levels for renewable energy sector development. In the first tier of policy levels, the direction and guidance are given for the developments of renewable energy sectors so as to benefit the environment. Similarly, in the second tier of policy levels, the objectives are given for developments in rural areas along with the view of promoting technologies in renewable energy sector. In the third tier of policy levels, the managerial guidelines and specific incentives are given [31].

Renewable Energy Law of China was introduced and came into effect in year 2006. It was then again updated in year 2009. It is supported based on two funds collected by Chinese government. The first fund collected is the RE Surcharge, which is collected from the end consumers of electricity. It is collected at the rate of 0.8 cents/kWh. Every year around RMB 20–25 billion Yuan is collected. The second fund is Special RE Fund. It is directly under control of Finance Ministry. Every year around RMB 10–20 billion Yuan is available.

New FIT Regulation was later introduced by Chinese government. It brought forth the schemes for large ground mounted systems development across China nation, mainly divided into four regions. The regulation will be effective from current year January 2017. 2016's FIT structure is applicable only for projects filed and approved before year 2017. The proposed FIT is at a new level calling for reducing the present FIT which is presently 1 RMB/kWh i.e. approximately € 12 cents/US $ 16 Cents to up to 25% as applicable for different regions. The level of solar radiations was also determined by this scheme. The scheme will

insure an IRR of 8% to be achieved for these four different regions [32].

Although, in China the domestic market does not support much for the introduction of new solar renewable sources, but the global demand was met through support of their local and provincial governments. The local governments gave incentives to the solar firms such as low interest loans for purchasing solar equipments, or in dealing with land transfer price refunds, or for electricity price refunds along with a reduction in cumulative-year corporate taxes. Additionally, in global PV market the Chinese firms developed superiority through their flexible response to orders. This was due to their ability to bring reduction in costs of the manufacturing process [33]. The low-cost capital became easily available with a parallel increase in international demand which led to the firms in China to get a sturdy financial circumstance for rising solar PV module production along with the manufacturing value chain.

In this respect, Poly-silicon production capacity in 2007 was 5000 T which increased in 2012 to 190,000 T. Also, wafer production capacity in 2008 from 4.5 GW increased in 2012 to 50 GW. The cell production in 2005 was 0.2 GW has increased in 2012 to 21 GW [34]. The module production capacity has increased to 23 GW in 2012 [35].

Ministry of Science and Technology (MOST) in China makes an annual average investment of $80 Million in their research and development (R&D) sector. This supports R&D across the manufacturing value chain covering: wafer, solar cells, poly-Si, PV modules, CPV, thin-film technology, BOS components, energy storage and system engineering. These investments contribute both towards research on advanced technologies as well as towards demonstrations. The government, through Chinese Academy of Sciences (CAS), has also facilitated in the development of solar PV and small inverter testing laboratories in Beijing, Lhasa, Wuxi and Baoding. The system prices have come down from 10 USD/Wp to 1.5 USD/Wp [34]. The efficiencies across different technologies have also increased drastically (with mono-crystalline PV already reaching an efficiency of 20.5% at the laboratory and 19% at the industry) [35].

From a demonstration and market formation standpoint, the central government in 2009 launched two funds to support the deployment

of solar PV in China. One of the funds (approx. $3.5 Billion USD) is capitalized through a surcharge levied on all electricity end-users. This fund is used to support ground mounted large scale photovoltaic (LS-PV) projects through Feed-in-Tariffs (FIT).

In 2008, in China the cumulative 4 years LS-PV installations accounted to have increased from 1MW to 4,392 MW by 2012 [34]. The second fund is controlled by Finance Ministry which is Special RE Fund. These funds are used for demonstration projects such as the PV Building Project and Golden Sun Program.

These demonstration projects have developed the distributed PV market significantly in China which is shown to grow from 3166.5 MWp in 2011 to 3,775 MWp in 2012 [34]. With the perspective of technology transfer, the ability of Chinese firm's to access capital have made it feasible for them to purchase technology licenses. It is also feasible for them to avail services from foreign experts venture with or buy foreign firms and further develop technology partnerships with R&D institutes and educational universities [33]. China has also been combative in responding to anti-dumping tariffs. When the US and EU imposed tariffs on Chinese solar exports in 2013, China retaliated by conducting investigations into poly-silicon exports from the US, and the EU [36].

The current contests that China faces include:

- Overcapacities across the entire value chain of the solar PV industry.
- a recent dip in confidence among financial institutions on the solar companies' credit.
- issues related to its combined pricing policy [34].

India

In contrast to China, India has had moderate success in developing the solar PV industry within its economy. Though many states in India e.g. Maharashtra, Andhra Pradesh, Gujarat, etc. had defined Renewable Purchase Obligation (RPO) laws before 2009 [4], their impact on the solar PV uptake was negligible. By June 2010, the solar PV plants in India had only reached a cumulative generation capacity of 15.2 MW [37].

***Solar PV Policies in details for India*:**

In 2010, the Government of India (GoI) launched the Jawaharlal Nehru National Solar Mission (JNNSM) with a target of expanding India's grid connected solar capacity, including

both Solar PV and CSP, to 20 GW by 2022 [38], [39]. From the research and development stand-point, though MNRE has constituted the Solar Energy Research Advisory Council and set-up a framework for research, which includes several partnerships [39], the output has been minimal, or has not been reported yet. From the market formation standpoint, the focus of JNNSM Phase 1 (2011-2013) was largely on 3 grid-connected projects. To achieve the target of 500 MW of PV, the government conducted reverse auctions in two batches. The bidding process offered feed-in-tariffs and long term PPAs to the selected least cost developers [39]. In addition, Government directed the state owned NTPC Vidyut Vyapar Nigam (NVVN) to buy 500 MW of solar PV power from developers at $0.30/kWh (a price determined through reverse auction) and bundle it with 2000 MW of unallocated power from NTPC's coal based stations at $0.04/kWh and sell it to utilities at $0.1/kWh. Projects constituting a capacity of 150 MW in batch 1 and constituting 350 MW in batch 2 were allotted. In addition to the national level initiatives, several Indian states have also devised policy initiatives to fulfill their Solar RPOs. Approximately 5 GW of Solar projects (including both PV and CSP) have been announced. Approximately 1 GW of projects has already been commissioned by 2012 [39]. Policy framework for Solar Energy in India is briefed here in Table 5.

As AN effect of aforesaid solar PV policy framework, currently a total installed capacity of solar PV India is 8.3 GW [40]. With this pace of growth for solar PV capacity addition it seems very difficult to achieve 100 GW, a revised target (earlier 20 GW) set by Government of India by 2022 [41].

The challenges faced by Indian firms in the solar PV sector include:

Table 5: India's State and central Government Policy framework for Solar Energy Sector.

Central Government	State G**overnment**
Tax Benefits - Indirect, Direct	**Feed –In-Tariff (FiT) –** Gujarat 1st , flat tariff structure
Feed in Tariff (FiT) – preferential benchmark tariff, regional and national entities obligated to buy renewable energy	**Accelerated Depreciation (AD) –** 80 % dep. of capital asset, to compensate profit in earlier tax period
Power Purchase Agreements – Power purchase	**Renewable Energy Infrastructure Development Fund**

Agreement-PPAs (for Long term basis) – 10/25 yrs, intense load on Distribution Companies (DISCOMs)	**(REID):** last mile infra 5 to 10 % - by Rajasthan
Renewable Purchase Obligation (RPO) – Energy Conservation Act 2001 authorizes State electricity Regulatory Commission (SERC) to allocate specific share of Renewable Energy to (DISCOMs), Open Access Charges (OAC), CAPTIVE POWER.	**Exemption of miscellaneous charges –** no charges for wheeling , banking, as infrastructure is already available, increases viability, Andhra Pradesh , Tamil Nadu
Renewable Energy Certificates (RECs) – Extended part of RPO to make rationale among the states	**Other support –** subsidies on interest rate, no availability Based Tariff (ABT), NO land registration cost, Madhya Pradesh 1st introduced.
Clean Energy Cess - Rs. 50/T of coal produced goes to NCEF. Now its Rs. 100/T	
Generation Based Incentives (GBI) -100KW to 2 MW, CERC tariff – Base tariff = Generation Based Incentive (GBI)	
The Partial Risk Guarantee Fund - by providing commercial banks with partial guarantees of risk exposure against loans	
Viability Gap Funding (VGF)- 20% share of capital cost of project , 750 MW is awarded in Year 2014	

- from a financial standpoint: non-availability of low-cost financing for manufacturing, lack of adequate participation of scheduled commercial banks (SCBs), and payment security through NVVN for the future [38].
- from an administrative standpoint: bottlenecks in land acquisition, delays in approvals at the state level, limited field data availability of solar irradiation, leniency in imposing penalties on utilities for non-compliance of RPOs, and limited coordination between the central and state institutions [38].
- from a manufacturing stand-point: lack of raw materials, and an underdeveloped supply chain leading to high inventory costs [38].
- This paper aims to review and identify the aspects which are contributed to the success and failures of the government policies aimed at driving the up-take of solar PV sector in Germany, China and India.

Parameters affecting differences in growth of solar PV sector for Germany, China and India

Government policies have been critical to the development of the Solar PV industries both in India and other countries. However, certain key parameters have marked the differences in their growth trajectories.

(i) *Low cost capital* - The PV manufacturing sector of China flourished due to the availability of low-cost loans whereas Indian firms are not able to access these loans. Even in deployment, investors shied away from India as its conventional electricity prices are very low [37].

(ii) *Preferred Strategy* - China follows an export-oriented strategy and invests heavily in research, development and demonstration projects so as to develop a competitive edge in the global market. Germany is pursuing degression based FIT which is focused on decreased solar tariff aiming for sustainable growth of the sector. India, on the other hand, views solar energy just as a means to reduce their carbon footprint. Thus, the impetus for performance in all three countries is very different.

(iii) *Incentive Mechanisms by government* - China has been able to collect a surcharge from its consumers which it can plough back as feed-In-Tariffs for Large Scale – PV installations. This is more sustainable as compared to India as the unallocated power used for bundling may not be available in the future.

(iv) *Supply Chain accumulation* - The colocation of players in the supply chain, coupled with its labor laws, and has helped China to achieve a competitive edge in responding to changing demands. In contrast, an underdeveloped supply chain in India has increased the inventory costs across Indian firms thus making manufacturing unviable.

Conclusion:

Comparing all three countries policy framework for solar PV sector it is concluded that besides above an additional parameters like efficiency of the bureaucracy, availability of knowledge networks and enforceability of laws is keeping China ahead comparative with Germany and India.

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"Indian Demonetization: A Boon or a Bane"

Dr. Rakhi Dawar*, Meenal Arora**, Prof. (Dr.) Raju Ganesh Sunder***

**Assistant Professor, CCE, University of Petroleum and Energy Studies*
***Doctoral Research Fellow, COES, University of Petroleum and Energy Studies*
****Professor & Head, CCE, CoMES, University of Petroleum and Energy Studies*

Abstract:

To curb the problem of corruption, terrorism and counterfeit money the government of India announced a massive reform of demonetization in the year 2016.It was a surprise move for the citizens of India. The situation created anxiety, helplessness and fear amongst people as they were confused about the fate of their hard earned money. This change was well planned by the prime minister as some of the supporting policies were introduced before demonetization reform for people to get accustomed to the major reform. This review article delivers a close view of the causes and impacts of demonetization on the Indian economy and it also provides recommendations based on strengths, weaknesses, opportunities and threats of demonetization.

Introduction:

Demonetization can be described as an act where currency unit is stripped of its status as legal tender [1]. It takes place when the existing unit of currency is superseded by a new currency unit. Old currency is retired and replaced by a new currency. Such a replacement of local units of currency takes place to combat prevailing conditions like corruption and inflation [2]. .

Demonetization in India: A Brief History

January 1946

The demonetization reform was introduced in India for the first time when 1000, 5000 and 10,000 rupee notes were taken out of circulation in, a year and a half before the country got independence from the British. The Rs. 10,000 notes were the largest currency denomination ever printed by RBI introduced for the first time in 1938 [3].

Early'70's

The Wanchoo Committee was set up by the Government. The direct tax inquiry Committee suggested that demonetization was a measure taken to uncover and counter the spreading of Black Money [3].

January 16, 1978

Denomination Banknotes (Demonetization) Act was instated by The Janata Party Coalition government, which came into power in 1977. The act deemed 1000, 5000 and 10,000 rupee notes illegal for the second time as the three notes were previously reintroduced in 1954 [3].

Demonetization by the Indian Government

8th November 2016

The Indian Government announced to demonetize the 500 and 1000 rupee notes which accounted for a portion of 86% in cash supply of the Indian Economy [4].

The main aim of the government was to fight against problems such as counterfeit currency, tax evasion, black money generated from money laundering, financing of terrorist activities and establishing a cashless economy.

If the entity is not able to provide the proof of making any tax payments on the cash, a tax penalty of 200% of the tax owed is imposed.

Global Trend in Demonetization

1982, Government of Ghana

Currency notes of Cedi 50 were demonetized in the country, causing people to lose faith in the economic policies of the country.

In 1991, demonetization occurred in the Soviet Union to ban rubble 50 and 100. It reduced inflation by reducing the money supply, but it resulting in continuing economic collapse and the chronic non-payment of wages and taxes.

In 2010, dictator Kim Jong 2 made some changes with currency to lower down the market of black money and to improve the economy of North Korea.

In 2015, the government of Zimbabwe, implemented demonetization of the Zimbabwean dollar in order to combat the country's hyper-inflation.

On 11th December 2016, within 72 hours, the 100 Bilivar bill was announced as illegal. The measure had to be postponed due to unrest, including one death. According to data, 40% of citizens of Venezuela do not own a bank account.

The primary reason for initiation of the ban was to force people with illegal cash

holdings to deposit into bank accounts and incur taxes on them.

Immediate impact

Initially, there will be heavy deflation as people who have earned money through illegal means such as smuggling, corruption would be afraid to declare the money as they might be prosecuted by the government income tax department on the legitimacy of their income. This will reduce the total currency circulation in the economy leading to deflation. Deflation increases the value of money that we have because the total money supply goes down, but the commodities and the things available in the market have not gone down.

Gold Prices, stocks and commodities will drop. Slowly, banks with more money will lend more and increase the money supply, creating inflation. Of course, it will not happen overnight.

Positive impact in future

- *Real Estate Market:* The drive will wipe out corruption as well as tax evasion in India's real estate market.
- *Banking Sector:* The increase in deposits would lead to positive gains which would be countered by slowing down of other sectors in the group like real estate.
- *Terrorist Activities:* Lack of funding will provoke activities such as arms smuggling, espionage and other related activities [5].
- *Criminal Activity:* The government expects to be able to use the ban as an opportunity to round up counterfeit currency minted by terrorist operations.
- *Cashless Society:* The ban will promote the cashless society and the people will move towards digital India.

Views of eminent economist around the world

Kenneth Rogoff

Former IMF chief economist wrote that the move was bold, risky and extremely ambitious step to completely alter the mindset of an economy where less than 2% of citizens pay income tax and where official corruption is prevalent.

Man Mohan Singh

The former Prime Minister of India ManMohan Singh rather unhappy, called demonetization as an "organized loot and

legalized plunder" and added that it was a "Monumental Management failure". He added, in the long run, we all are dead quoting J.M.Keynes. He is of the view that GDP growth can fall by 2 % which is an underestimate. It will hurt agricultural growth and small scale industries, in fact, all the informal sectors. He said, in no country it happens that people deposit their money and are not allowed to withdraw their money.

Professor Amartya Sen

He said demonetization is an authoritarian move. He said millions of innocent people have been deprived of their hard earned money and are being subjected to inconvenience.

Kausik Basu-World Bank chief economist

Mentioning the loopholes which have already been found by the hoarders, he said that we cannot wipe out the black money**.**

Arun Shourie

Former economist at the World Bank; recipient of the Padma Bhushan and Union Minister

He said demonetization will not be able to weed out black money as its owners have intelligently converted all that black money into tangible and intangible assets. He said the people with black money or holding it abroad in the form of property may be jewelry, other assets or may be stock markets.

He added that farmers and daily wage owners are affected the most since a daily wage owner earns in a day and cannot afford an e-transaction.

Arun Jaitley:

In the private sector, the investments will be enhanced as all the money of the shadow economy will be in banks now.

Surjit Bhall: Chairman, Oxus Investments

Mr Surjit called it as a "bold step**"** taken by the Prime Minister of India.

Conclusion:

Hence we conclude that the SWOT Analysis of the demonetization act is as follows:

Strengths of Demonetization

- It will extinguish the unaccounted money in the economic system of the country
- It will reduce the liabilities of the government as it will increase its finances.

- Government spending will increase on large government projects.
- Banking habits of the people in the country will improve.
- It will improve tax collection.
- Price level will lower due to the moderation of demand.
- Property has become affordable for the masses.
- Digital transaction systems will increase in demand.
- RBI can ease the Monetary Policy Rate.

Weaknesses of Demonetization

- Public inconvenience
- Reduced Money Circulation.
- ATMs not fully operational.
- Corruption and Fraud.
- Deaths due to unavailability of cash.
- Stock Markets decline.
- Losses to Manufacturing Sector.
- Losses in Exports.
- Lowered GDP
- Demand for gems and jewelry will decline.

Opportunities of Demonetization

- There is ample opportunity to raise capital for startups, expansion, diversification and investment.
- Good time for financing business, i.e. arranging or brokering finance for people who want money.
- IT and Pharma to do well
- The banking sector will flourish.
- Once the consumers start moving to plastic money or legal transaction based buying, there should be recovery seen in most of the sectors, but not before Q1 2018.

Threat

Increased potential for cybercrimes against financial institutions.

Hence we can conclude that the surprise move of demonetization to drive out 86% of the currency of Rs.1000 notes and Rs. 500 notes [4] is for a noble cause of driving out black money. But if the preparation had been better there would not have been any temporary restrictions on the amount of withdrawals.

This move was necessary in order to remove the black money from its root, but it was not sufficient. It had deliberate consequences, especially on the poor section of the society

which is less educated, unbanked and rural. The cash economy dependent citizens of India had to be a part of long queues not as an act of love for the country or its ruler but for salvaging their own savings.

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Bearing of logistics on remonetization – India 2016

Prof. Balaram Swamy J[*], Sandhya Garg[**]

**Professor, CoMES, University of Petroleum and Energy Studies*

***MBA LSCM, CoMES, University of Petroleum and Energy Studies*

Abstract

Purpose:

This paper intends to investigate the role of logistics in remonetisation i.e. replacing the old currency notes with new ones in the demonetisation exercise from November 8, through December 31, 2016 (about 50 days), that the country (India) experienced.

***Research Design/Methodology/Approach*:**

Content Analysis of daily newspapers was done to assess the effects of demonetisation on the common man and the reactions of a number of stakeholders and, finally to document the process of remonetisation.

***Findings*:**

It was known that until complete remonetisation is not over there will be inconveniences; but, the extent of it bordering on to suffering of the common man could have been avoided if logistics were handled properly.

***Research Limitation / Implication*:**

Remonetisation is still an ongoing event when this research is concluded. Also, crucial data is not available because it was not kept to maintain secrecy. Vernacular papers were not taken.

***Practical Implications*:** Demonetisation is a planned intervention in the circulation of currency notes. In spite of it, the suffering of common man was palpable besides near-time loss of industrial and agricultural production. It was akin to man-made disaster without adequate preparation to reduce the after effects.

***Originality/Value*:**

It will help understand the role of logistics in such a herculean exercise and, will give broader perspective to the planners which, in future will help to plan events of this magnitude better.

Key Words:

Logistics, Demonetisation, India 2016

Introduction:

The Beginning:

08:30 pm, Tuesday, 8thNovember 2016 - the Honorable Prime Minister of India, Shri Narendra Damodardas Modi addressed to the national on the national television channels. It was an unscheduled but important announcement and, lasted for over an hour. Prime Minister declared that starting from mid-night that night, Rs. 500 and Rs. 1000 notes in circulation in Indian are no more valid currency.

The whole nation went into a frenzy of activity starting that moment. All through the night until the wee hours in the morning people, those who had plenty of such notes were busy spending it on purchases in gold jewelry –a high value item and always considered an insurance for the future by the Indian society besides the bonus of "look-and-feel good" during festivals and in parties.

Prime Minister's Speech:

In his speech the Prime Minister said that India is first in the rate of economic growth but about two years back we were ranked close to one hundred in the global corruption perception ranking and, now we stand at seventy-six. Terrorism is a frightening threat, so many loose lives. Funding of such misadventures is done by enemies from across the border using fake currency notes. The magnitude of such cash in circulation is directly linked to the level of corruption.

The Prime Minister said that "to break the grip" of these ailments on the economy "we have decided that the 500 rupee and 1,000 rupee currency notes no longer be legal tender . . . .. (these) notes, hoarded by anti-national and anti-social elements will become just worthless pieces of paper."

In his speech he also mentioned that the "the rights and the interests of honest and hardworking people will be fully protected". And, mentioned twenty-one measures which the government has decided to take to facilitate remonetisation i.e. about 50 days until 31st December 2016, and ease the difficulty. The ATMs will start dispensing new currency latest by 11th November but, from 10th November 2017 onwards all Banks and Post Offices will convert the old notes with new ones. Government Hospitals and Pharmacies there-in, Railway Ticket Counters, Petrol, Diesel and CNG stations, State and Central Govt. Consumer Co-operative Stores will accept old notes.

Passengers coming to India will be able to exchange their old notes with new ones at the International Airports itself. Prime Minister recognized that "temporary hardships" will be faced by the citizens and appealed them and, political parties, all governments, social service organisations, media and all sections of the society to be patient and cooperate with the administration for a better and cleaner tomorrow.

End of the Ordeal:

As promised by the Prime Minister, post January 1, 2017, availability of currency has started to become normal gradually. Most of the ATMs have started dispensing new Rs 500 notes. Banks are also allowing withdrawal of Rs 24,000 per person for savings accounts and Rs 50,000 on current account at time. But the ghosts of Rs. 500 and Rs. 1000 notes living in the neighboring Nepal and Bhutan are still haunting – the Nepalese Envoy to India has requested India Government to devise a Nepal specific solution because a lot of people in Nepal keep their savings in Indian Currency and in Bhutan the rupee is accepted as a valid tender.

Research Purpose:

Prime Minister, in his speech of 8th November dwelved deep into the reasons for demonetisation - to fight terror funding, counterfeit currency and corruption manifested as black money. This paper is not about the objectives – neither, on demonetisation as means to fulfilling these objectives, nor its timing with elections in six states. This paper is about the execution i.e. remonetisation. The purpose of this paper is to investigate the plans made and executed to fill the vacuum created by demonetisation with minimum discomfort to the citizens – directly, as "no (valid) money" to meet the daily needs and indirectly, as loss of lively hood due to economic slowdown.

Sampling:

The researchers chose to use daily newspapers as the source of data. Daily newspapers over business magazines carry more news than analysis; and, since we were documenting a fast paced activity in a short period of about 50~70 days post 8th November 2016, we consider this is the best source of data. Vernacular newspapers were not taken because of our translation incompetency; also since, popular English and Hindi dailies would adequately cover the investigation topic because of its pan India nature. Hence, we took The Times of India, the most-read English daily (7.590 million) and supplemented it with Dainik Jagran (16.631 million). The circulation figures

are as per Indian Readership Survey 2015. However, for a given sub-topic we stopped searching for news items when we felt that more of them are only repetitions, hence we arrived at a saturation point.

Limitations:

Data, on some important issues is not available. Against a query under the Right to Information Act filed by Mumbai-based activist Anil Galgal seeking information about printing of 10, 20, 50, 100, 500 and 2,000 notes between November 9 and 19, 2016, Reserve Bank of India (RBI) replied, "The information sought is not available with us." Election Commission, on being prodded by former vice-chairman of National Disaster Management Authority Marri Shashidhar Reddy to write to RBI to part with the information; they refused to give the information citing Section 8 (1) (g) of RTI Act, 2005. This section says information can be denied if the disclosure would endanger the life or safety of any person.

Paper Structure:

The balance of the paper is divided in four sections. Section 02 puts the situation post announcement of demonetisation until year-end and beyond until 21st January 2017 into perspective for further discussions. It describes the initial shock and confusion of the stakeholders and, the fallout of the announcement. Section 03 describes what the common man, who was at the center stage in the Prime Minister's address to the nation, went through. In Section 04, we discuss the gaps in the planning and execution which made the 50 days' journey a very painful exercise for the general public as described in Section 03. At the end, we conclude and propose what further research can be done to take this exercise further in Section 05.

Initial Reactions and the Fallout:

The whole country was quickly divided into two groups – those who thought that this is amazingly a bright solution to kill three birds with one stone and those who did not. And, of course a third group, the cautious-ones who tread carefully - Prakash Karat, Leader CPI (M) said he would rather study the implications and would issue a detailed response.

Industry:

Nirmal Jain, Chairman, IIFL said, "Powerful measure against black money . . . it will have deflationary effect in general and more specifically on real estate prices and make homes affordable". Chanda Kochhar, MD, ICICI Bank, "It is perhaps the most significant move ever taken to curtail the parallel economy". Manoj Gour, Executive Chairman, Jaypee Group, "This is a positive step . . . ". Gagan

Banga, VC&MD, India Bulls Housing Finance said, “It’s a very innovative move”. C.S. Ghosh CEO and Founder, Bandhan Bank, “This decision would cause problems to small traders and common public.” Mukesh Bhutani, Managing Partner, BMR Legal said, “An unprecedented and bold move”. Kunal Behal, Co-founder & CEO, Snapdeal said, “We welcome . . . the quantum of India's economy moving through the digital pipes will witness massive growth”. Saurabh Agrawal, CEO and Co-Founder, ZebPay said, 'It is a great move . . . this will mark the beginning of digital currency era”. Business Head - India & SAARC Countries Sunil Kataria of FMCG major Godrej Consumer Products Ltd expects established brands to gain in the aftermath of demonetisation and GST as the markets currently served by several regional players may see some changes.

Political Parties:

The Opinion of political leaders are clearly divided between for and against based on the alliances and affiliations – all BJP ruled states welcomed it and non-BJP states condemned it. The main opposition, Congress Party is the main opposition to demonetisation. TMC, JDU, CPM, NCP, SP, BSP, AAP etc. all condemned it; but, for various reasons they were vary of putting up a united fight against demonetisation.

Government:

Amitabh Kant, CEO, NITI Aayog said, "Bold, dynamic and brilliant move to end the black money menace . . . beginning of the cashless, paperless economy in India." Justice (Retd.) M. B. Shah, Supreme Court appointed Chairman of Special Investigation Team on Black Money said, “those holding untaxed assets, income despite opportunities to declare will suffer”. The Institute of Chartered Accountants of India has issued an advisory, asking its members not to criticise demonetisation. The members have also been advised not to share or write any negative personal views by way of an article or interview on any platform on the demonetisation. Those who criticise demonetisation action would be taken against them as per the act.

Pain and Agony

Manufacturing:

New car sales are down by 20-25%. About 30,000 units manufacturing automobile spare parts and about the same number of agro based industrial units have shut shop and, about 1.5 lakh MSME units in around Hyderabad are on verge of shutting down operations after facing huge losses over the past one month. Also small

players in retail, textile, food processing and plastic industry are also bearing the brunt of demonetisation. Micro industry completely runs on cash, be it placing of orders, transportation, payment to workers or purchase of raw materials; they have witnessed 50 to 70% loss of production over the month.

Trade:

The cattle trade in Visakhapatnam and Vizianagaram districts is down; traders never dealt online or ever accepted cheques. Payakaraopeta and Manapuram, two of the biggest cattle trade markets in these districts the number of cattle sold every week amounted to a few thousands and amounting to weekly turnover at Rs 2 crore each, which is fallen by almost 70 per cent with less than a few hundred milch cows and bullocks making it to the market yard.

Consumer Goods:

FMCG industry witnessed cautious consumer spending. Market Researcher company, A C Nielsen observes that sales of the industry have gone down by 1-1.5% or Rs 3,840 crore in November, compared to October. In percentage terms it may not be large considering the size of the industry at Rs 2.56 lakh crore, this is a large drop in terms of absolute value. The industry's problems can become bigger. Data revealed that retailers are stocking goods lesser than ever before due to cash and supply constraints. Their purchase in November has gone down by 6.4% compared to October.

Banking:

Industrial credit slowed across all sectors in November. Credit to small & micro enterprises fell by 7.7% y-o-y to around Rs 3.44 lakh crore and to medium enterprises by 10% y-o-y to Rs 1.03 lakh crore. Credit to industries fell 3.4% year-on-year (y-o-y) to Rs 25.79 lakh crore for November compared to a 1.7% drop in October. Credit to large industries, which have about 33% share in non-food credit, was down by 2.3% on a y-o-y basis to around Rs 21.33 lakh crore. A slowdown was observed across sub-sectors such as food processing (13.4% fall compared to 1.3% decline in November 2015), engineering (down 5% compared to 8.9% growth) and chemicals &chemical products (2.1% drop compared to 1.5% increase). However, retail and agriculture were the only bright spots in credit off-take. Retail credit jumped 15.2% y-o-y to around Rs 1.5 lakh crore at the end of November while credit to agriculture increased 10.3% y-o-y to about Rs 91,000 crore and, credit growth to the services sector slowed down on a month-on-month

(m-o-m) basis but performed relatively better than industries.

Real Estate: The real estate market was slow, 39% slower in Oct-Dec quarter than the previous one in Mumbai alone, in absolute terms it is revenue loss of Rs 22,600 crore. Two reasons are attributed for this; non-availability of cash where it is a component and speculation that the rates will go down.

Transportation:

Toll collection at 317 toll plazas across the country were suspended from the afternoon of November 9 to the midnight of December 2, 2016. The loss of revenue is estimated to be Rs 1,212 crore based on average daily collection in October 2016. The plazas operate on PPP; the loss to the private operators is about Rs 922 crore.

Human Suffering:

Noida garment industry laid-off over 40% of contractual workforce in 40 days since demonetisation. It is the home for about 1800 garment manufacturing and export units. The contractual workforce is on daily wages; such workers do not have bank accounts. District Labour Department and workers associations confirm that most contract workers from states like Bihar, Jharkhand and West Bengal have gone back to their states over the last month. Demonetisation has dealt a big blow to the mining sector. Mining activities reduced by 75% in Uttarakhand. Number of vehicles which collect mining material from river bed have come down from 200 to mere 20-30 in Dehradun only. The vehicle owners face problems in paying money at toll booth and to the labourers.

Many people had to take leave or leave behind productive work to stand in the que to change money at the bank, the supply being meager one is not surprised that the money is over before he/she reach the counter. Then, the ordeal begins again on the next day or, when money is replenished at the bank. The worst part is that this torture had taken lives of 100 people. Stalin or Mao did restructuring of their countries at the cost of many deaths; their response to deaths were, no omelette is ever made without breaking a few eggs (and the proper response to Stalin and Mao being "So, where's the damn omelette?"). But, that is definitely inhuman, cruel or, even, possibly bloodthirsty, particularly when there exists a way out – better “logistics” planning.

On the Sidelines:

In a hurry to use the old notes, pending dues with municipalities were paid across the country by many. Haryana recorded maximum increase (over five times) and, very high collections were recorded in Telangana, Maharashtra, Gujarat and Chhattisgarh etc. An analysis of payment of municipal dues across 450 municipalities in India puts Narkatiaganj (Bihar) followed by Gudur (Andhra Pradesh), Ghaziabad, Nagpur. Some of the arrears were dating back to 1970-71 and, 1986-87.

Over Rs 4,663 crore of undisclosed income was detected by the Income Tax department as part of its country-wide operations against black money hoarders post the demonetisation. They carried out 253 searches, 556 survey, 289 seizures and issued over 5,062 notices to various entities on charges of tax evasion. Apparently, sudden devotion has taken over many - the cave shrine of Mata Vaishnodevi had received donation of Rs 1.90 crore albeit, in old currency notes.

Discussions:

Demonetisation:

Demonetisation is an economic reforms measure. All reform measures have short to medium term pains but if it is well conceived and executed will definitely result into long term gains. World Bank's Ayhan Kose, Director of Development Prospects Group and Maurice Obstfeld, Economic Counsellor and Director of Research of International Monitory Fund official both have the same sentiments. WB pegged the growth rate for the fiscal ending March 2017 at 7.0%, a drop of 0.6%. But, they expect the economy to bounce back to 7.6% in fiscal 2018. IMF's estimate is more positive, 7.2% in 2017 and, The United Nations World Economic Situation and Prospects (WESP) have projected it as 7.7% in fiscal year 2017.

India had demonetized its high value currency twice before. In 1936, Rs 10,000 which was the highest denomination note, was introduced but was demonetised in 1946. Though, it was re-introduced in 1954 but later, in 1978, then Prime Minister Morarji Desai in his intensive move to counter the black money, introduced The High Denomination Banks Act (Demonetisation) and declared Rs 500, Rs 1000 and Rs 10,000 notes illegal. But, the experience of remonetisation during

those days is of little use because there is no match to the scale and people who would be affected in 2016.

Remonetisation:

We mentioned it earlier in para 1.3, that this paper is about execution i.e. remonetisation process which lasted for 50 days. The slowing-down of economic activities as mentioned at 3.1 thru' 3.6, though not mentioned in PM's speech explicitly, was expected. But, what was not expected and also not desirable that there should be inconvenience of the magnitude as experienced to the general public as mentioned in para 3.7 which include 100 plus deaths.

Twenty-one measures planned and elaborated by the Prime Minister to facilitate remonetisation was barely adequate (Para 1.2). It did precious little to reduce the hardship of the people, not because they were poorly conceived but because there was inherent lacuna, for which they could not be implemented properly.

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Logistics:

Remonetisation is purely a logistics exercise. Currency is always on the run, back and forth from the central bank to remote corners of the country covering the hills, plains, and islands, all types of terrain. On 8th November 2016, an estimated 86% of the total currency in Rs 500 and Rs 1,000 notes valued at about Rs 15.4 lakh crore was taken out of the system. This is huge vacuum which needed to be filled immediately. Filling major portion of the vacuum at the earliest will only give relief from pain and agony of not being able to meet the daily necessities and, medical and other emergency requirement of the people. This in view one needs to go beyond the limited meaning of logistics.

Product Design: Traditionally, logistics is used as synonym to transportation. But, in the context of modern globalized trade and commerce, the connotations are far reaching than that. For a professional, logistics begins with PRODUCT DESIGN. Traditionally, design considerations are keeping in view the consumer (say, esthetics, ease in use and store etc.), manufacturing (say, ease in engineering, assembly etc.) and, servicing (say, modular design for ease and speed in servicing). Besides these parameters, the design now also incorporate elements that make it easy to pack, stack, handle, inspect and transport from place to place without any damage and, at a minimum cost.

Both the new notes, Rs. 500 and Rs. 1000 were different in size. One understands the need for the new notes to look different than the old ones. And that could have been achieved by the colour. In facts by colour the Rs. 2000 note is strikingly different. A variation of size effected replenishment of ATMs. A lot of time has gone into replacing the hatch and reprograming.

Production: Next to product design, comes PRODUCTION. The logistics professional do bother themselves with production schedules and quantities produced because they have to answer the ultimate customer i.e. consumer, the king. The Prime Minister made the promise to the nation that all be normal on the New Year, 1st January 2017. And, the administration had to fulfill this promise, which it did with utmost honesty and diligence.

Urjit Patel, RBI governor told the members of the Parliamentary Standing Committee on Finance, that RBI and the government were in regular touch over the demonetisation of Rs 500 and Rs 1,000 notes since January 2016. But, no minutes were maintained to ensure that secrecy was not compromised. The actual decision was taken around May 27 last year.

Though the process had begun about ten months before demonetisation was announced, printing of new notes has definitely begun after 4th September 2016 because they carry Urjit Patel's signature as Governor who took over this position on 4th September. So, barely two months were given to production of these notes. Though number available as of 8th November is not known (refer 1.6 above) a safe guess would that it is not more than 25%.

Because, according to SBI Research Report, as quoted by Arundhati Bhattacharya, the SBI chief , "Nearly 50 per cent and 75 per cent of the total value of the extinguished notes can be supplied by December-end and January-end respectively, given the current phase of frantic printing." At the end of February, "78-88 per cent of the notes could be back into the system under the best case scenario in terms of an optimal currency distribution". Between mid-September and December-end i.e. in about fourteen weeks only 50% new notes by value could be produced. At the rate of 3.6% per week total notes manufactured between mid-

September and first-week of November i.e. in 7 weeks, it could at best be 25%.

25% of demonetized currency is far too low to fill the 100% gap created by the announcement. This gap of 75% created the havoc during the initial days. Banks and Post Offices were working few hours only because there was no cash to disburse. Initially, the replenishment will come after a gap of a day or two, again because of the availability.

Distribution: Third area in logistics is distribution. Initially, the channels of distribution were only Banks and Post Office. ATMs could not dispense cash for want of calibration. Finance Minister Arun Jaitley has assured the nation that the entire ATM network will be back on its feet in two-three weeks. But, bankers said it will take much longer, in some cases as long as six weeks, as physical configuration of the machines to accept new notes consume time because more than four lakh trays or cassettes that hold the currency notes inside the ATM machines need to be replaced because the new Rs 2,000 and Rs 500 notes to be circulated are smaller than the Rs 1,000 and Rs 500 notes being withdrawn. Besides this, software needs to be rewritten at 202,000 ATMs in the country. Fixing the entire system is a Himalayan task.

And, digital payment could not be done at the merchandising points for want of enough machines at Point of Sale (PoS) or Swipe machines. Post demonetisation, there has been a huge demand for the PoS, leading to short supply. Against a demand of 21,361 PoS with the State Bank of India, 7,926 have been installed. Of them 9,798 PoS were demanded in December alone. In Bank of Baroda, 350 people had applied for it while only 150 PoS could be supplied.

Conclusion:

The study has amply brought forward that the human suffering during remonetisation could have been reduced if some vital aspects of logistics were taken care in the planning and execution. Product design of the new notes in terms of size to fit into the shoes of the replaced ones would have saved precious time of enabling the ATMs to dispense the cash. Adequate stock of new notes could have been built before announcement which rendered 86% of the currency in circulation just a piece of paper. 25% is far too lower figure. Speed of distribution could have been increased by placing the new notes in RBI Branches in each state. And, this opportunity could

have been used to promote digital payment through swipe cards by making the handsets available at the traders.

Further research could be taken up on compliance of the objective of demonetisation and, how this measure has effected in the Indian business in the short and midterms and, likely effect in the future.

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Indian exploration & production sector at crossroads: NELP to HELP.

Akhil Mehrotra*,Dr Anshuman Gupta**

**Head (City Gas Distribution ,Business, India), Shell,*

***Professor, CoMES, University of Petroleum and Energy Studies*

Abstract

India needs to reduce its import dependency for oil, from current 77%, to 67% by the year 2022 and, to 50% by the year 2030. This is required not only to save precious foreign exchange, but also for the energy security of the country. However, the Indian sedimentary basins and geological data do not provide confidence of easy exploration success. Most of the prospective oil & gas in the Indian sedimentary basins are in deep water, ultra deep water and frontier blocks.

The Indian government needs to introduce a production sharing regime which provides adequate balance between the inherent risk and the expected return. This is the most essential, ingredient to attract capital, technology and management skills for exploration and production in India. NELP rounds have seen reasonable success, however host of litigations for cost recovery limits have slowed down the sector. The government has replaced NELP by HELP, with host of positive measures like single license, OLAP and reduction in royalty; however the move to revenue sharing mechanism seems regressive given the geological risks in India. India was better off with a modified version of current cost recovery regime with enhanced take for government.

Key Words

Exploration & Production; NELP; HELP; cost recovery; risk and reward.

Introduction

Oil & gas in India constituted 34% (27.9% oil & 6.5% gas) of the India's primary energy consumption in the year 2015. (BP, 2016). Historically, oil and coal have dominated, the world, as the main source of energy. However, the past few decades has seen a quantum jump in development of gas and renewables as an energy resource. Gas being considered a clean fuel, has increased in importance, in the energy map of the world.

Figure 1, provides the Indian energy basket in comparison to the world basket.

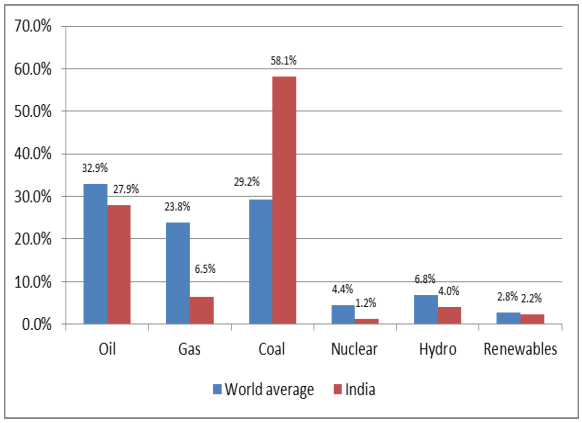

Figure 2; Energy Mix- World v/s India

In the year 2015, India had just 0.3% (5800 million tonnes) of the world's proved oil reserves and 0.8% (52.6 Tcf) of the world's proved gas reserves. India produced 0.9% (41.2 million tonnes) of the world's oil but

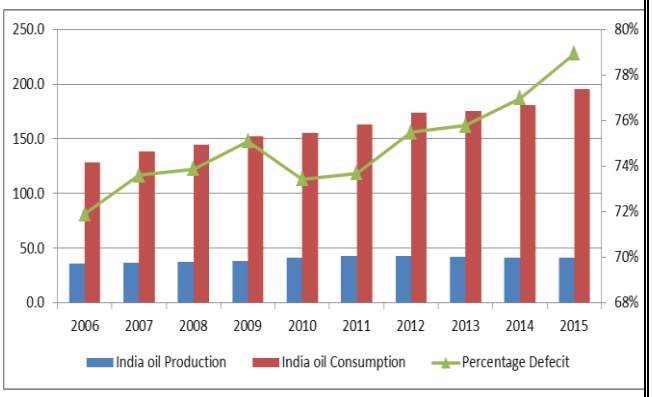

Figure 1; Percentage deficit of oil

consumed 4.5% (195.5 million tonnes) of the world oil. Similarly, it produced 0.8% (29.2Bcm) of the world's gas but consumed 1.5% (50.6 Bcm) of the world gas (BP, 2016). Analysing the trend of oil & gas production for the last 10 years (Figure 2 & 3), it is evident that the gap between consumption and production has continuously increased. While the deficit in gas production has doubled from 21% to 42%, the deficit in oil production has remained in the range of 72% to 79%. The gap between consumption and production is met through import of oil & gas, requiring large foreign exchange to meet the import bill (BP, 2016).

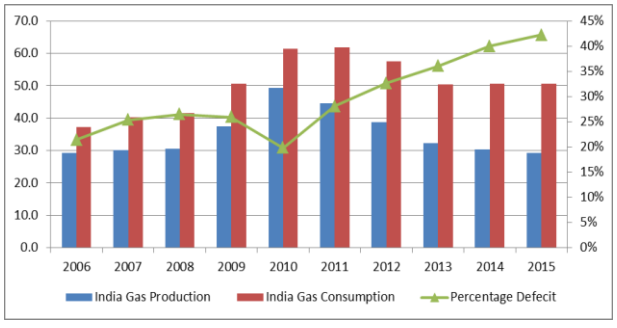

Figure 3; Percentage deficit of Gas

In the year 2015-16, the government spent $63,972 million (Rs 4.16 lakh crore) to import 202 million metric tonnes (MMT) of oil.

This oil import bill is estimated to increase to $68,686 (Rs 4.60 lakh core) to import 210 MMT of oil the in the financial year 2016-17 (PPAC, 2016, Nov). The deficit of oil stood at 77% in the year 2015-16. The government currently has embarked on an ambitious target of reducing the import dependence of oil from current 77% to 67%, a 10% reduction by the year 2022. Further the import dependence has to be brought down to 50% by the year 2030. (Indian Global Hydrocarbon Summit, 2015).

India's per capita energy consumption of 0.6 tonnes of oil equivalent (toe) is expected to move towards the world average of 1.9toe, (IEA, 2015) due to demographic changes like increasing urbanisation and growth in Industrialisation due to the make in India initiative. The growth in per capita consumption makes the task of reducing import dependence much more difficult to achieve.

However, the government has started in the year 2016, a second wave of reform process for the exploration and production of oil and gas, in order to attract higher investment in the upstream sector, with the launch of the new Hydrocarbon Exploration and Licensing policy (HELP) and other related policies. The first stage of reforms was initiated in the year 1997 with the introduction of National exploration licensing policy (NELP).

This paper intends to analyse and understand the implications of the new policy initiatives taken by the government of India in the upstream oil and gas sector. However, to help analyse the same it is important to understand the past developments and reforms. We will first map out the evolution of the upstream oil & gas sector in India, followed by discussion on the issues which hindered the risk capital finding its way into the sector and whether the new policy initiatives would be able to remedy the situation. In the end the paper intends to provide its recommendations and conclusions to help government of India achieve its objective of reducing import dependence of oil and gas.

Evolution of Indian Upstream oil and gas Industry

The evolution of the Indian oil and gas industry, especially the exploration and production regime, dates back to the year 1859 and can be classified into five distinct phases or eras as discussed below

- Pre- Independence Era (1866-1946)
- Nomination Era (1947-1978)
- Pre-NELP Exploration era (1979-1990)
- Pre-NELP Field round era (1991-1996)
- NELP era (1997 -2105)
- HELP era (2016- until date)

Akhil Mehrotra, 2015), (Mehrotra, 2016)

- *Pre-Independence era (1866-1946)*

The history of Indian oil & gas industry started in the year 1866 just seven years after Edwin L Drake drilled the world's first oil well in Titusville, Pennsylvania, USA in the year 1859. In the year 1866, Stewart and Company, drilled a 102 feet well in upper Assam, however they failed to establish satisfactory production. However, they were successful in their second attempt on March 26, 1867 when oil was stuck at 118 feet in Margherita (Makum) area of Upper Assam, which was also the Asia's first mechanically drilled well.

However, the first commercially successful discovery (200 gallons per day) was registered in London in September 1889, which was a well dug in Digboi Assam at a depth of 662 feet. This success was achieved by the Assam Railways and Trading Company Limited (AR&T Co Ltd), which later drilled 10 more wells at Digboi. AR&T later established Assam oil Company (AOC) in 1889 which took over petroleum interest of AR&T including Digboi and Makum concessions.

In the year 1911, UK based Burma Oil company (BOC) arrived in Upper Assam and by 1921 they acquired petroleum interest of AOC. The first ever license provided in India was a geophysical license by the Assam government to British Petroleum and Shell when they proposed to carry out geophysical survey of important plains of India. The successful outcome of well NHK-1 in 1937 was vindication for geophysical method in oil exploration (DGH, 2014-15).

- *Nomination Era (1947-1978)*

Post-independence, the government of India provided top priority to the development of oil in the industrial policy of 1948. The first oil discovery in independent India was done by AOC in 1953 in the Upper Assam area. To intensify and spread exploration to various parts of the country a separate, Oil and Natural Gas Directorate (ONGD) was formed in 1955, whose status was changed to a commission in 1956 (ONGC). However, in the year 1959, ONGC was made a statutory body by an act of parliament delegating it more power but it remained under the Ministry. Within a year of being formed ONGC discovered oil in Cambay and many more discoveries were made thereafter. Meanwhile Oil India Private Limited was formed in 1959, owned 2/3rd by BOC/AOC and 1/3rd by government of India, which later become equal partners in the JV Company.

In 1962, offshore exploration was initiated by ONGC in the form of experimental survey in Gulf of Cambay and also the Western Offshore.

This led to the India's biggest commercial discovery in Bombay High in the year 1972-

73. Encouraged by this, by the end of 1980's ONGC and OIL, had together drilled circa 3100 wells in India.

Until the end of 1970's, Indian exploration and production industry was dominated by two national oil companies ONGC and OIL, to whom the Petroleum Exploration License (PEL) were granted on nomination basis (DGH, 2014-15).

Pre National Exploration Licensing Policy (NELP) exploration Era (1979-90)

In the year 1979, in order to meet the future commitment and challenges of the Indian oil & gas exploration sector, the government of India took the strategic step of offering 17 offshore and 15 onshore blocks to foreign companies through bidding in order to attract foreign capital, investment and technology. Total 3 rounds under this were conducted from the year 1980 to 1986. These rounds known as Pre-NELP were not very successful, with very limited participation. The fourth round was conducted in 1990, where, for the first time Indian companies were allowed to participate with foreign companies.

The gas produce until this stage was used locally until GAIL was formed in 1984 to set up gas transportation infrastructure. The first high pressure transportation pipeline, the Hazira-Vijapur-Jagdishpur (HVJ) was fully operational in the year 1991. The price of gas, for the fields under this era was determined on a cost plus basis, known as Administered price mechanism ("APM"). North East of India was provided a discount of 40% on the APM price so determined (DGH, 2014-15).

Pre National Exploration Licensing Policy (NELP) Licensing Era (1991-96)

In the year 1991, the government of India adopted liberalized economic policy that led to de-licensing of core sectors including petroleum sector and partial divestment of government share including other measures. As a result ONGC was reorganized as a limited company, under the companies Act 1956, from Oil and Natural Gas Commission to Oil and Natural Gas Corporation Limited.

From the year 1994-1996, government of India conducted five rounds of bidding and offered 126 blocks. Besides many Indian companies, foreign companies like Shell, Enron, Amoco and Occidental participated in exploration and contracts were awarded to them. Price of gas for such fields was decided based on the formula provided in the PSC, which is primarily linked to oil indices (DGH, 2014-15).

In view of the liberalized policy in the exploration and production sector a need was felt for an independent upstream regulator who could oversee and review the oilfield development programs, so that to confirm to sound reservoir engineering practice to protect

national interest. Thus Director General of Hydrocarbons was formed vide a resolution on April 08, 1993. However, the DGH remained as an arm of the Ministry of Petroleum and Natural Gas (MoPNG) hence cannot be really termed independent.

National Exploration Licensing Policy (NELP) Era (1997- 2015)

The demand for oil was continuously growing post liberalisation of Indian economy in the 1990's. To increase production, India needed to attract significant risk capital, state of art technologies, new geological concepts and best management practices, from large foreign and domestic players. In order to meet this requirement government of India came out with the new competitive bidding system where the national oil companies have to compete with foreign companies to secure the PEL's. These bidding rounds were known as NELP. The NELP policy was approved in 1997 and it became operational in February 1999. Under this regime nine rounds of bids have been concluded in which production sharing contract for 254 exploration blocks have been awarded.

Petroleum and Natural Gas Regulatory Board (PNGRB) was constituted in 2006, starting the phase of liberalisation in midstream and downstream sector. The downstream regulator started international completive bidding for setting up transmission line and granting city gas licenses, mandated third part open access for transmission pipeline and provided for accounting separation of transmission and marketing business. These measures have taken place from 2008 till 2012.

The price under the NELP regime is based on the PSC signed between government and the contractor, which envisaged that the contractor follows a price discovery process, on an arm's-length basis for such price discovery, with the approval from the government.

However, government has, since determined the price of such gas through devising of formula, with linkage to various world indices to determine the price of gas at the well head. The current formulae devised as part of a report by Dr Vijay Kelkar, recommended that the price of gas be determined through volume weighted linkages to Henry Hub, National Balancing Point, Alberta and Russian Hubs (Kelkar, 2014). This changed the earlier formulae set up, as part of Rangarajan report (Rangarajan, 2012), dropping Japan LNG and local LNG import indices.

Hydrocarbon Exploration Licensing Policy (HELP) Era (2016 until date)

The Indian Oil & Gas exploration sector has been mired with numerous issues with contractors granted license under the nine

rounds of NELP. The government set up two committees first one headed by Dr Rangaranjan and the second one headed by Dr Kelkar to come out with recommendations to resolve issues and improve investment in the exploration and production sector.

Based on the recommendations of the two committees, the government of India on March 10, 2016 approved the New Hydrocarbon exploration licensing (HELP) regime. The key difference between NELP and HELP policy was the mechanism of sharing profits by the contractor with the government. While the NELP production sharing contracts allowed full cost recovery before sharing of profits which mostly were based on investment multiples quoted in the bid round, the HELP production sharing contracts envisages upfront sharing of profits through a share of revenue which would be the bidding parameter.

To understand weather the HELP mechanism would really help to resolve the issues in Indian exploration and production sector, let us now discuss comprehensively all the policy initiatives taken by the government in recent past.

New Policy Initiatives for exploration & production

The year 2015 saw many changes in the Indian Oil and gas industry. This was necessitated by the fact that the blocks awarded under the NELP rounds did not evoke the desired response from the international oil and gas majors. Also most of the blocks which were producing and got awarded under various stages of pre-NELP and NELP rounds are surrounded with controversy. Most of the private contractors developing and operating these blocks are under various stages of litigation with the government, due to variety of disputes arising out of the interpretation of the production sharing contract. Also mired into controversy is the control of gas price, by the government, at the well head. This move further reduced the incentives for the investors to bring in risk capital in the sector.

As explained earlier, the Government of India set up two committees to address the challenges faced in the production sharing contract (PSC) regime.

The first committee was chaired by Dr Rangarajan and he released his report in December 2012. The second committee was formed under Dr Kelkar and he released his report in September 2014. While Dr Rangarajan recommended a need to move away from the existing PSC regime of Profit share to Revenue share (RSC model), Dr kelkar recommended continuation of current regime with curtailment of powers of the managing committee and the government along with developing mechanism within Profit share model to increase government take.

Let's us now discuss the recommendation of both the committees since the policy measures taken by the government has elements taken from both the recommendations.

The key recommendations of the Dr Rangarajan Committee (Rangarajan, 2012) are:

- Shift to Revenue sharing (RSC) model since Profit share model allows all costs recovery before arriving at profit share. To delay profit share contractors have been alleged to indulge in gold plating of costs. Most arbitration under current regime is linked with cost recovery limits and Investment multiples.
- Shift away from the cost recovery method would reduce delay in approvals of the management committee.
- Biding parameters for minimum work program and fiscal package should remain the same.
- Limit role of managing committee and the government to monitor and control technical aspects.
- Allow 10 year tax holiday for ultra-deep water blocks due to the higher risk associated with such blocks.
- Contractors should be allowed to carry out exploration throughout the mining lease period, which will help enhance recovery.
- RSC model being a new fiscal regime should be reviewed every 5 years
- Dr Rangarajan recommended gas prices to be based on volume weighted average price of a set of indices like Henry Hub, UK Balancing Point, netback of LNG prices to Japan and netback of India's contracted LNG.

The key Recommendations of the Dr Kelkar committee (Kelkar, 2014) are:

- Central objective of the government should be to accelerate appraisal of the Indian sedimentary basin, maximise exploration and production activity and enhance security.
- Provide stability of contractual and fiscal terms to the contractors which are a must for attracting investments.
- Dr Kelkar has actually criticized revenue share model due to its inherent misaligned risk-return structure.
- The report by Dr Kelkar proposed the following fiscal regimes

1. Existing PSC with modified contract administration
2. PSC model with supernormal profit tax

Kelkar committee believed that the above models can achieve the government target of higher take while still maintaining the risk reward balance.

- The kelkar report strongly recommended introduction of open acreage licensing policy (OLAP) at the earliest.
- Provision of flexibility in completion of minimum work program.

- Primary responsibility of the managing committee and the DGH should be to ensure management of oil and gas resources.

  Managing committee (MC) and DGH should not get involved in the cost assessment or fiscal oversight of the contract. Self-certification by operating committee should be sufficient for assessment of profit petroleum.

  - Higher weightage (at least 50%) for technical criteria in the bid.
  - Establish model to allow contract extension to the end of the economic life of the asset.
  - Gas prices were recommended to be linked to volume weighted linkages four hubs i.e. Henry Hub, National Balancing Point, Alberta and Russian Hubs.

  Based on the recommendation of the Dr Rangarajan and the Dr Kelkar committee, the government came out with many policy changes in the year 2015 and 2016. The key changes are captured below.

  Policy no # 01 - September 02, 2015

  Policy for Marginal fields (MFP) of ONGC and OIL (GoI M. , 2015)Under the MFP, 69 oil fields discovered and held by ONGC and OIL will be opened up for competitive bidding with three key changes

  - Production sharing contract would be based on revenue share principle instead of profit share basis
  - Single license will be provided for all types of hydrocarbons
  - Freedom provided to contractor to sell gas at arm's length prices

Policy no # 02 - March 21, 2016

Marketing and Pricing freedom for gas to be produced from discoveries in deep water, ultra deep water and high pressure-high temperature (HPHT) areas (GoI M. , Policy, 2016).

The policy has been formulated to incentivize exploration and production in deep/ultradeep/HPHT areas and will unlock huge hydrocarbon potential.

- The policy guidelines would be applicable to future and existing discoveries which are yet to commence commercial production as on Jan 1, 2016.
- Not to be applied to existing discoveries where arbitration is there on gas price
- However the policy provides a ceiling on gas price to protect interest of consumers
- The ceiling price shall be the, lowest of the
- Fuel oil imported landed price
- Weighted average import landed price of substitute of fuels (30% x price of coal + 40% x price of fuel oil + 30% x price of naphtha).

- LNG imported landed price
- The ceiling shall be calculated once in six months. The price data used shall be the trailing four quarters data with one quarter lag.

Policy no # 03 - March 28, 2016

Policy for grant of extension to the production sharing contract signed by government awarding small, medium sized and discovered fields to private joint ventures (GoI M. , Policy, 2016). The policy provides for a uniform, non-discretionary framework for extension of contract in respect of 28 pre-NELP discovered fields

- Provision for extension exists in the production sharing contracts on mutually agreed terms.
- The extension would be for a period of 10 years or the balance economic life of the field whichever is earlier
- During the extension period it is proposed to increase the government take by way of :

a) Charging normal royalty and cess in place of concessional royalty and cess charged during the original contract period.

b) The profit petroleum during the extension period will be 10% higher that of the normal percentage.

- Extension can be applied maximum six years and minimum 2 years from the date of expiry of the production sharing contract.
- This will provide adequate time to contractors to take investment decisions
- In case the extension is not applied by the contractor then the field will be provided to the National oil companies (ONGC or OIL) or considered for rebidding.

Policy No # 04 - March 30, 2016

Hydrocarbon Exploration and Licensing Policy (HELP) (GoI M. , Policy, 2016). The salient features of the policy are

- Single License - A single license would be given for both conventional and unconventional resource.
- Open Acreage Policy – Option by contractors to select the exploration block without waiting for a formal bid announcement by the government.
- Fiscal regime of Revenue sharing Mechanism – Bidding to take place on revenue share. This would be simple and easy to administer since no cost recovery issues arise. No micromanagement required by government. Provides operational freedom to the operator.
- Royalty – Reduced royalty for offshore blocks.

Table 1; Royalty under NELP and HELP regime

Blocks	Duration	NELP royalty rates		HELP royalty rates	
		Oil	Gas	Oil	Gas
Shallow Water	-	10%	10%	7.5%	7.5%
Deep water	First 7 years	5%	5%	0%	0%
	After 7 years	10%	5%	5%	5%
Ultra Deep Water	First 7 years	5%	5%	0%	0%
	After 7 years	10%	10%	2%	2%

- The royalty for onshore areas has been maintained at same level of 12.5% for oil and 10% for gas in order to protect revenue of state governments.
- Pricing and sale of crude oil – Contractor are free to sell crude oil in the domestic market at arm's length basis. However the government take would be the higher of price determined through an arm's length basis or that determined by petroleum planning and analysis cell (PPAC) which would be the price of Indian basket of crude oil.
- Pricing and sale of natural gas - Contractor free to sell gas in the Indian market on an arm's length basis. However for the government take the price would be the higher of that determined under the Domestic Natural Gas Pricing Guidelines and that determined through and arm's length contract.
- Increase in exploration phase – Increased from 7 years to 8 years for onshore blocks and from 8 years to 10 years for offshore blocks
- Exploration will be at the sole risk of the contractor and exploration can be carried out during the entire contract period.
- The role of managing committee will be largely related to monitoring of the minimum work program and technical aspects.
- 100% participating interest allowed for foreign and Indian companies without any requirement of participating from government or government nomine companies.
- Exemption of custom duty on all machinery, plants, equipment's, materials and any supplies related to petroleum operations
- Site restoration process of field/ block will be governed as per Government of India guidelines.

To understand if the policy announcement under HELP and other policies are helpful, let us discuss and understand the key differences in past and present fiscal regime and outline any issues with the new regime.

NELP v/s HELP

To compare the NELP and HELP PSC, let's discuss each of the mechanism in detail with its advantages and disadvantages

Key features of NELP

- 100% foreign direct investment (FDI) allowed under NELP.
- There would be no mandatory participation of the state through ONGC or OIL, nor, there be any carried interest of the state.
- Private and public sector companies to compete for obtaining exploration license on competitive basis instead of getting PEL's on nomination basis.
- Open availability of exploration acreages to provide a continuous window of opportunities to oil companies. The acreages will be demarcated on a grid system and pending preparation of the grid, blocks will be carved out for offer.
- Freedom to be provided to contractors to market oil and gas in domestic market on arm's length basis.
- Royalty payments on crude oil will be at 12.5% for on land blocks and 10% for offshore areas. Royalty for natural gas will be 10%. Half of the royalty from the offshore area will be credited to a hydrocarbon development fund to promote and fund exploration related activities.
- Royalty would be half for the deep water areas (beyond 400m bathymeter) for first seven years of commercial production to promote exploration in deep waters.
- No cess on production of crude oil under NELP
- No import duties on goods imported for petroleum operations
- No signature, discovery or production bonus
- Seven year tax holiday would be provided from date of commencement of commercial production.
- The Policy stipulated to provide fiscal stability to contractor during the entire period of contract i.e. no changes in fiscal and contractual terms.
- Full cost recovery will be allowed under NELP for exploration, development, and production cost, with unlimited carry forward period on contract area basis unlike the past regime where exploration cost was allowed to be recovered on contract area basis and development cost on a field wise basis.
- Profit share to be based on investment multiples achieved pre-tax instead of post-tax sharing.
- Agreement between contractor and government governed through a production sharing contact

Thus it could be appreciated from the above measures that NELP in the year 1997 was a big bang reform with complete opening up of the exploration and production sector and introduction of production sharing contracts based on best international practices.

Key features of HELP

- Single License - A single license for all kind of hydrocarbons discovered to be provided. This does away the requirement of multiple licenses for different form of hydrocarbons discovered by the contractor.
- Open Acreages – Contractor to decide which blocks to bid for including the timing of the same.
- Revenue sharing model – Move to upfront profit share through share of revenues, with/without any cost recovery for the contractor.
- Marketing and pricing freedom – Pricing to be determined based on arm's length basis.
- Increased exploration phase
- Reduction of royalty for deep water and ultra-deep water blocks. This would promote exploration and high risk deep water and ultra-deep water blocks.
- Curtailment in role of managing committee due to PSC model based on revenue share and not profit share where costs are to be audited

Comparison of NELP and HELP

Table 2; Comparison of NELP and HELP regimes

Sr. No.	Parameter	HELP	NELP
1	Fiscal Model	Revenue Sharing	Profit sharing
2	Cost Recovery	Not allowed	Allowed before sharing profit
3	Cost efficiency	Encouraged	Neutral
4	Royalty	Low rates for offshore	Standard Rates
5	Exploration Period	8 years for Onland & Shallow waters AND 10 years for deepwater and Ultradeepwater	7 years for Onland & Shallow water AND 8 years for Deepwater
6	Management Committee	Focus on reservoir management. Micro management not required since costs are not linked with profit share of government	Technical and financial examination
7	Revenue to Government	On production	After cost recovery i.e from profit petroleum
8	Exploration in ML areas	Allowed	Not allowed
9	E&P Activity for all hydrocarbons	Allowed	Not Allowed

The key difference between NELP and HELP is the mechanism of profit recovery by the government from the contractor.

Issues with HELP and other policy Initiatives

The government of India in its new policy directives has tried to do a balancing act. While on one hand they have tried to meet the requirement of the petroleum Industry, on the other hand they have tried to protect the interest of the government; but while doing so it has not been able to provide the optimal solution which would have helped to increase investments in exploration and production sector and reduce import dependencies.

The man issues with the new HELP policy are

It has failed to balance the risk reward between the contractor and the government. It is well documented that by moving to the Revenue sharing model, the government is asking contractors to take higher risk. In revenue sharing model the contractor shares profit with government from its revenue while the risk of cost recovery is entirely taken by him.

- Revenue Sharing mechanism is inherently inefficient since it is extremely difficult to design RSC systems to adjust to any variations to cost, timing and pricing.
- The Indian acreages (geology) are not classified among the best; also evident from the fact that India is one of the largest importers of oil and gas. It is expected that more oil & gas would be found in the deep water and frontier blocks, were cost of production would be higher. Therefore the contractors are not ready to take risk for such blocks under revenue share model.
- Since the revenue sharing model brings the economic limit forward, this makes fields susceptible to premature abandonment and hence not allowing full recovery, leaving valuable resources in the ground.
- While the government has tried to provide marketing freedom for oil and gas, it remains to be seen how this would function with the current allocation regime of the government. Even the NELP had provided for pricing on arm's length basis; however the allocation of gas to specific sectors acted as a cap for the pricing.

  (Johnston, Feb 2015)

Recommendation and Conclusion

The Indian sedimentary basins are not very prolific in terms of their prospectively for hydrocarbons, as also demonstrated from the fact that very few oil and gas discoveries have taken place over the last few decades. Any contractual regime for exploration and production should take into account the inherent risk and provide with a commiserate award.

Moreover, any contractual model for the Indian exploration and production industry

needs to take into account the following objectives

- Maximize production from frontier, deep water, marginal and mature fields where the investor companies are required to take considerable risks and where significant investments are required before any hydrocarbons are discovered. As a hydrocarbon importing country where hydrocarbon imports account for nearly a third of the total import bill, the emphasis needs to be on production maximization rather than revenue maximization.

Provide balance between risk rewards - The government take should comprise mainly of elements like income tax which are based on the profitability of the investor and ensure that the contractor has the opportunity to recover investment before paying rent to the Government. Contribution of regressive elements like revenue share or royalty to the total government take should be minimized. This is an essential feature of all fiscal systems which have a balanced risk-reward profile. Excessive reliance on such regressive elements will cause long term damage to the Indian upstream sector and defeat the purpose of the Government's intention of reducing import dependence and increasing energy security.

- Encourage incremental hydrocarbon recovery through Enhanced Oil Recovery (EOR) projects and exploration efforts in contract areas having mining leases. The contract model needs to ensure that the risk of undertaking such projects is not skewed towards the government. Any contract model that discourages efforts to recover additional hydrocarbons by leveraging existing infrastructure will not be in the best interests of the country.

- The administration of the contract needs to be simple.

The Indian exploration and production sector has been characterized by numerous disputes and litigations in the recent past. The contract model should have features which minimize Government oversight while ensuring that regulatory scrutiny is maintained using established institutions and processes. The government auditors should limit their scope to accounting issue and not dive into business decisions.

The business relationship between the Contractor for petroleum operations and the local government has been the point of discussion for decades. This relationship is unique in a way that unlike other industries where a contractor is paid a fee for delivering results, exploration and production requires higher incentivization and hence the

contractors are remunerated from the share of revenue, production, profits or combination of any of these factors.

These structures have developed due to the high risk associated with exploration, where for example in India only 1 out of 10 wells drilled are successful. Further in case of India, where most of the prospectively lies in expensive deep-water pockets, each well cost can be in the range of $ 80 to $120 million. Even if the well is successful the contractor is not sure that the successful well will produce oil or gas and the size of reservoir and its materiality (Johnston, Feb 2015).

Exploration & Production contracts are risk sharing contracts and their design (whether profit share or revenue share) should depend upon the risk inherent in the exploration and production sector of the country. A productive reservoir requires the confluence of probabilistic and uncertain geological factors, a seal to protect hydrocarbon from escaping, porosity to hold sufficient hydrocarbons and permeability for hydrocarbons to flow at an acceptable rate. Moreover, to develop such a reservoir requires technology, capital and management expertise to run such an operation.

The government's choice of contract to be offered to investors would depend on the balance between the geological risk and commercial return, which would determine the flow of capital. A study of the world's oil and gas producing countries provide a very interesting insight into the way government of various countries have been making their choices. There is a marked difference between countries exporting oil like Tanzania, Algeria, Malaysia and OPEC countries when compared with oil importing countries like China, US and India.

- Most onerous contract choices are made by hydrocarbon exporting countries, due to easy and large availability of hydrocarbons. Here the host governments are confident that capital and technology will flow into the sector due to low risk. The average government take in the exporting countries is 71%
- As a comparison, countries which are hydrocarbon importers (since largely unexplored, having poor geology or high geological risk) tend to offer contractual structures that offset the geological or country risk (in case on new country entry by investors). The average government take in importing countries is 52%

(Johnston, Feb 2015)

If the importing countries like India alter the risk reward balance, the investment flow will decline inevitably. Tough contract terms with high geological risk are a nonstarter to increase production in hydrocarbon importing country.

Therefor the decision taken by India to go for a revenue sharing model seems totally misplaced based on above data and logic.

The most common business structures in the industry today are either production sharing contracts (PSC's) or Royalty/Tax systems(R/Ts). While 50% of the industry uses production sharing contracts, the other 50% uses Royalty tax systems. While these two systems are different from legal stand point, but both are fundamentally same from accounting point of view wherein, both systems provide a means of recovering cost incurred and earn a share of profit. There are only a handful of countries talking of the alternative structure of division of production or revenue. The reason for such debate is the concern of cost overruns, gold plating and transfer pricing, which impact the government take. However such concerns can be addressed by modifying the profit based system as also recommended by Kelkar rather than moving to the revenue based model.

Thus in summary, the government's recent initiatives are unlikely to yield results since

- Revenue sharing mechanism is extremely regressive. No successful precedents exist in the industry and this system more or less seems to have become extinct.
- Indian geology requires a part of risk to be shared by the government which is properly captured in the current structures. Revenue sharing mechanism would in fact disincentivise investments into India.
- Profit based system represents over 90% of the governments worldwide, thus proving that the system has been the most acceptable and stood the test of time.
- Revenue sharing systems are prevalent in OPEC countries and most of Russia; however there the geology and business dynamics are different (all of these are net exporters of energy).
- While revenue sharing mechanisms has been introduced to ease administration of PSC's, this will not totally eliminate government oversight.

The current profit sharing system can be tweaked to achieve the higher take for government i.e. with use of rate of return method or imposing windfall tax.

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Role of pilgrimage tourism in the economic development of Uttarakhand : A study of major temples of Garhwal region

Dr. Raju Ganesh Sunder*, Dr. Meenakshi Sharma**

**Professor, CCE, University of Petroleum and Energy Studies*

*** Assistant Professor(SS), University of Petroleum and Energy Studies*

Abstract

There is huge demand for tourism in the state of Uttarakhand from both the domestic as well as international markets in terms of content and standard of utilities and facilities. The state attracts various tourists for leisure tourism, pilgrimages, cultural tourism, leisure tourism, nature tourism, wildlife tourism, adventure tourism, eco-tourism, and amusement.

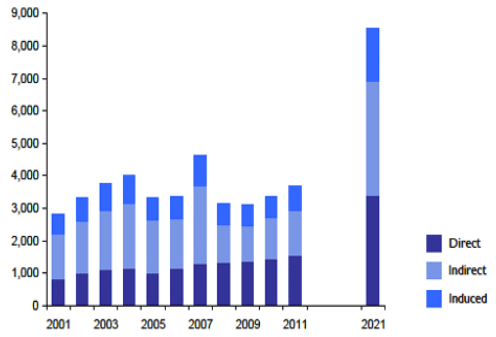
Pilgrims are visiting since years in the region with hope of salvation, purification from the sin. Gangotri & Yamunotri, are in the upper reaches of the State together with Badrinath and Kedarnath form the Chardham yatra, one among the most spiritually auspicious pilgrimage packages. Rishikesh a city near Haridwar is famous for the finest yoga centre in India, the popular "Patanjali Yogpeeth" of Swami Ram Dev has developed as another fine yoga centre since last few years. The spectacular view from Hemkund Sahib gurudwara captitivates the tourists. In addition, the Uttarakhand has plenty of religious temples and shrines, many of them dedicated to local deities or manifestations of Goddess Durga and Lord Shiva and, the old temples being well-known for their unique architectural features. Tibetan Buddhism also has many tourists with the new reconstruction of Mindroling Monastery and its Stupa, the highest in the world located southwest of Dehradun.

This paper is an attempt to understand the basic concept of Pilgrimage Tourism and analyse its impact on the overall economic development of the state with reference to the contribution by the major temples of Garhwal region.

Key Words: Pilgrimage Tourism, Economic Development, Religious Tourist.

Introduction

- The Indian Tourism Industry is among the largest service industries, in terms of Gross Domestic Product (GDP) contribution, & Foreign Exchange Earnings (FEE), and also for increasing employability. The Tourism, and the Hospitality industry contributed a total of US$ 2,468.39 billion (INR 1,094, 48.4 billion) in Foreign Direct Investment during the financial year April'2000 to March'2011, as per the Department of Industrial Policy and Promotion. This ranks India third among countries with fastest growing tourism industries in the next 10 years.
- The total share of, Travel & Tourism sector, to GDP, along with its wide economic impacts, is expected to increase by 8.8 percent p.a. from INR 3,680.4 billion, (US$ 83.0 billion) ; (4.5 per cent of GDP) in year 2011, to INR 8,523.1 billion (US$ 191.2 billion) ; (4.9 per cent) by the year 2021.



According to the Tourism Satellite Accounting research done by World Travel and Tourism Council, and its strategic partner, Oxford Economics in 2015:

- The direct share of Travel & Tourism to the GDP is found to be (US$ 41,582.4 million) (2 percent of total GDP) in year 2015, rising by 7.9 per cent p.a. and expected to be (US$ 95,302.5 million*) (2.4 per cent of total GDP) in 2026
- The contribution, of Travel &Tourism to GDP, along with its broader economic impacts, is expected to increase by 7.5 percent p.a. from (US$ 129,493.0 million) (6.3 percent of GDP) in 2015 to (US$ 286,154.0 million) (7.5 percent of total GDP) by 2026.
- The sector in fact has contributed around US$ 41.6 billion in 2015 and the total share, of Travel and Tourism, to Indian GDP is

forecasted to rise to 71.9 billion U.S. dollars in 2026.

Latest highlights of the Indian Tourism:

The number of Foreign Tourist Arrival in India in the year 2015 increased to 8.03 million in comparison to 7.68 million in 2014 and 6.97 million in year 2013. The growth rate in FTA's during 2015 over 2014 was 4.5 % as compared to 10.2% during 2014 over 2013 and 5.9% during 2013 over 2012.

1. The number of International, Tourist Arrivals is 264.0million: Annual Growth Rate 5.7%
2. The no. of Foreign-Tourist Arrivals, in India is8.03 million: Annual Growth Rate 4.5%
3. The number of Domestic Tourist Visits, to all States/Union Territories is 1432 Million: Annual Growth Rate 11.6%
4. FEEarnings from Tourism, in INR terms is 135193 Crore (#2): Annual Growth Rate 9.6%
5. International Tourism Receipts is 418.9 US$ Billion (P): Annual Growth Rate -0.3%
6. India's share in the International-Tourist, Arrivals is 0.68%
7. India's ranking in World-Tourist, Arrivals is 40th
8. India's share in International Tourism, Receipts 1.71%
9. Rank of India in World Tourism, Receipts is 14(As per RBI's estimate)
10. India's share in International Tourist Arrivals is 2.88 %
11. Rank of India in International, Tourist Arrivals is 11th
12. India's share in International, Tourism Receipts is 5.03%
13. Rank of India in Tourism Receipts is 7th (As per RBI's estimate)

Objectives:

- To find the economic impact of pilgrimage tourism.
- To study the Multiplier-effect in pilgrimage tourism
- To identify economic dimensions of pilgrimage tourism**.**

Methodology

The data collection for the study was done from local people of those areas, who are engaged in various tourism activities. The tourists were defined, as a key factor in development of tourism, in the local areas. The research is based mainly on the secondary data like broachers, pamphlets, books, newspapers, internet resources, advertisement etc.

Literature Review:

In India different castes and communities with their varied cultural patterns, offer a rich field for research on religion. Anthropological studies on temples were made by Bose et al. (1958), Bhoumik (1960), Saraswati (1963), Ray (1969), Goswami and Morab (1970, 1970a, 1974), Freeman (1971), Sinha (1972), Mahapatra (1973), Jha (1971, 1973 and 1974), Narayan (1974), Chakrabarty (1974), Mahapatra (1974), Sahay (1974), Upadhyay (1974) among others. Das gupta (2006), pilgrim tourism plays an important role, in socio-economic changes.

Orland (1990) the pilgrimage tourism places in developing nations, like India are subjected to extraordinary, economic pressures. Mc Garth (1999), the role & importance of the pilgrimage tourism as an economic, social as well as spatial phenomenon can't be neglected. The term "pilgrimage tourism" means visit to a religious site or a holy place, it is like, recreational tourism movements as a type of, migration for short duration, it is the most significant way geographically of the religious behaviour.

Pilgrimage as Tourism:

According to Indian emotions, the pilgrim centres or tirthasthan were visited by many tourists to gain virtue, travel or tour has a very vital place in human life, tourism that means travel of people, in their own country, or across the borders, became one of the largest and profitable industries, in the economic domain. (Das Gupta and et al. 2007). On domestic front religious Tourism is found to be very supportive for regional development, creation of employment, and can also enroot the cultural & ethical values again.

Pilgrimage tourism, generates revenue in a way, which is different from other tourism, because of the pull of huge crowds of people, in the form of tourists (Chattopadhyay 2006). Pilgrimage tourism to different holy places is an old and continuing, religious culture of the Hindus. In pilgrimage tourism, the dimension of religious beliefs becomes the base of tourism, by delivering the award of purification, of the mind and soul and attaining objectives, relative to the issues of mundane- existence.

Pilgrimage as Revenue Earner:

Religious tourism, earns profits & revenue, in a different way which is different from other types of tourism. It has an edge over other types of tourism, because of huge crowd attraction, in the form of tourists (Chattopadhyay 2006). It is found that pilgrimage, to the sanctuaries in the Himalayas started somewhere between, the

4th and 2nd century B.C. The oldest written evidence, for pilgrimage to the Himalayas is the Epos, Mahabharata from the 1st century, B.C., which speaks about Hardwar and the sources of river Ganga (Badrinath and Kedarnath) as pilgrimage places. The most visited pilgrimage destinations were, which still are, the sources of the rivers, Ganga and Yamuna, and, even more important are the Manasarovar lake, Mount Kailash, the home of Shiva, in southern Tibet, Vishnu Devi temple and Amarnath yatra, the two caves.

Role of Religious Tourism in Balancing Economic Growth:

In a country like India, pilgrimage tourism, plays very prominent role in tapering down the economic, imbalance. Many of the places, especially the rural places and the areas which do not have business potential, survive because of religious tourism. It not only provides different business and employment opportunities, to the local communities but also take care of their needs and demands.

Whenever a tourist visits certain place and spends money there, part of the money spent becomes earnings for the local people residing in those places, part of this income further generates, income for others. So, this money changes, hands many a times. The impact of expenditure, on the county‘s economy will keep on multiplying, if this way it is spent and re-spent several times. Thus the foreign currency entering, the nation spreads very fast, in the market. For example, money spent in hotels, infrastructure development, taxi services, car parkings, food & catering services, buying of goods and services, like water, electricity, fuel, food etc. all result, in generation of income.

The flow of cash generated by tourism keeps on multiplying as it passes through various divisions of economy. This is referred to as the multiplier-effect, in tourism revenue generation. This is the extra amount of income, generated in an economy as a result, of the initial money spending. This extra amount of income earned is again invested directly, or indirectly and there have been observed various rounds of income generation. Many places based on faith such as Israel, Italy, Saudi Arabia and India has developed, big industries which are providing services for pilgrims.

The economic impact of the religious tourism, could be estimated by its share & contribution to a nation. The maximum contributions, to religious tourism is observed in the various religious places in India, (Bruner 1994). In the year 2009,

pilgrimage tourism itself contributed 44.5 percent of total export earnings, of Indian tourism. In 2009, pilgrimage tourism in India accounted 23.3% of the total foreign-exchange earnings. The pilgrimage tourism contributes substantially to the employability, both direct as well as indirectly. In the year in 2009, the tourism industry in Indian region created jobs for about 21% people, as an average of 8.9% of total employment.

Pilgrimage in the state of Uttarakhand (CHAR DHAM YATRA)

The tourism industry, has the major contribution to the economy of Uttarakhand. The Rajera hills at Mussoorie, Almora, Ranikhet & Nainital being some of the most frequently visited destinations. Apart from this, the region also has some famous holy Hindu shrines, and since almost 2000 years, pilgrims, had been visiting the temples of Haridwar, Rishikesh, Badrinath & Kedarnath with the hope, of salvation from the sin. The state also acts as host to some of the famous dam projects, in India namely the huge Tehri dam (THDC) on the Bhagirathi-Bhilangana rivers.

Adventure, leisure and pilgrimage tourism play an important role in Uttarakhand's economy. While the total population of Uttarakhand, as per 2011 census, is 1.02 Crores, the State receives over 3 Crore tourists (300% of the population of the state) every year. This inflow puts tremendous pressure on existing resources and infrastructure. The unplanned development at certain religious or scenic places, added with inadequate management planning, increase in traffic and pollution has not only had a severe and negative impact on the environment but also exponentially increased the vulnerability to disasters.

Tourism has major share in the economy of Uttarkahand. Infact, it contributes to the socio-economic development of the Uttarakhand by giving employment opportunities and developing local resources. Since pilgrimage tourism in the state has more than 60% share of all types of tourism, it supports the socio-economic development in the region and encourages local community to participate and earn their livelihood through it. 183 temples, 83 religious fairs (81 annual) Gurukul Asharms & 71 tapasthalies, Kundas, Chardham Yatra, 5 Prayag, 5 Badri.

Trend of Tourist Arrivals over the years (2000-2015):

Table A :Tourist Arrival in Uttarakhand (Since Formation of the State) (Fig. in 100,000)

Source : Department of Tourism, Govt. of Uttarakhand, India

S. No.	Year	Indian Tourists	Foreign Tourists	Total
1	2000	110.79	0.57	111.36
2	2001	105.49	0.55	106.04
3	2002	116.52	0.56	117.08
4	2003	129.3	0.64	129.94
5	2004	138.3	0.75	139.05
6	2005	162.81	0.93	163.74
7	2006	193.58	0.96	194.54
8	2007	221.54	1.06	222.6
9	2008	230.64	1.12	231.76
10	2009	231.54	1.18	232.72
11	2010	309.72	1.36	311.08
12	2011	266.66	1.43	268.09
13	2012	282.93	1.41	284.34
14	2013	200.25	0.9	201.15
15	2014	225.25	1.1	226.35
16	2015	293.74	1.11	294.85

The above table shows that the maximum tourist arrivals were in the year 2011 with a total of 311.08 lakh tourist arrivals, the 2013 disaster resulted in a downfall to 201.15 lakh total tourist arrivals with a rising trend noticed in 2015 & 2016.

Reasons of Tourist Visits in Uttarakhand

The pilgrimage tourism has a significant contribution in creating employment, both direct as well as indirectly, in the year 2009 the tourism industry in India provided employment to around 21% people, making an average of 8.9% of the total employment in the country.

Table B : Reasons of Tourist Visits in Uttarakhand

(Reference Period: April 2005 – March 2006)

Purpose of visit	Domestic	Foreign	Total Visitors
Cultural Programs	53.1	59.3	53.8
Visit Resorts	13.9	10	13.5
Wildlife visits	10.7	10.2	10.6
Others	8.3	4.7	7.9
For visiting friends & family	2.9	2.3	2.8
For business & professional reasons	4.6	1.2	4.2
For Healthcare & Treatment	0.6	0.6	0.6
Social/Religious purposes	5.5	11.6	6.2
Pilgrimage	0.4	0	0.4
Conference	0	0	0
Total	100	100	100

Pilgrimage in the state of Uttarakhand (CHAR DHAM YATRA)

**Tourism Statistics collected from the State of Uttarakhand*

Table C : Location wise estimation of number of visitors (April 2005 – March 2006)

Destination	No. of Domestic Overnight Visitors	No. of Foreign Overnight Visitors	Total Overnight Visitors	Estimated No. of Day Visitors	Total Visitors+ Day Visitors
Badrinath	67838	981	68819	4982	73801
Kedarnath	41878	222	42100	1565	43665
Gangotri	87587	3440	91027	5182	96209
Yamunotri	88280	6883	95163	3623	98786
Total	285583	11526	297109	15352	312461

Destination	Accommodation Units	Friends & Relatives	Domestic Overnight Visitors
Badrinath	63331	4507	67838
Kedarnath	36545	5333	41878
Gangotri	87468	119	87587
Yamunotri	81132	7148	88280
Total	268476	17107	285583

Table D : Reasons tourists do not visit pilgrimage places

Reasons	Domestic	Foreign	All Visitors
Lack of Awareness of those locations	41.9	44.4	42.2
Financial Constraints	30.5	26	30.1
Time Boundations	17.8	24.2	18.4
No Interest	18.4	19	18.5
Transportation Problems	8	22.2	9.4
Connectivity Issues	26.3	39.3	27.6
Security Reasons	11.4	19.2	12.2
Availability of the budget circuits/package	21	10.7	20

The table C demonstrates the location wise trends of availing accommodation by tourists in Accommodation units or with friends & relatives. Around 268476 visitors during the period April 2005 – March 2006 stayed in different accommodation units. Nearly, 17107 tourists stayed with friends & relatives.

The reasons given by visitors for not visiting on majorly are lack of awareness, budgetary constraints, time constraints etc.
In 2011 and 2012, over 5.71 lakh and 5.83 lakh pilgrims visited the Shiva temple built over a thousand years ago. This fell to 3.12 lakh in 2013 before the yatra was halted mid-way due to the floods. The catastrophe which took place in the Uttarakhand state on 16 June 2013, was a tragedy waiting to happen. The Chardham Yatra pilgrimage was cancelled for repair of damaged roads and infrastructure. The half of the yearly batch of the "Kailash-Mansarovar" Yatra also suffered because of Uttarakhand disaster. The loss in property is estimated to be around 3,500 Crores, whereas the damages done to environment cannot be evaluated in terms of money and would take decades to recover completely. A PHDCCI survey declared that the damages caused due to torrential rains which lashed Uttarakhand would cause a loss of around Rs. 12,000 crore to the State's tourism.

After few months of the flood, the rebuilding of the infrastructure of the state and other attractive tourist spots started so that locals can start their normal lives once again. Here are the major developments that held in Uttarakhand after the flood disaster 2013:

- Kedarnath Yatra reopen or pilgrims**.**
- Valley of flowers rebuilds and opened**.**
- Trekking route was considered a "Safe and Tempting"**.**

Impact on Economy

The start of the mass tourism period in Uttarakhand had abundant impact on the local economy, resulting in rapid increase in the number of tourists rapidly and the money spent by them too. The expenditure done by tourists has a diverse impact on the local economy, it stimulates the expenditure done by these visitors and induces the "multiplier-effect" by creating employment, capital accumulation and help local people who were depending on subsistence farming, they begin their own businesses by serving the tourists, by selling and renting supplies, making guides available or selling souvenirs to various tourists. These businesses hire people as guides or workers, who get benefited indirectly by the money spent by tourists, but a portion of the income earned from tourists can be used to raise the living standards of local people by providing better health care facilities, education and infrastructure. The great portion of money spent on the tourism industry makes the economy at an extreme rate dependent on the revenues generated from this industry. The tourism sector is very sensible, so the revenue generated from this sector is quite fluctuant.

Recommendations

- The tourism industry should be a part of the balanced economy.
- Tourism environments should have a long term perspective and tourism industry should of these environments.
- The tourism sector must give respect to the character of that region.
- The tourism industry should provide economic benefits in the long run.
- Tourism industry should consider the needs of the local population.

-Govt (Centre and State together) should work towards infrastructure overhaul:

- Move all physical structures away from the banks of Alaknanda, Bhagirathi, Mandakini and all other major streams and gorges. Improve road facilities, widen the bridges and roads and have good pavement.
- Create and mark helicopter landing spots in mountains and keep fuelling option available every 100 km distance. Also place a helicopter bay and 10 staff to execute rescue operations every 100km.

- Provision of a simple telephone number for helpline and co-ordination centre which must be in the centre of the pilgrim routes.
- Medical facilities at every 100 km range or in major spots where there is helicopter landing or bay.
- Ensure to provide pilgrims with laminated photo identity cards with clear name, emergency contact number and their address.

Conclusion:

This study has tried to explain the socio-economic importance of pilgrimage tourism, evaluations in terms of employment is quite large. The study has also tried to demonstrate that religious tourism interventions could play a vital role in improving the living standard and in reduction of poverty in local areas. It is usually essential to design and implement various policies which take privilege of the potential advantages of pilgrimage-tourism for socio-economic development of the Uttarakhand state. In certain cases, it is just a question of improving awareness, such that the combined benefits to religious tourists and local population can be considered at the planning stage. This study also supports and explains the idea that the economic impacts of the pilgrimage tourism must not be ignored, though many religious institutions have made attempts to downplay this in the previous periods. Additionally, the study argues, that religion and tourism have something in common. In this modern era it becomes difficult to ignore the belief that in pilgrimage places, the profane impacts of tourism are as important, than the religious.

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The Development of a Dynamic Major Accident Hazard Risk Model to assess Human and Asset impacts associated with On-shore Gas Drilling Operations

Ignatius Prashanth*, Dr. Benjamin Boardman**, Dr. Raju Ganesh Sunder***,
Dr. Geo Jos Fernandez****

**Senior Process Safety Engineer, Al Hosn Gas, Abu Dhabi*

***HSE systems Manager, Al Hosn Gas, Abu Dhabi*

****Professor and head, CCE, University of Petroleum and Energy Studies*

*****Assistant Professor (SG), University of Petroleum and Energy Studies*

Abstract:

Active monitoring of risks is critical as it provides feedback on barrier performance before the risk results in disastrous impacts such as personnel or asset damage. The current paper focuses on presenting an active risk monitoring method which evaluates barriers and transforms the existing Bow-Ties to a Bayesian risk model considering an onshore gas drilling environment.

The Bayesian risk model is used to identify the operational risks associated with the major accident hazards for personnel and asset impacts. This paper presents a novel approach to transform the Bow-tie to a Bayesian Risk model. The results of this model have been validated and well received by drilling engineers and Safety/ HSE professionals.

Keywords:

Bayesian network, dynamic risk analysis, safety barriers, operational risk, major accident hazards, onshore gas drilling

Introduction

Barrier based model was originally derived from the Swiss cheese model developed by James Reason. The model focused primarily on latent and active failure with focus on more psychological factors (Reason, 2000). From an industry perspective, Royal Dutch/ Shell group was the pioneer in integrating the bow-tie methodology into its business practices (Primrose et al., 1996).

The method was developed as an assurance tool that ensured fit for purpose risk controls were consistently implemented throughout all their worldwide operations. Meanwhile,

regulators recognized the importance of a risk based approach to evaluate major accident hazard risks during the operational stage of an asset lifecycle (POST, 2001). It has been emphasized that active monitoring of risks is critical as it provides feedback on barrier performance before the risk results in disastrous impacts such as personnel or asset damage. It was identified that several reactive risk assessment techniques (Incident investigation) have been developed linking incident investigation to facility risk assessment bow-ties depicting which bow-ties have failed in order to have an accident through a review of various accident pathways (Pitblado et al, 2015).

50% of the major losses are due to incidents in the upstream industry and it is estimated that 33% of world gas fields are contaminated by hydrogen Sulphide (Risktec, 2009). Recently, the Chongqing blowout in China of an onshore sour gas well helps us to relate to the magnitude of such an event.

The Chongqing blowout resulted in 243 fatalities, 1242 hospitalizations and over 65000 evacuations. The related economic loss of this event was around USD 10 Million (Jianfeng, Bin, Yang, & Mao, 2009) . This is the background for the focus into onshore sour gas drilling.

The current paper focuses on presenting an active risk monitoring method which evaluates barriers and transforms the existing Bow-Ties to a Bayesian risk model. The Bayesian risk model is used to identify the operational risks associated with the major accident hazards.

Review of existing Barrier based Risk Assessment frameworks

In this section, we will appraise several barrier based risk frameworks (qualitative and quantitative) based on review of published literature.

Real time risk management and response were evaluated through transformation of risk management tools to a real time risk management environment (Jose et al, 2014). This model followed the typical process safety assurance steps through monitoring of process instrumentation and subsequent surveillance actions are initiated through barrier specific workflows.

Trost had used a qualitative barrier categorization technique to be considered while evaluating an accident or potential accident situation. The factors included energy, the target and the existing barriers/ control placed

between the energy and the target. The barriers were classified based on type, location and function (Trost et al, 1995). Jacinto used a semi-quantitative risk assessment approach to represent occupational risks in the Ship Building industry using bow-ties. The qualitative technique focused on the bow-tie technique and identified the need to breakdown the bow-ties into relevant accident pathways (Jacinto & Silva, 2010).

This approach using the bow-ties to map the events on a one to five scale based risk matrix by experts using actual accident statistics data available for the relevant industry sector. Pitblado has highlighted that human aspects are not effectively captured in risk assessments. The model prescribed integrated the bow-tie model with the Success pathways approach typically used in the nuclear industry. This model focused on human and organizational factors having an overarching influence on technical, administrative and procedural controls.

The model was developed under the assumption that barriers degrade over time during operations. Therefore, a real time barrier status was developed using inspection, maintenance, audit and incident investigation methods (Pitblado et al, 2013). The conclusions of the above model were not derived or verified against real data.

Leger had used a safety barriers based approach for risk analysis of socio-technical systems. The proposed methodology was based on system knowledge unification and its structuring to enable quantitative estimation of risks. The proposed approach integrates safety barriers and structural alignment of barriers in the form of Bayesian networks.

This approach was limited as its focus was on safety instrumented systems (Leger, et al., 2008). Barrier and Operational risk analysis method was qualitatively and quantitatively assessed for hydrocarbon release scenarios considering the effect of safety barriers and analysis barrier performance based on the various risk influencing factors. The risk influencing factors included technical, human and operations. The method was verified using a case study approach for an offshore oil and gas production platform (Sklet et al., 2006).

Lewis had presented the learnings based on the real world application of the Bow-Tie method. The Bow-Tie is used as a visualization tool to present the relationships between the causes, escalation events and safety controls including

preventive and recovery preparedness measures.

The Bow-tie cannot be used to quantify risk based on the barrier failure and it does not account for inter-dependency of barriers (Lewis, 2010). Several industry regulations (such as UK COMAH and ADNOC HSEMS) stipulate the requirement to demonstrate the control of hazards by linking the safety controls to elements of the management system (HSE, 1999) (ADNOC, Health, Safety & Environment Management System Guidelines, 2002).

In addition, ADNOC guidelines has an associated Code of Practice on Control of Major Accident Hazards (COMAH) elaborates on the bow-tie methodology to demonstrate the visual depiction of safety controls and its hazards (ADNOC, 2014).

Based on the review of risk assessment frameworks, several gaps were identified. There was no linkage identified in any of the risk frameworks between barrier performance and the associated risk impacts. Therefore, risk analysis is static and does not consider barrier performance. This paper outlines a method and application of a dynamic risk assessment for major accident hazards which consider the failure of safety barriers.

Review of existing Major Accident Hazard Bow-Ties for onshore sour gas (service) drilling operations

Sour service refers to a well environment containing significant amounts of Hydrogen Sulfide (H_2S). H_2S is toxic and considered hazardous to human health, living organisms, and the environment in general. Failures in sour wells are a major concern to Oil & Gas companies due to their consequential effects (American Petroleum Institute (API), 2001). In the majority of areas, gas is categorized as sour if H_2S comprises of more than 2.5% of gas contents.

The Middle-East region has highly sour fields with H_2S up to 30% in some fields. Canada was one of the earliest discovered sour fields for high H_2S with one of its wells containing up to 90% H_2S. H_2S can be found in oil and/or gas fields, onshore and offshore, High Pressure High Temperature Fields (HPHT) and conventional fields, etc. H_2S content can keep on increasing during the aging of the asset irrespective of initial composition.

The International Energy Agency (IEA) published in their 2014 medium term gas

market report a 1.2% growth in global natural gas demand over the span of 2013.

And BP forecasts in their energy outlook an increase in global natural gas demand by an average of 1.9% per year to 2035. With increasing demand of gas worldwide, some highly sour oil and gas reservoirs are being explored, mainly in Russia, the Middle East, China, North America, and are now more and more associated with complex well profiles – such as deep reservoirs or extended reach wells. As time passes, more of the previously uneconomical sour fields will become viable development projects.

Major Accident Hazards (MAH), put personnel, production, capital investment and corporate reputations at risk. The management of MAH risk includes a structured approach to minimize the event likelihood and reducing the consequence of a Major Accident Event (Dalzell & Ditchburn, 2003).

A review of MAH was conducted for three (3) onshore sour gas drilling operations within the region of the United Arab Emirates (UAE). The review was conducted to compare the various MAH along with the number of threats and consequences identified for each of the drilling operations. The summary of the review is presented in Table 1.

Based on the review, Asset-3 was selected as the asset for further study due to the comprehensive listing of the MAH and the associated safety barriers. The listed information in Table 1 was sourced from the Health, Safety and Environment Impact Assessment (HSEIA) and details were referred in the COMAH Reports. Based on the identified MAHs for Asset -3, only six (6) out the eleven (11) hazards were related to the core drilling operations. Due to the confidential nature of such reports, it has been kept anonymous and not referenced.

Table 1 Review of Major Accident Hazards -3 onshore gas drilling assets

10	MAH umber	MAH description	Risk Classification category	Applicability to Drilling operations	No. of threats	No. of consequences
Asset -A	1	Loss of containment during site preparation	People	No		
	2	Loss of sub-structure stability during 26 inch hole drilling	Asset	Yes	2	1
	3	Loss of containment during 16 inch hole drilling	Asset	Yes	1	1
	4	Loss of containment during 12.25 inch and 8.5 inch hole drilling	People	Yes	4	1
	5	Loss of well bore integrity during 12.25 inch and 8.5 inch hole drilling	People, Asset	Yes	2	2
Asset -B	1	Loss of containment during Onshore well drilling	People, Asset	Yes	4	5
		- during Casing		Yes		
		- during wireline logging		Yes		
		- during drilling		Yes		
		- retrieving core to the surface (logging)		No		
Asset -C	1	Loss of containment during well operations - During drilling activities - During work over - During Well testing Resulting in multiple fatalities onsite and offsite and asset damage	People, Asset	Yes	3	2
	2	Loss of containment (Blowout scenario) - during drilling through Habshan Reservoir while running 9 5/8" x 10 3/4" casing	People	Yes	2	2
	3	Loss of containment (Blowout scenario) - during drilling 8 1/2" Pilot Hole through Arab Reservoir	People	Yes	1	3
	4	Loss of containment Formation fluid influx (kick) during coring Induced well control while retrieving core to the surface Unstable well conditionsfrom pumping C's into the well bore while logging on the drill pipe	People	Yes	3	3

10	MAH umber	MAH description	Risk Classification category	Applicability to Drilling operations	No. of threats	No. of consequences
	5	Loss of containment (kick and well flow) during - Drilling 8 1/2" hole through Arab reservoir - Well flow while running 7" casing - Running 7" CRA liner	People	Yes	3	3
	6	Loss of containment (kick) during Drilling 6" hole through Arab reservoir	People	Yes	1	3
	7	Loss of containment (kick) during - while running 7" CRA Production tubing - while installing XMT - while nippling down BOP and nippling up XMT	People	No	3	3
	8	Loss of containment Equipment failure in riser while coil tubing within hole Down hole conditions leading to stuck well tools in the tubing	People	No	2	3
	9	Loss of containment - Human Error while stimulating the well	People	No	1	3
	10	Loss of containment during Well operations (surface related issues) - Erosion - Corrosion - Vibration - Hydrate formation - Overpressure in the downstream of choke manifold - Improper operation of 3 phase separator - PAGE 692	People	No	11	3
	11	Loss of containment during flaring	People	No	1	3

MAH 1 focuses on the Simultaneous Operations (SIMOPS) aspect of the well campaign. SIMOPS typically occur within process facilities when multiple activities (two or more) occur at the same time and place. This may introduce risks that are not identified when each activity is considered in isolation (Baybutt, 2016) (IMCA, 2010).

The consequences of this MAH have been subdivided into the affected group; neighboring field personnel (e.g. second drilling rig, construction personnel etc.) and the general public. MAH 2 focuses on the loss of well control whilst operating in the Habshan section (Deeper drilling depths) of the wells. MAH 3 relates to loss of well control whilst drilling the Pilot Hole through the Arab Reservoir. MAH 4

relates to loss of containment whilst performing data acquisition in, and plugging of the Pilot Hole. MAH 5 relates to loss of containment whilst drilling the 8 ½ ” hole to the landing point in the Arab Reservoir and cementing the 7” Corrosion Resistant Alloy (CRA) Liner. MAH 6 relates to loss of well control while drilling through the Arab reservoir to Total Depth. MAH 7 to MAH 11 have not been analyzed due to their non-applicability to core drilling operations.

Risk Model

Based on the review of the Company Risk Analysis report, Bow-Tie analysis has been applied to all Major Accident Hazards to identify and assess the prevention, control, and mitigation measures proposed to manage these hazards and risks. The approach adopted is based on that presented in the ADNOC COMAH Code of Practice (ADNOC, Code of Practice on Control of Major Accident Hazards (COMAH), ADNOC COP V05-01, 2014). The below sub-sections lists the transformation of the Bow-Tie into a Bayesian based dynamic risk model, evaluation of risk using this approach and results of a model validation workshop.

Conversion of Bow-Ties to Bayesian Networks

Initially the drilling major accident hazard bow-ties into potential threat and consequence accident pathways. This approach proposed by Pitblado and Fischer transforms the Full-Bow ties into various incident Bow-Ties (Pitblado & Fischer, 2010). An illustration of the proposed approach is shown in

Figure ***1***.

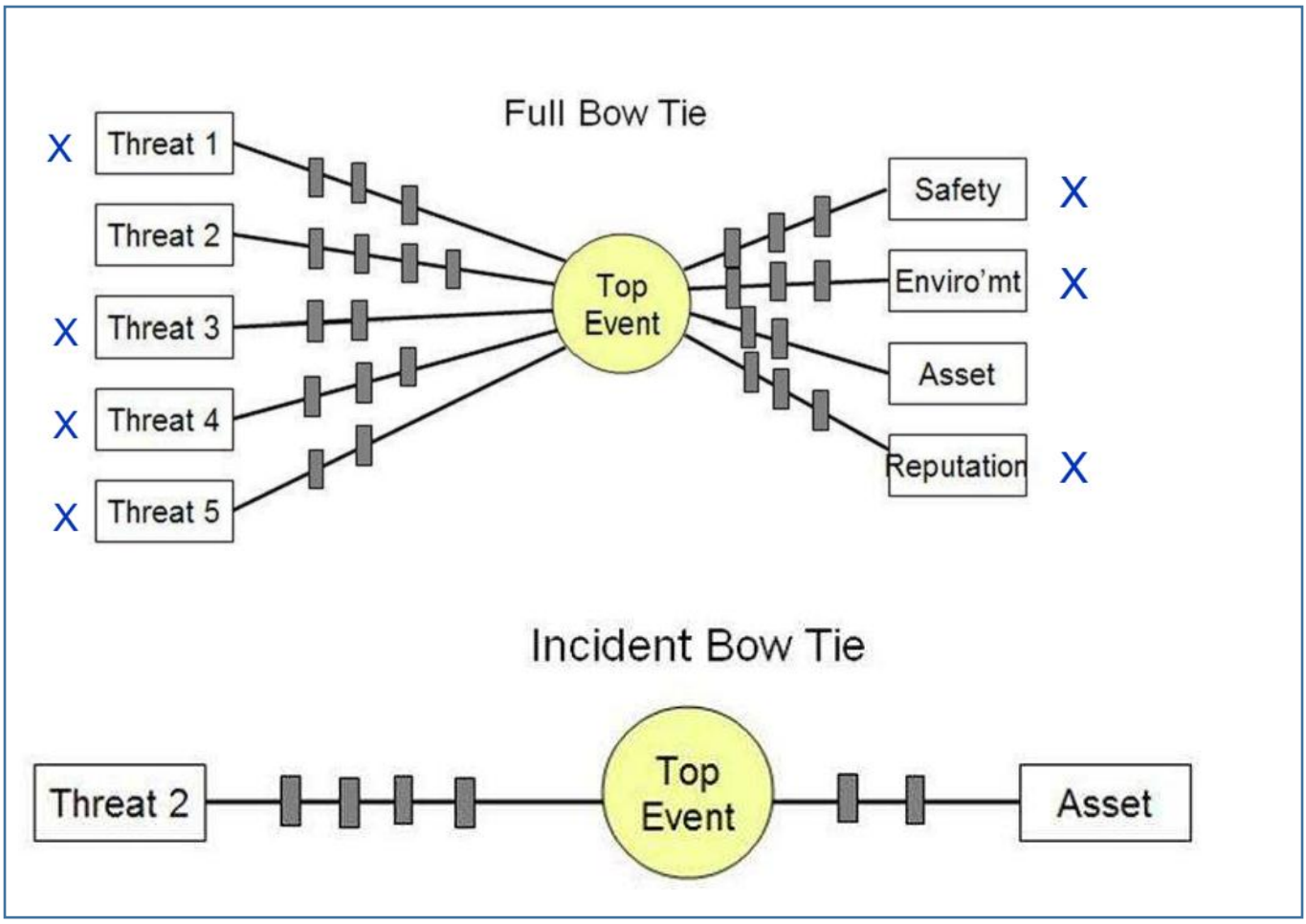

Figure 1 Transformation of full bow-Tie to an Incident Bow-Tie

The above approach was modified to meet the purposes of risk calculations. The term 'risk' is according to international standards (such as ISO2002) 'combination of the probability or an event and its consequence'. Other standards, like ISO 13702 (ISO 1999), have a similar definition: 'A term which combines the chance that a specified hazardous event will occur and the severity of the consequences of the event (Vinnem, 2014).

An operational expression for practical calculation of risk is the following, which underlines how risk is calculated, by multiplying probability and numerical value of the consequence for each accident sequence i, and summed over all (I) potential accident sequences:

$$R = \sum_i (p_i \cdot C_i)$$

where:

p = probability of accidents

C= consequence of accidents

Therefore, based on the above definition of risk, it was decided to split the Bow-Tie into Threat and Consequence event pathways respectively. The current paper focuses on evaluating risk impacts on personnel and assets. All the Major Accident Hazards related to drilling operations (MAH 1 to MAH 6) are attached as part of Appendix-1.

Evaluation of Safety barriers performance using the factors

Research was conducted to identify safety barrier performance factors for onshore gas drilling operations. The factors included performance, defense, trust, limit, perception, dependency and robustness (Prashanth et al., Under Review). The grouped variables under each of the factors are listed below:

Factor 1 – Performance factor

- Availability
- Validity
- Lagging indicators
- Effectiveness
- Barrier test simulation
- Safety critical tasks

Factor 2 – Defense factor

- Adequacy
- Redundancy
- Impact of safety critical tasks
- Survivability

Factor 3 – Trust factor

- Reliability
- Response time
- Integrity

Factor 4 – Limit factor

- Triggering event
- Capacity
- Maintainability

Factor 5 – Perception factor

- Level of confidence during operations
- Error promptness
- Operational complexity
- Barrier reputation

Factor 6 – Dependency factor

- Human dependence
- Barrier inter-dependence

Factor 7 – Robustness factor

- Robustness

Drilling and HSE personnel were required to rate each of the safety barriers using the identified factors. Drilling personnel included two (2) senior drilling Engineers who worked in the specific asset. HSE

personnel included a Drilling HSE Manager and a Senior HSE staff.

The ratings were carried on a 5 point scale, where 1 relates to Very Low (Highly ineffective) and 5 relates to Very High (Highly effective). A total of 28 threat barriers and 18 Recovery measures were identified. The categorization of barriers is listed in the below table:

Type of Barrier	No. of Barriers on Threat Side	No. of Barriers on Consequence Side
Hardware	15	7
Operating Procedures	10	3
Training	1	1
Design	1	2
Maintenance Management	1	-
mergency Response Planning	-	4
Communications	-	1
Total	**28**	**18**

The summary of the ratings based on the average score is listed as part of Appendix-2. The average scores from all the participants were normalized (Conversion of the rating scale from 1-5 to a normalized scale of 0-1) for usage as input in the Bayesian Networks.

Operational Risk evaluation through Bayesian Networks

Bow-Ties (BT) has not been recognized as a dynamic analysis technique. Since, it is composed of static methods such as Fault tree and Event tree (Khakzad et al., 2013a). Weber has highlighted the usage of Bayesian networks in reliability, risk and maintenance function due to their ease of use with domain experts. Bayesian networks are particularly suitable for collecting and representing knowledge on uncertain domains. It also enables probabilistic calculus and statistical analyses in an efficient manner (Weber et al., 2012). In this stage, the static Bow-Ties are transformed into a dynamic risk model using Bayesian Networks (Ale, et al., 2006) (Ale, et al., 2009) (Khakzad et al., 2011) (Khakzad et al., 2013b). Bayesian Network (BN) is a graphical technique that has started to be widely applied in the field of risk

analysis. BN is composed of nodes, arcs and probability tables to represent a set of random variables and the conditional dependencies among them. (Khakzad et al., 2013a). The Bayesian network was developed using AgenaRisk Version 6.0 software. This software has been in use from 2005 and is widely used in defense, transport, banking, telecommunications and safety engineering companies which owned safety critical systems and for which quantitative risk assessment was required (Fenton & Neil, 2014) .

The drilling Bow-Ties were transformed into a dynamic Bayesian network as shown in Figure 2 Figure 3, Figure 4 and Figure 5 .

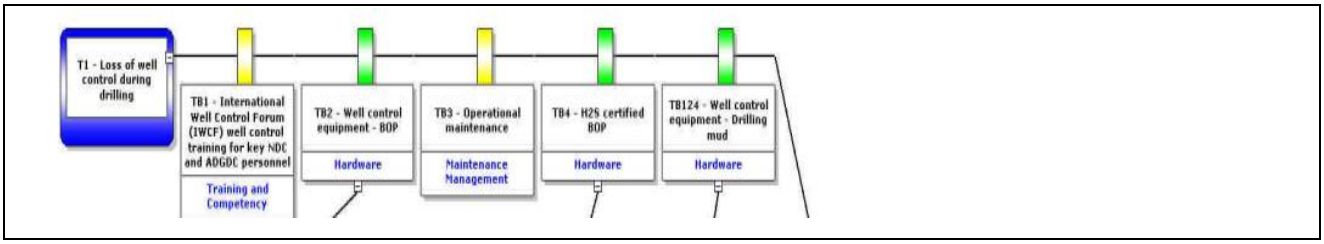

Figure 2 : Static Bow-Tie for a threat in the Drilling Bow-Tie

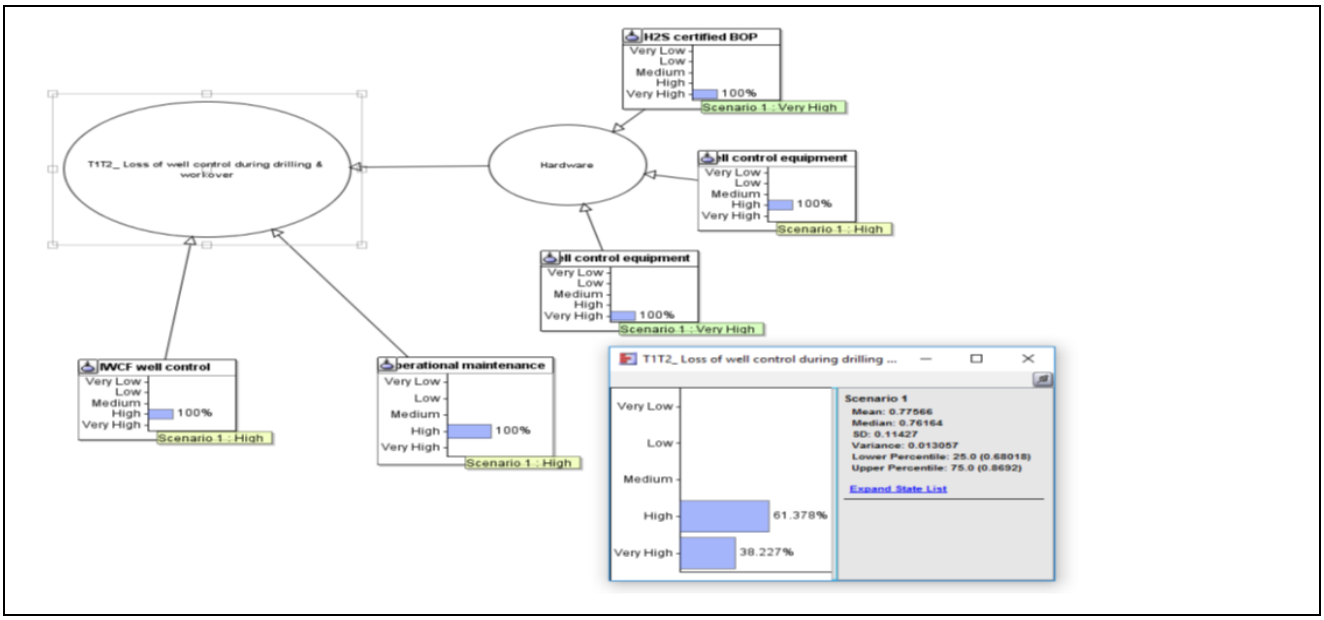

Figure 3: Transformed Bayesian network – Threat line

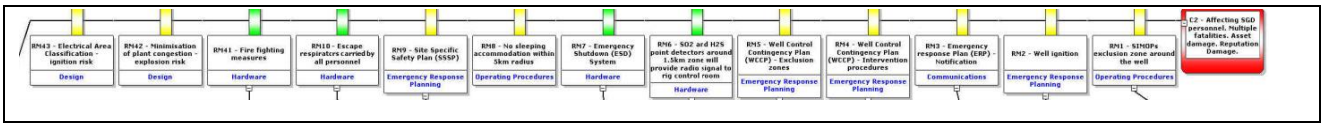

Figure 4 : Static Bow-Tie for a Consequence in the Drilling Bow-Tie

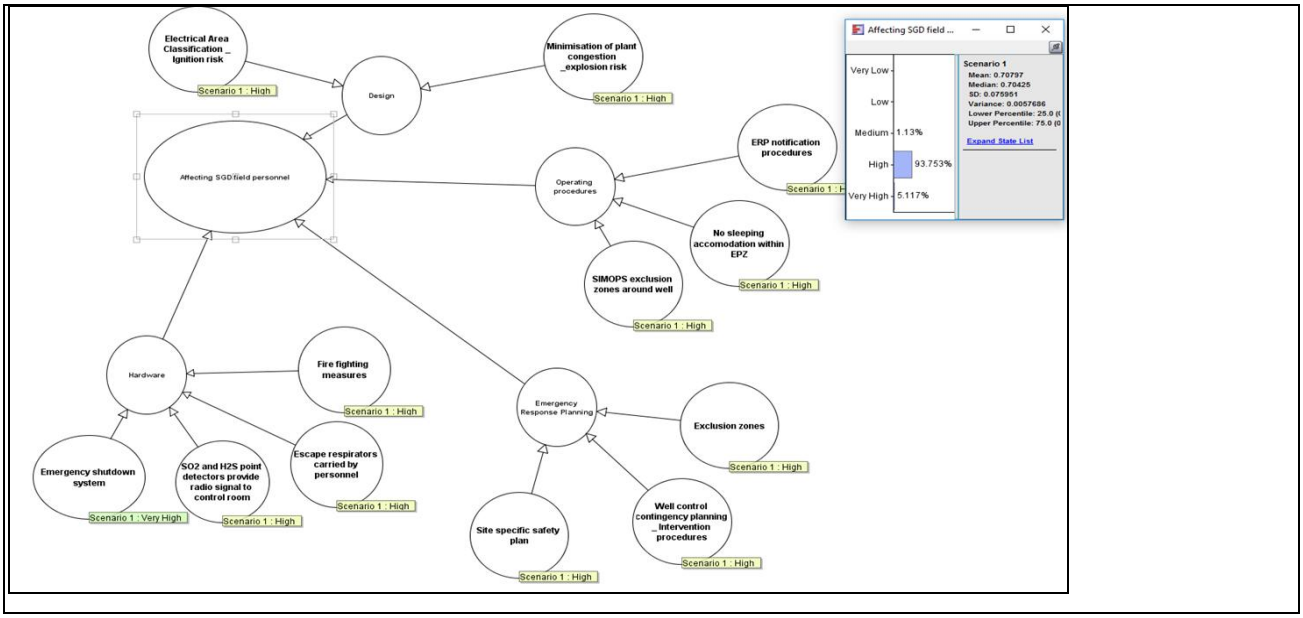

Figure 5 : Transformed Bayesian network – Consequence line

Each of the safety barriers were modeled using the ranked nodes. Ranked nodes represent discrete variables whose states are expressed on an ordinal scale that can be mapped onto a bounded numerical scale that is continuous and monotonically ordered (Fenton et al., 2007). Ranked nodes have been defined on an underlying unit interval [0-1] scale. A five point scale such as {very low, low, average, high, very high}, is chosen to model the individual safety barriers in the Bayesian network. The interval width for each state is 0.2. Thus, "very low" is associated with the interval [0 - 0.2), "low" is associated with the evaluated as a criteria for MAH identification considering "NO" safety barriers.

Mitigated risk is ranked considering Safety barriers are perfectly functional (100%). interval [0.2 - 0.4), and so forth. Ranked nodes enable the BN construction and editing task much simpler than is otherwise possible. Through this method, each of the threats and consequences were transformed into a dynamic Bayesian network diagram.

Threat barriers and Consequence barriers were evaluated using the constructed Bayesian networks – An overall barrier performance is thereby evaluated for each threat and consequence associated with a MAH is presented in Table 2 . Inherent risk is

Inherent and mitigated risk were ranked using ADNOC 5 X 5 Semi-quantitative risk matrix (ADNOC, 2014). Typically, these rankings are usually agreed in a HAZID Risk Ranking workshop. Meanwhile, Risk control is built on

the reduction of the frequency of occurrence of the major dangerous phenomena taking into account the safety barriers performance, so that the dangerous phenomena are defined with an acceptable couple, i.e. gravity-frequency of occurrence. In reality, the actual risk exposure should be directly correlated with Safety barriers performance.

Table 2 : Summary of Barrier effectiveness - threat and consequence

Asset	MAH number	MAH description	Risk Classification category	Applicability to Drilling operations	Inherent Threat (without barriers)	Mitigated Threat (with barriers)	Actual Threat barriers effectiveness (%)	Actual Threat (considering barriers effectiveness)	Inherent Consequence (without barriers)		Mitigated Consequence (with barriers)		Actual Consequence barriers effectiveness (%)		Actual consequence (considering barriers effectiveness)	
									P	A	P	A	P	A	P	A
Shah	1	Loss of containment during well operations - During drilling activities Resulting in multiple fatalities onsite and offsite and asset damage - affecting ADCO personnel (offsite) - affecting AHG personnel (onsite) - affecting public	People, Asset	Yes	E	C	78%	Between C & D	5	5	2	1	75% (ADCO field personnel) 70% (AHG-SGD field personnel) 75% (General public)	75% (ADCO field personnel) 70% (AHG-SGD field personnel) 75% (General public)	3	2
	2	Loss of containment (Blowout scenario) - Formation fluid influx into well bore - during drilling through Habshan Reservoir - while running 9 5/8" x 10 3/4" casing resulting in major toxic release, fire and explosion	People	Yes	E	C	78%	Between C & D	5		2		70% (toxic) 70% (fire) 70% (explosion)		3	
	3	Loss of containment (Blowout scenario) - during drilling 8 1/2" Pilot Hole through Arab Reservoir resulting in major toxic release, fire and explosion	People	Yes	E	C	78%	Between C & D	5		2		70% (toxic) 70% (fire) 70% (explosion)		3	
	4	Loss of containment - Formation fluid influx (kick) during coring - Induced well control while retrieving core to the surface - Unstable well conditions from pumping HC's into the well bore while logging on the drill pipe - Plug failure while plugging pilot hole resulting in major toxic release, fire and explosion	People	Yes	E	C	78% (Coring) 68% (Induced well control) 70% (while logging) 68% (plugging pilot hole)	Between C & D	5		2		70% (toxic) 70% (fire) 70% (explosion)		3	
	5	Loss of containment (kick and well flow) during - Drilling 8 1/2" hole through Arab reservoir - Well flow while running 7" casing - Running 7" CRA liner resulting in major toxic release, fire and explosion	People	Yes	E	C	78% (Drilling) 76% (Casing) 78%(CRA Liner)	Between C & D	5		2		70% (toxic) 70% (fire) 70% (explosion)		3	
	6	Loss of containment (kick) during - Drilling 6" hole through Arab reservoir resulting in major toxic release, fire and explosion	People	Yes	E	C	78%	Between C & D	5		2		70% (toxic) 70% (fire) 70% (explosion)		3	

Based on the results listed in Table 2, it is identified that the actual operational risk is between 3C and 3D in terms of the ADNOC risk matrix. Inherent Risk (IR), Mitigated Risk (MR) and the calculated Actual Risk (AR) have been mapped in the ADNOC Risk matrix for personnel in **Error! Reference source not found.**. It is observed that the Actual Risk (AR) is very close to the High Risk region and the risk is in the higher ALARP [1]region in comparison to the Mitigated Risk (MR). The medium Risk region is considered to be acceptable but must be managed by ALARP.

Reducing risks to ALARP means reducing them to a level at which the cost and effort of further risk reduction is grossly

[1] ALARP – As Low As Reasonably Practicable

disproportionate to the risk reduction achieved (ADNOC, Code of practice on HSE Risk Management, 2014).The inference from these results would prompt the organizations to focus on enhancing the performance of the safety barriers to reduce the risk to lower ALARP levels.

					Probability				
					A	B	C	D	E
Severity	**People**	**Assets**	**Environment**	**Reputation**	***Improbable 1 in 100,000 years***	***Remote 1 in 10,000 years***	***Occasional 1 in 1,000 years***	***Probable 1 in 100 years***	***Frequent 1 in 10 years***
(5) Catastrophic	Multiple Fatalities or permanent total disabilities	Extensive damage	Massive effect	International impact					
(4) Severe	Single fatality or permanent total disability	Major damage	Major effect	National impact					
(3) Critical	Major injury or health effects	Local damage	Localised effect	Considerable impact					
(2) Marginal	Minor injury or health effects	Minor damage	Minor effect	Minor impact					
(1) Negligible	Slight injury or health effects	Slight damage	Slight effect	Slight impact					

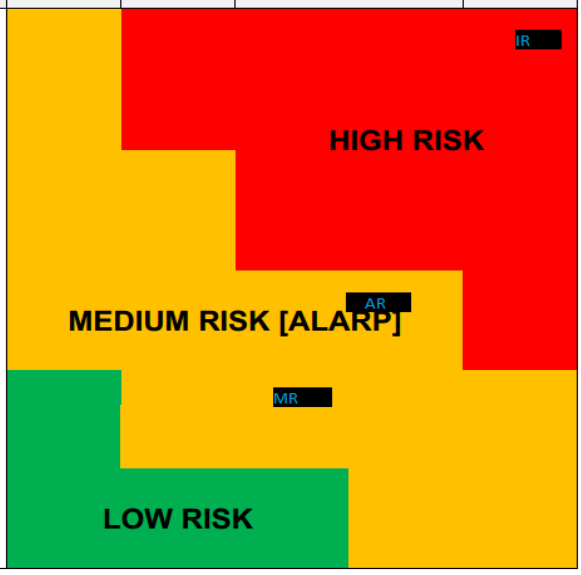

Figure 6 : Mapping of IR, MR and AR in ADNOC's semi-quantitative risk matrix

Model feedback & validation

The barrier based risk model & results were validated through a workshop consisting of mixed group comprising of HSE Manager, Process Safety Engineers, Senior Drilling Engineers, Senior Well Integrity and Regulators (Safety Department Manager). A total of nine (9) members participated in the workshop conducted in December 2016.

The model development approach and the results were presented to the audience, followed by a question and answer session for further clarification. A five-point scaling technique was used through a structured questionnaire. In the five-point scale 1 represents the least and 5 represents the best situation, meaning the degree of the validity of the model varies from 1 to 5. The parameters included were Overall conceptual framework (Barrier performance

factors), relevance of data, models / techniques, Interpretation of risk and overall applied value of the risk model (Abbas & Routray, 2013).

The summary of the scores and the average scores for each of the parameters are listed in

Table ***3***

Table 3 : Summary of scores - Model feedback and validation workshop

Member	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**		**verage score**
Overall Conceptual framework - Barrier Performance factors	5	5	5	5	5	5	5	4		**4.89**
Relevance of data	4	4	5	5	5	4	4	4		**4.33**
Models and Techniques	5	5	5	5	5	5	4	5		**4.89**
Interpretation of results	5	4	5	5	5	3	5	4		**4.56**
Overall applied value of the Risk model	5	4	5	5	5	4	4	5		**4.67**

Based on the scores listed, the respondents have given a score of 4.89 to overall conceptual framework and models/ techniques, 4.67 overall applied value of the risk model, 4.56 for the interpretation of the results and 4.33 for the relevance of the data. The average of all the components was 4.67 which means that the model is highly reliable. In conclusion, the respondents found value for the model application in real life.

Apart from the ratings, the respondents gave positive comments in the feedback form. Excerpts from the forms are given below:

- Use of Bayesian Network and combination of Bowtie is a very excellent idea & its self-learning ability will maintain a dynamic overview of Barrier Risk Management.
- Excellent presentation. Clearly a deep understanding of the topic. The presentation was well received.
- Very good project and good research.
-

- **Conclusion and Recommendations**
- This paper has presented a novel approach to transform the Bow-tie to a Bayesian Risk model. Through the use of the Safety barrier evaluation factors, a subjective rating was assigned to the individual barriers and the scores were used as an input for the

Bayesian model. The Dynamic Bayesian Risk model can be used to evaluate the operational risk of the drilling Major accident hazards. Through this model, it was identified that the personnel risk during drilling operations was found to be higher in comparison to the asset risk. The results of this model could assist the drilling operators to prioritize their efforts on safety barriers performance which could have a positive effect in reducing the operational risk to personnel. The model was validated through a workshop and the approaches along with the results were presented to a multi-disciplinary group. The model and the results were well received by the group with an average rating of 4.67 out of 5 for all the parameters.

Future work could be carried out in the areas of benchmarking safety barriers performance across various asset locations and safety barrier performance optimization to manage the operational risk in an effective manner. Further, this model could be extrapolated to other disciplines such as Environment and Enterprise wide Risks.

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Unfolding evolution of strategic CSR: A review.

Navdeep Singh Mehram*, Dr. Tarun Dhingra**

**PhD scholar , CoMES, University of Petroleum and Energy Studies*

*** Senior associate professor, CoMES, University of Petroleum and Energy Studies*

Abstract

Corporate Social Responsibility (CSR) has a long history on how it is defined and evolved from philanthropy to responsibility. This review paper is an attempt to understand the evolution of CSR from periphery to become strategic, through a structured literature review which unfolds different concepts and themes. This paper analyzed the evolution of CSR from 1950s onwards and also how the researchers have captured the trends and evolved the concept to bring it closer to the corporate reality, both nationally and internationally.

The journey reveals how CSR evolved at international level and also tries to examine the Indian scenario in terms of acceptance and evolution. The review reveals that the two cycles of evolutions appear to be fettered with each other. The international evolution is ahead of the curve, especially in the area of reporting due to compliance requirements of the developed economies.

This paper unveils how this shift towards 'Performance Orientation' has resulted in CSR's metamorphose to its new avatar of Strategic CSR. In light of new policy regime in India, where the CSR has moved from voluntary to mandatory requirement, the Strategic CSR has now been positioned in the boardrooms. This paper attempts to unfold the evolution of CSR in three phases starting from 1950s to 1970s, 1970s to 1990s and finally the momentous 1990s onwards years. In continuation, how CSR evolved to Strategic CSR and what are the salient feature of the same.

Key words

Corporate Social Responsibility, Strategic CSR, Evolution of CSR.

Introduction

Academicians and practitioners have realized that from what was dismissed as an irrelevant and debatable idea, how CSR has emerged one of the high ranking topics. CSR gained attention over the last two

decades when the world developed at a rapid pace with technological advancements and a more outward-looking society. According to Lee (P., 2008) the research on CSR has largely been conceptualized in two areas. One in terms of its level of analysis from macro social effects to more firm level analysis and its impact on firm's performance. Second, on the theoretical orientation, which shifted from explicitly normative and ethics orientation to implicit normative and performance-oriented.

This paper attempts to understand how this shift towards 'Performance Orientation' has resulted in CSR's metamorphose to its new avatar of Strategic CSR. In light of new policy regime in India, where the CSR has moved from voluntary space to mandatory requirement, the Strategic CSR has now been positioned in the boardrooms.

This paper attempts to unfold the evolution of CSR in three phases starting from 1950s to 1970s, 1970s to 1990s and finally the momentous 1990s onwards years. In continuation, how CSR evolved to Strategic CSR and what are the salient feature of the same.

Finally this paper tries to capture how CSR has evolved in Indian context, especially from voluntary to mandatory effort.

Defining CSR

Corporate Social Responsibility (CSR) is much researched topic and a number of definitions are developed on constitution and delivering CSR because of interface with different groups who hold diverse perceptions and prioritization depending on the context they operate in (Dahlsrud, 2008). The major aspect of CSR is how companies identify and engage its stakeholders and how community relations are viewed and placed within these broader frameworks and its variations. The definitional confusion surrounding CSR might potentially be a significant problem. The productive engagements will not happen, if people have different understanding or interpretation of CSR and competing definitions will create diverging biases. Since there is no methodology to verify, so any effort to develop an unbiased definition is challenging. People who would be engaged in CSR will only appreciate through ground level understanding of the reality to be able to develop an unbiased definition.

The European Commission (2013)defined CSR from the perspective of impacts it leaves on society through its various operations and activities. It suggests the CSR policy shout integrate ethical human

rights, social, environmental and consumer concerns into the core strategy of the business working closely with all stakeholders. The World Business Council for Sustainable Development (WBCSD's) defines CSR as a continuing commitment by business to make positive impact on communities and society at large and contribute towards economic development responsibly.

Analysis: The 1950s and 1970s

During 50s Bowen (H, 1953) suggested that social responsibility may not be the best solution to the potential social issues of the business, however, this may suggest business in long term to pursue social responsibility or not. Social responsibility is an obligation of the business and must define necessary policies to address it. *The Practice of Management*(Drucker, 1954) introduced the concept of public responsibility by the business as a key foundation stone for success. Ethical obligation also started getting growing attention during this period, where managers to assume responsibility of public good. To have harmony, stability and growth, business should promote public good. Fredrick (W.C., 1960) in his viewpoint wrote that the in this decade CSR was believed to be the idea of corporate managers as public trustees and their role to balance the competing claims to corporate resources; and the acceptance of charity as an expression of company's provision of good causes.

Heald(M. H. , 1970) analyzed that in 1960s philanthropy, customer relations, employee improvements and stockholder relations were considered to be the socially responsible actions. The mention of community as stakeholder was new on the horizon. This period also was a stage of ''corporate social responsiveness''. Scholars put forward the argument of ethics to define CSR and to assess the financial implications of the social actions, where it may not be possible to assess the direct measurable economic return.

Dynamic Phase of CSR: the 1970s to 1990s

In the 1970s, the major focus of the authors highlighted CSR efforts as a strategy that did not conflict with the fundamental interests of business. Milton Friedman (M. F. , 1970) in his article in New York Times Magazine 'The Social responsibility of business is to increase profit' emphasized ethical practices and market intervention in determining the discourse on CSR.

For long terms, if such social demands generate financial gains, then they should be considered positively. So if firm's self-interest of generating profits is met, social initiatives are welcomed.

In the beginning of 1970s, a lot of focus came on reporting which also created a new opportunity for the auditors to conduct social audits. On April 22, 1970 the first Earth Day was celebrated to create awareness about environment. Greenpeace, the first major Non-Governmental Organization (NGO) shifted its focus from public body to private sector to campaign around their unethical business practices. Social Audit Limited was established in 1978 in UK. A lot of focus on environmental issues was emphasized by various stakeholders.

Perhaps one of the best known concepts of CSR is Carroll's Pyramid of CSR (1979) which segregated the definition of CSR in four key responsibilities Economic, Legal, Ethical and Philanthropy. For economic component, it is expected that business to produce goods and services and sell them at a profit, not compromising the law, serving the legal component. Carroll then specify that nature of the other two responsibilities extends beyond mere compliance to the law which being ethical and have philanthropic efforts. The ethical components represent the kinds of ethical norms and behaviors expected by the society from business to follow. The discretionary components of demonstrating voluntary or philanthropy roles that business undertakes but there is not much clarity from the society as it does in ethical responsibility.

In 1982, Business in Community was founded in UK with focus on Corporate Social Responsibility. Donaldson (Donaldson, 1982) brought a very important theme on the table that businesses have a social contract with the society in which they operate. This further brought the term *social* license to operate(Kieren Moffat, 2013), which emerged within the mining industry as a response to social risk. Since then, the term has been adopted by a wide range of actors in the resources sector including mining companies.

One of the most revolutionary book by Edward Freeman (Streategic Management: A Stakeholder Approach, 1984) made CSR as mainstream agenda. The fundamental principle that "the firm takes into account all of those groups and individuals that can affect, or are affected by, the accomplishment of organizational purpose".

As per stakeholder theory, the firm not only requires an understanding of the types and nature of the stakeholder's influence but also the response by the firms to those influences, will complete the engagement loop. The stakeholder engagement is suggested under three major categories Normative (ought to), Descriptive (how it is) and Instrumental (conducive).

Steven Wartick and Philip Cochran (1985) offered their three dimensional integration model which considered social issues and social responsiveness to understand the social performance. Social responsiveness is a process to respond to the ethical principle of CSR and it should achieve the policy of managing social issues responsibly. Proper integrated approach to the three dimensions; philosophical (ethical), institutional (social responsiveness and organizational orientation (social issue management), would contribute equally to achieve successful corporate social performance.

The Brundtland Commission (1987) appointed by UN, which studied the connection between Development and Environment and came up with a report "Our Common Future". This report probably first time introduced the term "sustainable development'. In this period, the interests of society and business came closer and businesses became more responsive to their stakeholders, moving beyond shareholders focus.

Momentum Building: the 1990s and Onwards

A transformational period which began with 'Earth Summit' in Rio de Janeiro in 1992, where delegates of 180 countries agreed on 'Rio Declaration on Environment and Development' which had 27 principles backing sustainable development. In mid 1990s, Business for Social Responsibility (BSR) in US and Fair Trade founded with a mission to improve the position of disadvantaged producers in the developing countries by setting the Fair Trade Standards and supporting their interests. In 1995, World Business Council for Sustainable Development (WBCSD) came into existence with an aim to foster sustainable development and CSR agenda by catalyzing dialogue and policy level interventions. In 1996, Kyoto Protocol for implementation of Framework Convention on Climate Change was introduced. In 1997, SA8000 standards were introduced by Social Accountability International, USA, which was a voluntary verifiable certification program. This period experienced greater focus on lifting the

standard of CSR efforts and benchmark them for further improvement.

In the mid-1990s, with internet and all other technologies, the communication capabilities of the world enhanced the strength of institutions to exert new pressures on businesses to increase their CSR efforts. Majority of the company's assets were more in intangible form (reputation, goodwill and human capital (Waddock, 2008), which provided great opportunity to increase the importance of CSR. In 1997, John Elkington attempted to measure sustainability by incorporating an accounting framework called the Triple Bottom Line (TBL), a framework that goes beyond the traditional measures of return on investment, profits and value to the shareholders, but add social and environmental dimensions to the performance evaluation. TBL framework focused on comprehensive investment on people, profits, and the planetwhich emerged asimportant tool to support sustainability goals. In the same year, Global Reporting Initiative (GRI) was launched by UN as sustainability reporting guidelines, which later on developed more updated versions.

The year 1999 witnessed two major developments. The UN launched Global Compact, which brought together businesses, civil society, labour and UN agencies to support ten principles on human rights, labour and environment. Second was the Dow Jones Sustainability Index which tracked the performance of leading sustainable companies was the first global indexes. The Millennium Development Goals (MDG) were launched by UN to work on 8 goals for next 15 years, which were adopted by 189 member states. In the year 2000, the UK Government appointed the world's first minister for CSR. The FTSE4Good index was launched in 2001. With huge emphasis on ethics and reporting, this period was dominated by 'social audits' resulting in sustainability reporting by businesses.

Som Sekhar Bhattacharya (2009) attempted to captured the historic journey of CSR using metaphor like labyrinth which discovered many sister terms of CSR in business and society literature. These terms were: Corporate Social Responsiveness, Corporate Citizenship (CC), Global Business Citizenship (GBC), Business Citizenship (BC), and CorporateSustainability, business Case for Sustainability, Strategic CSR, and CSR

Continuum. This informed that there are varied shades and colors of interactions of society and business in the social responsibility space. Scholars analyzed various competing terms and concepts which were shaping the understanding on CSR Waddock (2004).

The ambiguity of defining same concept with different terms and connotations in different and sometimes same papers. Salzmannet al. (2005) defined this as the Business Case for Sustainability (BCS) as profit-driven, strategic corporate initiatives towards social and environmental issues. BCS initiatives are done by a firm's primary and secondary activities. According to Waddock(2008), the emerging institutionalization of CSR brought forward new rules of engagement particularly for companies with global footprint. These new rules go beyond to do better corporate responsibility efforts on environmental, social, and governance issues and not limit to maximizing shareholder value. For example, large corporations are expected to; be more transparent about their activities; Produce sustainability; engage with stakeholders in dialogue, partnerships; Live up to different principles and standards depending on their industry.

Evolution of Strategic CSR

Prudent altruism would be more desired status for any individual or business to aim for as suggested by Friedman, can be the epitome of Strategic CSR. Economic and social objectives of any business are inseparable as believed by Porter and Kramer (Porter, 2006) because they both contribute towards making the society a better place to live. Strategic CSR viewpoint is much more than that which aims for profit making while remaining socially and ethically responsible. Other scholars emphasized that business should do only those type of CSR activities in which they have knowledge, experience and expertise, and if possible in the areas related to business activities. Moving away from traditional charity, strategic CSR requires utilization of business core skills/competencies which includes human, financial, processes and visioning to address social issues. Traditional benevolent contributions do not hold good in strategic CSR framework, especially when the business is strategizing long term suggested by McAlister and Ferrell (2002).

Strategic CSR is carried out to secure business continuity and also address social causes (McAlister, 2006). Some firms

adopted strategic CSR activities to support or augment business marketing and PR activities. The lack of sustained interest through charity type CSR activities lead to new emergent thought around strategic CSR in literature, which looked for making business sense or strategic sense (Porter, 2006). Many scholars started to believe that the traditional CSR could not excite beyond 'good to do' whereas more contemporary section of thinkers (Allen, 2007); Porter and Kramer, 2006; 2002); Carroll, 2001) viewed that strategic CSR would deliver great good as well as maximize business benefit in the long run. Business performance can be enhanced through strategic CSR interventions by addressing social causes and creating win-win situation. Werther and Chandler (2006) suggested philosophy of integrating CSR into firm's strategic perspective, processes and invest in activities or themes related to its core business or core competencies.

To build strategic CSR intervention at firm level Bhattacharya at all (2008) attempted to provide a structured conceptual framework. First step is to identify stakeholders (Freeman R. E., 1984) who are parties or individuals that are affected or can be affected by firm's business operations. On similar lines (Hopkins, 2003) said that firm's stakeholders have a concern, claim (because of moral or legal reasons) and interest in firm activities. On moral grounds Langtry (1994) suggested that in both scenarios of firm/s decision to act or not to act on concerns, the stakeholders face the consequences.

The trends and patterns of firm's behavior in past, present and future guide the relationship dynamics between the firm and the stakeholders Clarkson (1995). These stakeholders can be internal (shareholders, owners, investors, employees) and external (suppliers, competitors, customers, special interest groups, Government and wider community.) Some authors were of the opinion that stakeholders have to be classified either as primary stakeholders or as secondary stakeholders. Primary stakeholders were seen as stakeholders who impacted or related to the primary firm functions and thus were important for the survival of the organization (Clarkson, 1995). While Secondary stakeholders are concerned with the secondary (support) firm functions and thus, are not of existential importance to the firm. Thus, primary stakeholders consists of shareholders, employees, customers, suppliers etc. while a secondary stakeholder would typically be special-interest groups.

The way stakeholders are identified can be viewed as the starting point for the conceptualization of the nature of stakeholder theory (Kaler, 2003).

Mitchell and his colleagues theorized to identify stakeholders based on their salience as they termed it. Stakeholder salience was a function of the stakeholder attributes of stakeholder power, legitimacy and urgency. Stakeholder Power means that the stakeholder can harm, hurt and damage firm assets and functioning. Powerful stakeholders are often politically connected and thus, are the influencers and are very prominent in the society.

Legitimate stakeholders are harmed because of the firm business activities (Porter, 2006); (Ronald K. Mitchell, 1997). Also stakeholders have legitimacy when the firm management view the stakeholders' claims as appropriate and reasonable (Suchman, 1995). This legitimacy is derived from the moral values, norms or beliefs of the firm management. Stakeholder urgency represents the degree of quickness to which a stakeholder claims has to be attended to.

It represents the time sensitivity and criticality of the firm stakeholder relationship. The salience of stakeholders of a firm will differ from one firm to another.

When a firm does CSR with a salient stakeholder (Ronald K. Mitchell, 1997) then this CSR activity has to satisfy the needs and aspirations of the salient stakeholder. If the CSR activity with a salient stakeholder goes wrong (unsatisfactory) then the salient stakeholder may challenge the discourse. Francis Weyzig(Weyzig, 2008) argues that there are political and economic dimensions which firm needs to bear in mind while selecting their strategy and approach to CSR.

Firms should integrate CSR into its corporate strategic plan and action suggested by Van de Ven and Jeurissen(2005), the more and the better the firm is, the more chances to meet the needs and demands of its stakeholders. Thus, to undertake strategic CSR initiatives, the firm management has to identify salient stakeholders because it is the salient stakeholders, who are important, relevant and matter to the firm. Thus, based on the parameters of stakeholder attributes, first of all salient stakeholders have to be identified. The firms can identify the salient stakeholders based on the inputs from:

- Firm's internal sources like its employees and managers, who are associated or interact with such stakeholders. Such type of firm

employees can provide the firm management necessary information about the salience of the stakeholders.

- NGOs and Community Based Organizations (CBOs) or Institutions are the second possible source of figuring out the salient stakeholders.
- These institutions can provide details about the nature of stakeholder attributes demonstrating salience. These institutions can provide such information because they are more embedded in the society than a business organization.

Further, in certain cases, these institutions represent sections of society (can be stakeholders) and also air the voice and concern of the society.

Once the salient stakeholders are identified, the interests of the salient stakeholders have to be listed based on intimate, repeated interaction with the salient stakeholders. The listed interests of the salient stakeholders provide the firm's management a direction to anticipate and deliberate about what the key and relevant stakeholders expect from the firm.

The concept of value chain and creating shared value was presented by Porter and Kramer (2006), which emphasized on building strategic CSR interventions to improve and secure value chain activities. Few examples of MNCs like Nestlé's, enunciate how they integrated their CSR within their value chain to improve efficiencies to secure sustainability. Their focus on primary activities such as securing means of inputs and support activities such as smooth logistics led to great trust, reputation and credibility.

On similar line of thinking, Porter and Kramer (Porter, 2006) suggested to understand that a firm operate in a context which has externalities, which should be aimed to improve through strategic CSR interventions to firm's competitive advantage. This advantage will have spillover to improve the whole industry which in turns helps the firm. Intervention that can generate long terms opportunities such as infrastructure, conditions for demand of higher quality product and services, trained workforce pool, uninterrupted means of inputs can be envisioned while developed strategic CSR portfolio to improve value chain and the business context.

Other strategic CSR activities can be focused on improving product/service quality aspects such as environment friendliness, responsible marketing codes,

product safety etc to improve quality of life. Long terms public policy initiatives to recommend and help frame rules and regulations for healthy competition, better investment climate, protection of intellectual property etc. so as to make inter firm rivalry situation favourable.

By undertaking strategic CSR interventions the firms can get access to both tangible (physical resources such as raw material, human resource, increased profits etc.) and intangible resources (reputation, brand name, goodwill, know-how) that is of strategic importance to the firm (Fouts, 1997); (Manuel Castelo Branco, 2006). If such resources are unique to the firm, valuable to the firm's customers, rare, inimitable or imperfectly substitutable for the competitors, then such resources are strategic resources (Bhattacharyya, 2010) and can provide the firm competitive advantage (Barney, 1991).

New products, which are for the economically marginalized (Bottom of Pyramid) or the socially marginalized (physically challenged) would provide new product-markets and hence, would reap in new benefits. Strategic CSR also leads to an increased credibility, recognition and visibility of a firm from both the key internal and external stakeholders.

The business can enhance its image through CSR, which in turn can create favorable environment to get social license to operate, plan brown field investments, access to finance, visibility, reputation, being preferred employer and favourable customer choice.

Strategic CSR has the potential to ensure business continuity and can mitigate negative image emerged because of some historic intendants. In addition, Strategic CSR builds positive and stable environment which may divert any stringent regulation and investigations. It can protect from negative risks that may arise from uncertain externalities such as extra duties or any other financial risks.

Evolution of CSR in India

Indian history is rich enough where scholars, thinkers and philosophers have promoted charity and philanthropy. Literature conveys that businesses were asked while doing business, they should help the deprived and needy people. Many religions in the country guides and motivate to draw some percentage of your personal earning to help

the poor and needy. Industrial houses in 19th century, out of their compassion have made definite contribution (cash or kind) for charity work. But these activities were carried out sporadic and from feel good or fear from god perspectives, mostly from personal savings, without disturbing the shareholders wealth in the business. Mostly the spending was done on building civic infrastructure like schools, colleges, hostels, health centers and temples for public use.

This shift in thinking from charity and philanthropy only started during 1990' where business could see connection between CSR and business engagements more directly. The society and business cannot operate in isolation and the interdependencies of each other were felt very strongly. Since there are wide gaps between different sections of society in India in terms of various socio-economic status, an ideal CSR practice will have both philosophical and ethical dimensions. With evolution need for policy changes to foster more inclusive and sustainable practices is being felt.

We have seen CSR evolving rapidly and progressive firms adopting Strategic CSR policies and practices which also contribute to the larger purpose of nation building. These strategic intervention focus on need based intervention with structured interventions aligned with national priorities. CSR activities are planned in structured, objective and time bound manner to tackle national issues such as education, livelihoods, health, environment and natural resource management.

In 2009, Ministry of Corporate Affairs (MCA) issued Corporate Social Responsibility Voluntary Guidelines by bringing the CSR in forefront. Earlier CSR was understood as governance aspect even in the reports submitted by Task Force on Corporate Excellence. The report made recommendation while highlighting the benefits being realized through CSR activities, but did not suggested any strict actions.

The Voluntary Guidelines of MCA made recommendation to include ethical practices, workers' rights, respect for human rights, safeguarding environment and further the agenda of inclusive growth and development. A guidance on distinction between CSR and philanthropy was provided and was suggested that CSR should be beyond the legal and compliance requirement. In 2011, the revised guidelines were issued by MCA calling them National

Voluntary Guidelines of Social, Environmental and Economic Responsibilities of Business. These guidelines were drafted through a series of stakeholder consultations across the nation. Nine principles with definition and some exemplary work was for business to comprehend the same and then apply within their CSR policy framework.

The guidelines also suggested to earmark a percentage or amount for planned CSR activities. Interestingly during this period, a gradual transition from voluntary to mandatory starting to show up. Securities Exchange Board of India (SEBI) was the first institution to ask their top 100 listed companies, under Clause 55 in their Listing Agreement, to report their CSR activities in the Business Responsibility Reports (BR Reports) as part of Annual Reports. SEBI believed that this will serve the larger public purpose of transparency and integrate corporate governance and social responsibility. Currently the scope is enhanced to top 500 listed companies from 100 earlier.

Indian government while upgrading Company's Act also included provisions for CSR and surprised everyone by mandating it with the enactment of Section 135. There are certain guidelines on percentage spending, schedule VII outlines the kind of activities that will qualify as legitimate CSR activities and a reporting format is also provided for annual reporting. So there is a mandates to spend and report also, leaving very little scope for escape. The expenditure on activities which are benefiting employees and their families does not qualify as legitimate CSR activity as per the new Rules.

However, up to five percent of the CSR spending can be utilized in capacity building employees through expert agencies and institutions. Including the provisions on CSR in Company Law is a milestone event. CSR is still a voluntary effort in the rest of the world and is left to the preference of the business and individual leaders. However, a number of countries have adopted to make reporting of CSR activities undertaken by corporates mandatory, such as Denmark, France, Sweden, the Netherlands, Norway, China and Australia, through some statutory institution(s).

Discussion - Known and unknown facets of CSR

The literature reviewed provided insight into how CSR evolved from 50's when the 'business of business was just business' and

going through transformation during 70's to 80's where it became more dynamic agenda and focus came on firms economic, legal, ethical and philanthropic responsiveness. During 90's it caught up attention of various watch dogs and activist and gained greater momentum. The focus amplified from not only being responsive, but also report and be transparent. In this amplified period UN also patronized CSR and activated their efforts through GRI, Global Compact and MDGs. In the millennium era the academia also gave greater focus to the concept of Strategic CSR by Porter and Kramer was not only popularized in the academia corridors but it caught attention of the business community also.

A number of thinkers have tried to define CSR in various aspects, dimensions, approaches and theoretical orientation, and most appropriate in our opinion being derived from the Stakeholder Theory by Freeman. Understanding the ecosystem of business context and identification of its stakeholders from their salience perspective was suggested by scholars. The dimension of normative, descriptive and instrumental approach of engaging or managing stakeholders can be very relevant for practitioner to develop strategy. Scholars have time to time challenged the definition of CSR and this got more refined over period when the wide gap between theory and practice is being narrowed. The view on Strategic CSR has not only excited the scholars, it has also taken center stage in business decision making. Concept like 'triple bottom line' and people-planet-profit has jargonized the CSR and become part of the business narrative. From last one decade, CSR is in the spotlight and is being used as a vehicle to promote corporate brand and build reputation.

This review also attempts to understand how CSR evolved at international level and also tries to examine the Indian scenario in terms of acceptance and evolution. The review reveals that the two cycles of evolutions appear to be fettered with each other. The international evolution is ahead of the curve, especially in the area of reporting due to compliance requirements of the western economies. The structured CSR scenario in India saw its advent with the introduction of the National Voluntary Guidelines in 2009 followed by CSR provisions of Companies Act 2013, which make it mandatory to spend and report on CSR starting 1st April, 2014 onwards.

The evolution of CSR from philanthropy or charity to strategic CSR has been well

researched and lot of scholars have contributed to the literature to enrich it. In this journey, CSR has also gained legitimacy at least in India in its new avatar of being a mandate from a voluntary activity. This means that new or fresh body of knowledge is being generated in the decision making process in the corporate board rooms. If we chose the metaphor for firms being black boxes, what happen inside is not publically shared, so there is strong need to understand how boardroom discussions are embracing this new mandate and shaping the future discourse of CSR in India. More research is required to gather empirical evidence of impact of theoretical or conceptual constructs being practiced by the firms in this new regime in India.

Requirement of knowledge development on possible topics for further advancement of the field post CSR is a mandate in India.

RQ1 - What kind of new requirements are emerging in India in terms of strategic planning to deploy firm's strategic resources on Strategic CSR activities.

RQ2- What kind of human resource requirements are emerging in terms of knowledge and skill set for CSR practitioners to deliver Strategic CSR.

RQ3 – What kind of courses and certificate programs are to be developed by academic institutions to develop CSR professionals in India.

RQ4 – What kind of impact matrices and monitoring & evaluation frameworks are being developed which will be able to provide insight into social and economic return on investment on CSR activities in India.

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