CHAPTER-1
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This chapter presents the macro picture of the need for this study, an introduction to Oil and Gas Engineering Services Outsourcing (O&G ESO) industry and the emergence of Brazil, Russia, India and China (BRIC) as global power houses. The background and motivation for this study are covered in Section 1.2 of this chapter. A subset of the issues detailed in the macro picture are identified as objectives for this study and presented in Section 1.3. The last Section 1.4 outlines the chapters of this thesis and its structure.

1.1 NEED FOR THE STUDY

The strong demand for energy saw the price of Crude Oil soaring past the all-time record high of USD 130 a barrel mark in mid-2008 propelled in significant part by the economic growth in China, India and other emerging economies. This has reawakened fears of energy and product shortages in the decades ahead.

Once again, there are hectic activities taking place globally to develop additional Oil and Gas (O&G) sources: Exploration, Production, Refining, Distribution, Petrochemicals, Liquefied Natural Gas (LNG) and Research and Development (R&D) are attracting quantities of capital they have not seen in a decade or more. The contribution of Engineering Service (ES) companies is crucial to making these new investments successful and profitable. These companies provide a large part of the vital design, engineering, construction and management skills and personnel to make these projects a reality and also to maintain the production assets. Whether as a member of the project management team for a petrochemical plant in India, designing an offshore platform in Russia, or engineering and project management for a North Sea gas field, or developing operating procedures for prototype technology exploiting the Alberta Oil sands, the ES industry is instrumental in turning prospects into projects and further into products. High energy prices and the consequent capital

investment have sharply raised demand for O&G services across the whole value chain of designing, delivering and supporting projects. A large proportion of the value chain is in the supply chain - ensuring that the right parts, people and processes are available at the right time. Moreover, within the supply chain, a few key roles can be significantly important to the success of a project. This strategic issue has been magnified by a global shortage of skilled personnel, which has created a mismatch between the number of projects and the number of people available to carry these out. As the demand for services intensifies therefore, all sections of the O&G industry have to find new ways of implementing projects and working together to produce the energy the world craves.

1.1.1 Changing Demand Side

Higher energy prices are resulting in much more than a simple increase in the number of O&G projects being proposed or undertaken around the world. The whole landscape has changed for the O&G industry and the ES industry in the few years since this latest energy boom began. New and different relationships are developing between the O&G ES industry and its clients; and in emerging economies such as China and South East Asia downstream projects, petrochemicals and LNG for example, are increasingly important. Alongside renewed interest in established O&G provinces, exploration and development is spreading to frontier environments; partly as a result, projects tend to be more numerous, bigger and more complex, employing new or previously uneconomic technologies, and there is pressure to complete projects on a fast track basis. Sustainability of projects is at the forefront of planning and implementation. In assessing contracts, greater consideration is given to value over and above the simple criterion of cost.

Historically, the main clients of the O&G services industry have been International Oil Companies (IOCs), such as British Petroleum (BP), Shell and Exxon, and National Oil Companies (NOCs), such as Indian Oil Corporation, Kuwait National Oil Company, Petronas in Malaysia, and China National Offshore Oil Corporation. More recently, other state enterprises, for example in the LNG and petrochemical sectors, have become increasingly prominent clients, as have large private investors or joint ventures between local national or private concerns and international companies, such as Reliance Industries Limited, Jamnagar or SECCO, the Shanghai Ethylene

Chemical Company (consisting of BP, Sinopec - the China National Petrochemical Company - and Shanghai Petrochemical Company). More recently, other state enterprises, for example in the LNG and petrochemical sectors, have become increasingly prominent clients, as have joint ventures involving local national or private concerns and international companies, such as ATA in Azerbaijan (consisting of AMEC, Tekfen of Turkey and Azfen of Azerbaijan) or SECCO, the Shanghai Ethylene Chemical Company (consisting of BP, Sinopec - the China National Petrochemical Company - and Shanghai Petrochemical Company).

The O&G ES industry's relationship with IOCs and other clients used to be relatively straightforward. IOCs executed projects and employed armies of experts; the O&G ES industry supported IOCs as consultants and contractors. But when energy prices were low in the 1990s, many O&G companies cut back their own engineering, project management and execution capacity. One result was that declining reserves were not replaced as fast as later proved to be necessary. Another result was that the weak demand for services discouraged people, especially qualified graduates, from entering the industry.

While some companies are trying to take skills back in-house, the dominant trend is towards energy companies outsourcing more scope from a project to reduce overall execution time. This is especially true of IOCs, but is also becoming more evident among NOCs and a wide variety of other, usually national or local, enterprises. The same is true of small O&G companies, some of whom are outsourcing to 'duty holder' level - under which, in the United Kingdom (UK) sector of the North Sea, an O&G ES provider company is legally responsible for ensuring that the statutory requirements in areas such as health and safety, employment and environmental protection are fulfilled for all of the project for which the company is contracted. Moreover, the relationships between the O&G companies themselves are shifting. In Russia and Azerbaijan, for instance, IOCs generally operate under Production Sharing Agreements.

1.1.2 Frontier Development and Sustainability

Relentless demand for hydrocarbons, higher energy prices and diminishing production from known and mature fields are increasing the attraction of hitherto unprofitable areas. But the attraction comes at a price. Conditions off Sakhalin Island, a frontier

O&G province on the Pacific coast of Russia, are extremely difficult. Temperatures range from –40 Degrees Centigrade in winter to +40 Degrees Centigrade in summer. The place is remote, the winds are strong, the water deep. The remoteness means that supply chains are long and tortuous. All these factors make risks, as well as costs, commensurately high and only very big, well-capitalized companies can undertake this kind of work. Companies are under pressure to find new reserves and bring them into production as fast a possible. The outcome is tight timetables for even the most complex projects.

However, not all the new work is in frontier areas. Some mature provinces are taking on a new lease of life. In common with many other oil provinces, the Middle East suffered from underinvestment in the 1990s. But the region is still home to the world's biggest known reserves of hydrocarbons and will continue to be pivotal long after other regions have declined. Middle East NOCs, that tend to dominate national markets, are anxious to bring more reserves to the point where they can be exploited. Similar trends can be seen in regions as diverse as the Gulf of Mexico, Indonesia and the North Sea. And projects need not be wholly new. The lives of fields are being extended by 'Brownfield' projects, for example a sub-sea addition to an existing well. Such developments are appealing when the imperative is to bring capacity on stream as fast as possible: instead of taking 4-10 years to bring a new field into production, a Brownfield project might take only nine months to two years.

A marked feature of the new market place is the sheer variety of projects by type and place. The classic types form a matrix of Asset Development (capital expenditure), Asset Support (operating expenditure), Upstream projects (O&G production) and Downstream projects (refining, liquefaction, petrochemicals). To these can be added storage, pipelines and marketing. Projects can be found in every corner of the world, and a significant number are global undertakings, involving people working together, for instance, in Aberdeen, Houston and Mumbai, exploiting the power of modern technology to share design, engineering and management expertise over great distances.

However, social and environmental concerns shape projects more than ever. IOCs and contractors operate globally under the watchful gaze of the media and Non-

Governmental Organizations (NGOs). They realized many years ago that the cost to their reputation of ill-considered behaviour could be severe. But in more recent years, host countries and NOCs have also become much more conscious of the importance of Sustainability. Essentially, Sustainability means two things: respecting the environment and people where they work; and in this context, ensuring that a project, which in its nature is usually long term, does not continue to draw excessively on foreign capital and expertise after it comes into production.

The practical consequence is that IOCs and contractors use fewer expatriate staff, strive to nurture local skills from welding to managing, and work with local enterprises to develop supply chains ranging from entire yards for fabricating rigs to specialist pump manufacturers. For the O&G ES service provider industry, long associated with a contractor mentality and accustomed to flying in to a job and then moving on, the idea of 'leaving something behind' is a significant culture change.

1.1.3 Value versus Cost

Capital efficiency is the watchword for many Oil companies, especially IOCs. Faced with a sudden abundance of projects relative to their resources, particularly their human resources, the companies need to make their capital work as efficiently as possible. Contractors, moreover, are playing bigger roles in Asset Development and Asset Support. The perhaps paradoxical result is that oil companies now ask contractors a different basic question. It used generally to be: "How much does it cost?" Today, it is increasingly likely to be: "What value do you add?".

This is not a simple question. The answer might involve a complex trade-off between, on the one hand, a low-cost solution which takes longer to bring a find into production and, on the other hand, a superficially more expensive suite of services which speeds up the completion of the project and saves money by generating income earlier. The more sophisticated the services, for example, the latest project management techniques, the more complex the trade-off may be.

The O&G ES industry's response to these challenges is dominated by the global skills shortage. The energy boom of recent years has exposed the underinvestment in the

O&G industry in the 1990s and poor prediction of future demand for people and services. Although O&G companies have stepped up spending in the last two or three years, much of it has gone on reserve replacement and raising production rather than service provision. Graduates and other younger people are entering the industry but many experienced engineers are close to retirement and underinvestment has left the ranks of middle managers – the next senior generation – particularly thin. Not all regions suffer equally. Skill shortages are a major constraint in Africa, the Middle East and parts of the Former Soviet Union. By contrast, South East Asia and the Far East do not face quite the same problems. A ready supply of labour from the Philippines, India and to a degree Indonesia alleviates some of the strain in this region. China is training hundreds of thousands of engineers and other qualified personnel. Indeed, some Chinese companies are competing with Western contractors, offering their services in the Middle East and even Calgary, where the O&G boom is causing typical labour market overheating. But overall the picture is broadly the same: oil companies, contractors and other enterprises are locked in fierce competition for a skilled labour pool which is too small for the available work. How is the O&G ES industry responding? The first step is to understand more clearly what clients want.

The basic services remain the same for all O&G ES companies. While Program/project management, Front end services (design and preparation), Technology (such as management software) and Engineering are areas the ES companies support in the asset development phase; Facilities engineering, Brownfield projects, Production operations, Operations and Maintenance (O&M) are support services rendered in the asset support phase.

The changes are in how work is executed. The key requirements which emerge from analysis of the demand side are: cost savings; faster project delivery; greater long-term value; world-wide support; multi-site partnering; sustainability, in particular training and development of local staff; service across the value chain; life-of-asset support; and access to technology and knowhow. The real challenge, therefore, is how to meet these requirements. The general answer is to increase efficiency. More specifically, there are two elements to focus on to achieve this - more efficient use of personnel and improved ways of working with partners.

1.1.4 Introduction to Oil & Gas Engineering Services Outsourcing (O&G ESO)

Given that it is no longer possible to use expatriates on the scale of a decade ago, even if that were desirable, the solution is a combination of personnel development and competence analysis. Many countries such as Nigeria, Oman and China have formal or informal requirements that local staff be a certain proportion of the total. Even in countries which do not have such requirements, there is little alternative to 'localization'. In Azerbaijan, for example, welders had to be found for a yard building rigs for the Azerbaijan International Oil Company (AIOC) project. There was no question of importing welders, but competence analysis showed that local welders did not work in ways compatible with new technology. They had to be retrained to do the job with different equipment. Local labour contributed 75 per cent of the man-hours on the project, but required 125,000 hours of training.

However, developing local capacity of this kind can take a decade and managers are particularly hard to find. One structure for making the best use of expatriates is to divide the world into regions, in which key managers are placed, and base functional expertise in hubs such as North America, the UK and Europe and Singapore. This approach gives clients the global support they require with the flexibility to adjust to conditions on the ground. Contractors can also redistribute work from employment hotspots: from Houston to the Carolinas, from Aberdeen to Newcastle, from Calgary to Vancouver. Indeed, in Alberta, where oil companies are investing tens of Billions of Dollars to recover potentially vast reserves from oil sands, redistributing work is only part of the solution. Work is also being outsourced to engineering centres such as Brazil, Russia, India and China and Indonesia and staffs are being recruited from around the world to relieve the acute local skills shortage. These companies in other countries that provide support are known as O&G ES Outsourcing companies or O&G ESO service providers. The ability to draw on and manage resources globally to support a client gives a services company a distinct competitive edge.

The amount of work being outsourced by O&G companies today means that many partners may be involved in a project. Leading Oil Field Service (OFS) companies

such as Schlumburger, Aker Solutions and Halliburton have become project integrators, responsible for ensuring that all aspects of the project fit together in the right way. The importance of being a project integrator has led to long-term contracts with clients, who increasingly appoint service providers on a preferred contractor basis. It also increases the pressure on contractors to share experience from around the world and reduce dependence on expensive prototypes. Instead of treating every project as unique, there is a trend towards sharing technology – as with the Harding gas field in the North Sea, whose new production platform draws on experience from the UK Continental Shelf and the Gulf of Mexico - or developing 'design one - build multi' installations. Clients and contractors are growing more willing to learn from each other and be less rigid about the boundaries in their relationship. The central idea here is communication – genuine two-way dialogue. With projects involving many parties and cultures, project integration demands more openness than in the past. All parties must be clear about goals, timetables, and methods and be prepared to discuss them. This is especially true of safety, not least because some societies have a different outlook with regard to safety issues. Communication also helps to engineer without – usually unpleasant – surprises, especially in frontier areas.

The reversal in the fortunes of energy markets in the new millennium has caused an overlap of generations of projects: working assets need to be serviced, old ones decommissioned or extended and new assets developed. Nor, barring an equally unexpected fall in demand for energy, will the picture alter soon. Although global energy demand is rising by three to four per cent a year, the proportion contributed by O&G is thought unlikely to change significantly over the next 30 years from the present two-thirds. New oil provinces such as Vietnam are under development and the thrust into frontier areas shows no sign of abating. Contractors and clients are still coming to terms with new markets and relationships characterized by a global skills shortage which is unlikely to ease soon. With O&G ESO companies becoming project integrators, technology, localization and communication will help to offset the skills shortage faced by the global O&G industry.

1.1.5 Emergence of BRIC Nations as Global Power Houses

In 'Dreaming with BRICs : The Path to 2050', Goldman Sachs Economics Research (2003) summarises the following findings:

- Over the next 50 years, Brazil, Russia, India and China - the BRICs economies - could become a much larger force in the world economy. Using the latest demographic projections and a model of capital accumulation and productivity growth, the report maps out Gross Domestic Product (GDP) growth, income per capita and currency movements in the BRICs economies until 2050.
- In less than 40 years, the BRICs economies together could be larger than the G6 (collective term for USA, UK, Germany, Japan, Italy and France) in USD terms. By 2025 they could account for over half the size of the G6. Currently they are worth less than 15%. Of the current G6, only the USA and Japan may be among the six largest economies in USD terms in 2050.
- About two-thirds of the increase in USD GDP from the BRICs should come from higher real growth, with the balance through currency appreciation. The BRICs' real exchange rates could appreciate by up to 300% over the next 50 years (an average of 2.5% a year).
- The shift in GDP relative to the G6 takes place steadily over the period, but is most dramatic in the first thirty years. Growth for the BRICs is likely to slow significantly toward the end of the period, with only India seeing growth rates significantly above 3% by 2050. And individuals in the BRICs are still likely to be poorer on average than individuals in the G6 economies, with the exception of Russia. China's per capita income could be roughly what the developed economies are now (about USD 30,000 per capita).
- As early as 2009, the annual increase in USD spending from the BRICs could be greater than that from the G6 and more than twice as much in USD terms as it is now. By 2025 the annual increase in US dollar spending from the BRICs could be twice that of the G6, and four times higher by 2050.
- The relative importance of the BRICs as an engine of new demand growth and spending power may shift more dramatically and quickly than expected. Higher growth in these economies could offset the impact of greying populations and slower growth in the advanced economies.

- Higher growth may lead to higher returns and increased demand for capital. The weight of the BRICs in investment portfolios could rise sharply. Capital flows might move further in their favour, prompting major currency realignments.
- Rising incomes may also see these economies move through the 'sweet spot' of growth for different kinds of products, as local spending patterns change. This could be an important determinant of demand and pricing patterns for a range of commodities.
- As today's advanced economies become a shrinking part of the world economy, the accompanying shifts in spending could provide significant opportunities for global companies. Being invested in and involved in the right markets - particularly the right emerging markets - may become an increasingly important strategic choice.
- The list of the world's ten largest economies may look quite different in 2050. The largest economies in the world (by GDP) may no longer be the richest (by income per capita), making strategic choices for firms more complex.

Several other economists, research scholars and consulting firms have studied these projections in detail and have concluded that the key assumption underlying these projections is that the BRICs maintain policies and develop institutions that are supportive of growth. Each of the BRICs faces significant challenges in keeping development on track. This means that there is a good chance that the Goldmann Sachs projections are not met, mainly on account of bad policy making. Economists tracking the BRIC nations in the last seven years ever since this report has published are of the conclusion that the predictions will indeed come true since these countries are showing commendable progress in the right direction. If the BRICs come anywhere close to meeting the projections set out by Goldmann Sachs, the implications for the pattern of growth and economic activity could be large.

The last two decades have also seen the emergence of Brazil, Russia, India and China (BRIC) as the principal offshore destinations for Information Technology (IT), Information Technology enabled Services (ITeS) and Business Process Outsourcing (BPO) industries. A combination of positive factors - the favourable wage differential in comparison to developed countries being one of the reasons - have helped aid this

growth. While the IT/ITeS/BPO industry is entering a phase of maturity, the Engineering outsourcing industry is still in its nascent stage and emerging as the new trend or growth area. Though the Engineering Services Outsourcing (ESO) industry in BRIC countries started off in an unorganised way not much behind the BPO and IT/ITeS outsourcing industry, the revenue generated by the ESO industry is much lesser than the BPO/IT/ITeS counterparts.

According to a National Association of Software and Service Companies of India (NASSCOM) and Booz-Allen Hamilton (BAH) study published in August 2006, it is estimated that the global annual spending on Engineering Services is currently valued at 750 Billion USD (BUSD). This market is expected to grow and exceed a Trillion USD (TUSD) by the year 2020. However, only a very small percentage of around 2% (15 BUSD) of the Engineering services spend finds its way to offshore locations. The O&G industry is a key end-user with projects involving intense engineering activities which are either done in-house or by engineering consultants or Erection, Procurement & Construction (EPC) contractors. Engineering work related to the O&G industry has started finding its way to destinations like Brazil, Russia, India, China, Israel, Poland, Mexico and East European countries in the last one decade. Other players in the ESO space are Automotive, Aerospace, Semiconductor R&D etc. Brazil, Russia, India and China possess formidable strengths in this industry but have a long way to go to increase their market share from current levels.

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1.2 BACKGROUND AND MOTIVATION FOR THIS STUDY

Immediately after graduation from the College of Engineering, Thiruvananthapuram, Kerala I joined as a Graduate Engineer trainee at Southern Petrochemical Industries Corporation Limited (SPIC) in their Heavy Chemicals Division at Chennai. However, within a short span of six months I left SPIC and joined as an Engineer trainee at Chennai Petroleum Corporation Limited, Chennai (CPCL - erstwhile Madras Refineries Limited). The training school at CPCL named RESOT (Refinery Engineering School of Training) provided the basic inputs to me on Upstream O&G industry and downstream refining and the petrochemical sectors. I also had the opportunity to work in the Crude/Vaccum distillation units and Tankfarm at CPCL's 7.5 Million Metric Tonnes

per annum (MMTPA) refinery at Manali, Chennai and at the 0.5 MMTPA Mini-refinery owned by CPCL at Nagapattinam in the Cauvery Basin delta of Southern Tamilnadu. My stint at CPCL laid the foundation for me to explore more about the O&G and Petrochemical industry. However, my interest in the Process Control & Instrumentation field (which was my basic subject of study during engineering) led me to take the decision to leave CPCL and join the Engineering company Asea Brown Boveri (ABB) Limited at Bangalore, India. I joined ABB's Chemical, Oil & Gas (COG) division at Bangalore, India and had the unique opportunity to work on a Grassroot Refinery project that was then being setup at Panipat, Haryana, India by Indian Oil Corporation Limited (IOCL). ABB was awarded the contract by IOCL to design, engineer, supply and commission the complete Control system for all the refinery units – Offsites, Utilities, Crude and Vaccum Distillation units, Visbreaker unit, Fluidised Catalytic Cracker unit, Catalytic Reformer unit and the Hydrocracker unit. I was fortunate to have the unique exposure to be involved in the 'concept to commissioning' of this complex project. I started off as a design engineer designing the control systems for certain process sections of this project and also commissioned these systems at the Refinery site at Panipat, Haryana. During my 18 months stay at site I was associated with the commissioning of the 6 MMTPA Crude Distillation Unit (CDU) as also the associated Utilities and Offsites sections. Later during my 9.5 year long stint with ABB, I also had the opportunity to work on several other Refining and petrochemical projects at IOCL Mathura, IOCL Gujarat, IOCL Guwahati, Reliance Hazira etc. and deal with international EPC contractors, design firms and engineering consultancy companies. However, during my busy schedule as a project professional, I always nurtured this inner ambition of doing a higher degree after graduation. This however remained a distant dream for a long time since my job required me to be away for long periods to several remote project sites all over the world. I was also deputed by ABB to their United Kingdom engineering office, and it was here that I was involved in 'process oriented' engineering and had the opportunity to work on International projects – the major one being the Azerbaijan International Oil Company at Baku, Azerbaijan. My stint in the UK extended over 2 years and upon my return to Bangalore, India I was given the unique challenge of setting up an Engineering Centre at Bangalore that was to be a Captive engineering unit for ABB UK's global O&G projects. The centre started

off as a small initiative with just two engineers to begin with, but grew in size to a team of over 100 engineers in a span of two years. I left ABB in mid-2005 to join Emerson Process Management, Mumbai as a Project Manager. Here again, I managed several O&G, Petrochemicals and metal industry projects. I am currently the Country Business Leader for the Asset Optimisation Division at Emerson Process Management based at Mumbai. In the current position, I help clients – primarily in the O&G Upstream/Downstream sectors as also Power plant clients to optimise their plant assets and operate them more efficiently. I have hence had the opportunity to be a maintenance engineer, a design engineer, a commissioning engineer, a project manager and now the in-charge of business for a division within Emerson during the last 16 years of my career.

I joined the University of Petroleum and Energy Studies (UPES) in January 2005 after over 10 years of professional experience in the industry. The University was registering experienced professional degree holders directly to enrol for the Doctoral program. I saw this as an opportunity to integrate my practical knowledge with the academic framework. My experience in the engineering industry motivated me to dwell more into the subject of the emerging trends in the engineering services outsourcing industry. A lot of study and research work have been conducted worldwide about the concept of 'Outsourcing' but one can find little or no information on this activity specifically focusing on the O&G industry needs. Majority of research work conducted on 'Outsourcing' are on the IT/ITeS/BPO Outsourcing and a few on the 'Engineering Services Outsourcing and Knowledge Process Outsourcing (KPO). There are no published studies so far on the engineering services outsourcing specific to the O&G companies. I have travelled extensively all over the world managing several projects and have met with senior management teams from several engineering companies, energy companies and process technology licensors.

I have been closely following the developments of Brazil, Russia, India and China (collectively known as the 'BRIC' economies) ever since the first report on these countries was published by Goldman Sachs in December 2001. This report generated a lot of interest about the future of these economies and when and how they will displace other giant economies like Germany, France, Italy, UK and Japan from the

elite G6 club. It was hence an interesting topic to compare the relative location attractiveness of BRIC nations on the subject of O&G engineering service capabilities since not much work has been done in this area in the past.

The above background led me to pursue this research work and I believe that this study will improve my ability to apply concepts to practice, develop strategic thinking and enhance my professional capability. I also want to use the concepts gained in this study to do a post doctoral research as also guide other doctoral students in their studies on areas of mutual interest.

1.3 STATEMENT OF THE PROBLEM AND RESEARCH OBJECTIVES

In this proposed study on '*A Comparative study of location attractiveness of BRIC nations for O&G Engineering Services Outsourcing (O&G ESO) and strategic growth options for India's O&G ESO industry*', O&G sector companies are defined as those companies that primarily have business interests in O&G, Refining, downstream petrochemicals, terminals and pipelines. The term Outsourcing (or Offshoring) primarily implies the process of 'packaging' engineering work and getting this executed from an offshore location or country. The following types of offshore service providers are part of this study:

- Captive design and engineering offices of O&G companies in Brazil, Russia, India and China which cater to the outsourcing requirements of their parent company. Captive O&G ESO units comprise the units of international engineering and design firms or end users. The offshore captive centres are complementary to other global centres of the same parent group. Captives are independently managed and work on projects for the parent business units globally. e.g. Shell Technology India at Bangalore.
- Engineering Contractors and Consultants who have setup offices in BRIC countries to provide services to their overseas principals/partners where the end-users are O&G sector companies. These are either Captive units, Joint ventures or strategic partnerships with Indian players. e.g. Toyo India Limited, Mumbai; Aker Solutions Limited, Mumbai; Toyo Engineering Corporation, China; Toyo, Brazil etc.

- Standalone O&G engineering companies/contractors that have setup offices in BRIC countries to serve the engineering needs of their offshore clients or for global projects executed by them out of BRIC countries e.g. Larsen & Toubro, Mumbai; Stroytransgaz STG Engineering, Russia etc.
- Sub-contracting companies, and Original Equipment Manufacturers (OEMs) e.g. Emerson Process Management, ABB Limited, and Honeywell Inc who have set up exclusive 'best cost engineering centres' in BRIC countries to serve their parent Business Units that ultimately serve O&G end users or EPC contractors.
- Oil Field Service (OFS) providers that have opened up centres in BRIC countries exclusively to serve the global O&G markets. e.g. Halliburton Oilfield Services India Limited, Mumbai, Halliburton Offshore Services Inc, China, Mumbai and Schlumberger Oilfield Services, Brazil, Mumbai, New Delhi etc. It is to be mentioned here that offices set up by any of these companies to serve the in-country domestic O&G industry are not considered to be part of the study.
- IT companies e.g. Infosys Limited and Wipro Limited that have opened up offshore engineering centres in BRIC countries in partnership with global majors like General Electric (GE) and Alstom, where the ultimate end user or beneficiary is the O&G industry. These are also referred to as Third party/vendor units.

The following six objectives of the study were identified:

1. To determine the variables to compare the location attractiveness between Brazil, Russia, India and China as O&G ESO service provider locations.
2. To determine the current ranking of each country in the BRIC block and rate them as HF-Highly Favourable, F-Favourable, MF-Moderately Favourable or UF-Unfavourable as service provider destinations for O&G ESO.
3. Evaluate the current status of O&G ESO industry in India and what service providers in India are currently doing to garner maximum market share against competing firms in other nations. Understanding the status-quo of the O&G ESO services provided by Indian firms is a starting point from where the directions for improvement can be identified.
4. Evaluate the contribution of the government in helping the O&G ESO service providers in India to tap the available market potential.

5. Recommend action points that industry players in India must take in order to gain market share in the O&G ESO field and build strategic capabilities amongst competing nations.
6. Recommend priority action points that the policy makers and the Indian government require to take in order for the Indian O&G ESO service providers to sustain competitive advantage and consequently position India as a global hub for O&G ESO services.

Earlier researchers on similar subjects have not looked at outsourcing specific to the O&G industry but were conducted primarily for IT/ITeS and BPO industry. No public study has quantified or rated the individual countries with specific reference to the O&G industry needs. Therefore, it was vital to identify and rank the individual countries and determine the ranking of India among the four countries as an important step in the research process. The terms 'O&G ESO' and 'O&G ESO industry' used elsewhere in this thesis mean the same as O&G ESO service provider industry.

1.4 CHAPTER SCHEME

This thesis is organised as described below:

As this study is centred around O&G ESO industry in BRIC countries, **Chapter-1** of the thesis introduces the Global O&G ESO industry and presents the objectives of the study.

Chapter-2 presents the details of research methodology adopted and spells out the research strategy, data collection methods and detailed research process.

In **Chapter-3**, a detailed review of literature has been presented that covers works on Outsourcing industry, works on location attractiveness, Engineering Services Outsourcing (ESO), emerging economies – Brazil, Russia, India and China (BRIC) and engineering services outsourcing related to the O&G industry.

Chapter-4 presents the country overview of BRIC nations from a macro perspective about the scale and size, economic scenario, educational system and services outsourcing industry in each country. A brief on the O&G industry in each country is

also included in this chapter. Assessment of the global spending on O&G ES and the market opportunity for O&G ESO companies is also presented in this chapter.

Chapter-5 presents the Comparative Case Study and the analysis to arrive at the location attractiveness of BRIC nations for O&G ESO. The variables for comparing Location Attractiveness (Objective No. 1 listed in Section 1.3) of BRIC nations for O&G ESO are arrived at in this chapter.

In **Chapter-6** a Statistical analysis of the survey data to determine location attractiveness of BRIC nations as O&G ESO service provider destinations is presented. The activities in India of twenty five select O&G ESO companies are also presented in this chapter to gain an understanding of the current industry trend. This chapter covers the result of the Objective Nos. 2, 3 and 4 listed in Section 1.3.

Chapter-7 is the last chapter of the thesis. This chapter covers the result of the Objective Nos. 5 and 6 listed in Section 1.3. This chapter distills the issues discussed in earlier chapters and also examines the strategic growth options for India's O&G ESO service provider industry so that a clear lead can be maintained over existing and emerging players from competing nations. The chapter concludes the study by presenting a comprehensive set of recommendations to the O&G ESO industry and policy makers so that the available market opportunity is well addressed through a structured approach. This is the main contribution of this study. The chapter also has sections on limitations of the study, contributions and directions for future research.