“Empirical Study of Human Behaviour Facet of Organisational Response (HBFOR) In Upstream Onshore Oil & Gas Industry (UOOGI) Disasters in India”

A Thesis submitted to the

University of Petroleum and Energy Studies

For the Award of

Doctor of Philosophy

In

Management

By

Colonel Avanindra Nath Soni

March. 2023

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DECLARATION

I declare that the thesis entitled *"Empirical Study of Human Behaviour Facet of Organisational Response (HBFOR) In Upstream Onshore Oil & Gas Industry (UOOGI) Disasters in India"* has been prepared by me under the guidance of Dr. Sunil Rai, Chancellor, University of Petroleum & Energy Studies (UPES). No part of this thesis has formed the basis for the award of any degree or fellowship previously.

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CERTIFICATE

I certify that Col. Avanindra Soni has prepared his thesis entitled "Empirical Study of Human Behaviour Facet of Organisational Response (HBFOR) in Upstream Onshore Oil & Gas Industry (UOOGI) Disasters in India" for the award of PhD degree of the University of Petroleum & Energy Studies, under my guidance. He has carried out the work at the School of Business, University of Petroleum & Energy Studies (UPES).

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I certify that Col. Avanindra Soni has prepared this thesis entitled ***"Empirical Study of Human Behaviour Facet of Organisational Response (HBFOR) In Upstream Onshore Oil & Gas Industry (UOOGI) Disasters in India"*** for the award of PhD degree of the University of Petroleum & Energy Studies, under my guidance as a co-supervisor. He carried out the work at the School of Business, University of Petroleum & Energy Studies.

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Acknowledgement

The scholar happen to be very closely associated with the disasters (minor or major) in different spectrum of its occurrence (pre, in-situ or post) from the early professional life and had been observing one of the very facet of human reactions to dangerous situations, which is referred as behaviour. The people display unique behavioural response when faced with dangers / extreme adversity whether affected directly and not so directly in the matrix of disaster. Whether it was a road accident; head-on collision of a bus with the road-side tree leading to many fatal casualties and injurers in year 1984, rescue / relief operations during Orissa Cyclone (1999), was indirectly affected during Bhuj Earthquake (2001), as a victim and leader of air rescue/relief/casualty evacuation of Kashmir Earthquake (2005) and witness to Oil-Well Blow-out, TPL Blast, Crude-Oil Spill, drilling-rig accident and mob-attack on an oil installation (2015-2020). I found the response of different set of people to similar set of danger or emergent situation did not display synchronised behavioural facets by the human resources. I always had this query which kept on growing direction-less since early professional life till superannuation from defence forces and continued even after joining Oil and gas industry (OGI) - highly prone to dangers and witnessed certain operational accidents where human behaviour facet was the causal factor for such accident/disaster.

It was a chance meeting with **Dr Sunil Rai,** then Vice Chancellor where I had an opportunity of having an intense discussion on my exposure to disasters in life (during tenure in defence forces later serving with ONGC Limited, a company dealing with oil and gas exploration and production (Upstream Oil and Gas Industry). The discussion led to giving a direction to my more than three decade query on unique display of behavioural response and igniting academic pursuance to explore the trilogy of disaster, human behaviour and organisational response with the backdrop of Upstream Oil and Gas Industry (UOOGI), an industry highly prone to disasters

and people are not trained to be prepared against square-on scenario with the life and death situations as troops are ingrained in the defence forces. **Dr Rai** (my Guide), a soldier himself (with long years of unblemished and celebrated innings in the submarine arm of Indian Navy), an academician of repute, administrator par-excellence) has been a great teacher, mentor and soul-healer for me. He took me out from bouts of research hallucinations and withdrawals, there were times when I felt this vast domain of research will drown me to unknown depths. And- then rai Sir motivated, prepared me, giving his precious personal attention from extremely busy official schedules and drove me towards the completion of this research project in the true spirit of **गुरु-शिष्य परंपरा** (Teacher-Pupil Tradition). I am extremely thankful to Dr Rai Sir for his continuous, relentless and dedicated support throughout the research study, and solving complex problems in the simplest possible way with multiple solutions and options to address the difficulties.

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I am indebted to Shri VP Mahawar (a renowned professional, internationally acclaimed disaster expert of OGI, often helped me understanding the dynamics of disasters, providing chopper vision of intricacies of managing disasters, behavioural interplay, matrix of human resources and boundary players' inferences and their significance in the scene, which would have evaded the attention of my eye), Shri SK Mitra former Directors Shri M C Mahapatra, Shri M Ayyadurai, Dr Hari Lal, Shri Feroze Dotiwala and Shri Vinay Pandya, the former Executive Directors and my colleagues from Indian Upstream Oil and Gas Industry (ONGC Ltd, OIL, RIL & Vedanta). In addition, Lt Col Tapas C Bhattacharya and other colleague of ONGC Ltd had been great help, who sharpened my skills in understanding the canvas of upstream Oil & Gas Industry, "how industry people and why behave in the way" well beyond mere intellectual add-ons, the valuable inputs provided by them immensely assisted in the related groundwork

and development of the questionnaires, conduct of the surveys and everything else that went into the conduct of this research. I acknowledge for their support as it would not have been possible for me to complete this research.

I would like to profusely thank my elder brother Major General (Dr) Om Prakash Soni, VSM (himself an academician), who very keenly enquired the progress and encouraged on my research. And lastly, yet most deserving thanks to my wife Sadhana whose rock support, motivation (at down times) and counselling ensured the completion of the study, my both Sons & D-in-L (Abhishek and Aditya, Sanjana) always reminded and teased with words “focus on research” consistently encouraged and pushed with the caution “not to quit”, also they helped me in understanding the nuances of papers/journals, presentations etc. At the end, acknowledge that without their bolstering of all it would not have been possible to fulfil this impassioned quest to its rational epilogue.

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Avanindra Nath Soni

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Abstract

The upstream onshore oil and gas industry (UOOGI) is an important sector that contributes significantly to India's economic growth. However, disasters in this industry can have severe consequences, both in terms of environmental damage, ecological destruction and human casualties. One critical aspect of the organizational response to such disasters is the study of human behavior facets of organizational response (HBFOR). Empirical research in this area can provide insights into how individuals and organizations react to disasters and how these reactions can be improved to minimize the impact of such events. This study utilizes the mixed method technique (Qualitative and Quantitative Research Design). The data were collected from 30 respondents through snow-ball sampling for Qualitative Investigation and 250 respondents through cluster sampling for quantitative investigation. Four themes were identified by the braun and clark six step theme identification technique. The study proposes a scale which is further utilized to generate the perception data on human behavior response. The identified themes highlighted the key findings of the study. The policy and procedures category revealed that UOOGI organizations strictly comply with policies, guidelines, and orders of the government of India and the upstream governance regulators. Wearing personal protective equipment is mandatory for all the employees and visitors within the installations. However, mock drills lack realism, innovation, and the element of surprise. Maintenance task schedules and execution are challenging due to production targets. The awareness on disaster category revealed that the human factor is the main cause of disasters in UOOGI. Upstream disasters cause havoc to the environment, ecology, flora, fauna, land, and cause population migration. Human error of omission or commission is the cause of blow-out disasters. Man-made acts cause UOOGI disasters instead of natural disasters. The culture and management perception category revealed that complacency of manpower and health parameters is a significant issue.

CHAPTER - I

INTRODUCTION

Chapter 1

INTRODUCTION

1.1. Introduction and Motivation

Oil India Limited (OIL) operates the Baghjan Oil Field in the Tinsukia district of upper Assam, which has 21 active wells. Of these wells, four produce natural gas while the remaining wells produce crude oil. On May 27, 2020, at 10:30 am, there was a gas blow-out that caused the rapid leakage of natural gas and explosion sounds were heard 12 kms away in Tinsukia town. The gas continued to leak until June 9, 2020, when it caught fire and turned into an upstream onshore disaster that caused fatal casualties, damage to local flora and fauna, wild and aquatic lives, and severe damage to the Dibru-Saikhowa National Park, which has global biodiversity significance. The blow-out fire continued for 159 days until the well was finally killed on November 15 with the help of foreign experts. The disaster resulted in five deaths (as per official data, enquiry pending), the evacuation of 1,610 local families, including 3,000 people, to relief camps, and the evacuation of Oil India Limited employees and their families from the area. In addition, the carcass of a Gangetic Dolphin covered in condensed oil was recovered from Maguri Motapung Beel, a local wetland near the national park.

According to Marius, S. Vassilou (2010), the history of petroleum is the history of the modern world. A disaster is a catastrophic event caused by nature or the natural process of the earth (Hyndman, D., and Hyndman, D., 2006). The United Nations International Strategy for Disaster Reduction (UNISDR) (2009) defines a disaster as "A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources" (NDMP, 2016). Disasters can have human origins as

well, according to the International Federation of Red Cross and Red Crescent (IFRC). The impact of a disaster on mankind can be categorized into four categories: displaced populations, food scarcity, health risks, and emotional aftershocks (Ahmad, W., 2019). The immediate combined impact leads to large-scale migration of the population abandoning their shelters/homes to mitigate their food scarcity and potential loss of life due to starvation/malnutrition, fear of epidemics and famine, and to avoid psychological conditions/post-traumatic disorder in the long run.

The oil and gas industry is highly disaster-prone due to the complex mix of technology, human resources, heavy machines/equipment, and highly inflammable substances and products. The industry operates in three major sectors: Upstream, Midstream, and Downstream (Adam, M., 2019) in both Onshore (on land) and Offshore (Oceans) areas. The Upstream sector has witnessed several disasters in its history, with offshore disasters being well-documented due to their special and unique work platforms, remoteness, and the huge risks involved in operating in deep sea waters. Onshore upstream disasters are not well reported or researched, but according to crude oil production reports on the Google webpage in Statista 2021, the Onshore Oil and Gas Industry (UOOGI) constitutes 72% while Upstream offshore only 28% globally. Disasters can cause huge damage, loss of life and property, and destruction, and UOOGI disaster challenges vary in managing disasters according to the dictates of terrain, demography, economic profile, political awareness, and influences, remoteness of the area, and the literacy where operating, as many stakeholders or boundary players emerge in the vicinity.

According to Melton and Hudson (n.d.), the oil and natural gas industry plays a significant role in the global economy as a primary fuel source and is divided into upstream, midstream, and downstream segments. The exploration and production processes involved in the upstream segment of the oil and gas industry are complex, hazardous, capital-intensive, human resource-centric, and require advanced technology. The history of the oil and gas industry dates back to

the modern world, as described by Quarantelli (1998). Natural, man-made, and hybrid disasters are the three major types of disasters, with severity being omnipresent in all of them, as noted by Shaluf (2007). Richardson (1994) described man-made or socio-technical disasters, including oil and gas well blowouts, oil spills, production failures, and warfare. Hybrid disasters, which are compound acts of both human and natural forces, were discussed by Rahman and Boruah (2020), citing the recent tragedy in Oil India Limited (OIL) Baghjan Oil fields. The upstream onshore oil and gas industry (UOOGI) is mainly affected by man-made or hybrid disasters due to its land-based nature. Reason (2000) noted that human error is a significant contributor to operational disasters, while non-operational disasters include terrorist attacks, hostage crises, bomb threats/blasts, strikes, sabotage, and civil disturbances. Bodhi, Singh, and Rahman (2021) identified different behavioral responses, such as panic, numbness, composure, confidence, escapism, surrender to the situation, no action, balanced, or hyperactive, which influence disaster management along with other important factors such as machines and equipment, technology, and process compliances. The human behavioral facet (HBF) is a crucial factor that influences disaster dynamics in UOOGI terrain, yet it remains unexplored or thinly explored, as stated by Bodhi et al. (2022), CA Soni, S Rai, and G Thakur (2022), and Robinson (2012).

1.2. Background of the Study

The upstream Oil and Gas Industry (OGI) has been marred by some of the worst disasters in history, whether offshore or onshore, leading to large human casualties and destruction of infrastructure, machinery, and property amounting to billions of dollars. This can be attributed to loosely enforced protocols, poor equipment design, awkward emergency procedures, and inappropriate human behavior responses. The offshore disasters have been deeply investigated and well documented due to their unique operational profile, remoteness, isolation from land

connectivity, and inherent high risks. On the other hand, the Upstream Onshore Oil and Gas Industry (UOOGI) disasters have not received much attention from academia and are scantily documented. This is probably due to the low loss potential of human and infrastructure capital, availability of land connectivity, and easy approachability to disaster sites observed during the course of this research study. Despite constituting 72% of the global Oil and Gas production, the UOOGI industry remains at a low profile compared to the Offshore Upstream Oil Industry which constitutes only 28%. Human error has been identified as the largest contributor, accounting for 70% of all accidents related to the handling of risky chemicals and hazardous operations, and costing heavily on employees, workplaces, the economy, and society. However, little research has been conducted to explore the extension of behavioral response as a human factor towards disaster management. The motivation for this study stems from the personal experiences of the researcher, who as a military leader, has gone through major disasters as a victim, onlooker, rescue works coordinator, DM-Team Leader/Manager, and also as a front-line manager in the Oil Industry. The researcher has interacted with OGI disaster-affected employees, has direct exposure to emergencies and disasters in upstream onshore operations at India's largest basin and asset, and has interacted with top OGI crisis handlers. The researcher has observed a lack of individual/group-level preparedness for emergencies in an industry highly prone to disasters and has concerns for nurturing an appropriate behavioral response culture amongst people, including boundary players, against disasters.

1.3. Major Disasters

GULF OF MEXICO

One of the most significant incidents in the Gulf of Mexico occurred in 2010 when an explosion on the Deepwater Horizon oil rig caused a massive oil spill. The explosion killed 11 workers and resulted in millions of barrels of oil being released into the Gulf, making it one of the worst

environmental disasters in US history. The spill affected marine life, fishing industries, and tourism in the region, causing significant economic and environmental damage. The cleanup effort took several years, and the incident highlighted the risks associated with offshore drilling and the importance of strict safety regulations in the industry.

The Deepwater Horizon incident was a tragic and complex event that had far-reaching consequences for the Gulf of Mexico region and beyond. It began on April 20, 2010, when the Deepwater Horizon, an offshore oil drilling rig, experienced a blowout in the Macondo well. The resulting explosion and fire caused the rig to sink and left 11 workers dead. In the following days, millions of barrels of oil spilled into the Gulf, forming a massive slick that spread across the water's surface and began to impact coastal areas.

The oil spill had significant environmental, economic, and social impacts on the Gulf of Mexico region. The oil contaminated beaches, marshes, and wetlands, affecting the habitat of numerous species of wildlife, including birds, fish, and sea turtles. The fishing industry, which relied heavily on the Gulf's rich seafood resources, was severely impacted, with many businesses facing economic losses and long-term uncertainty. The spill also impacted the tourism industry, as beaches and other popular destinations were closed due to the oil slick.

The response to the oil spill was a massive and complex effort involving numerous government agencies, oil companies, and other organizations. Efforts to contain the spill included deploying booms and skimmers to collect the oil, using dispersants to break up the oil slick, and drilling relief wells to stop the flow of oil. The cleanup effort took several years and cost billions of dollars, with long-term effects on the region's environment and economy still being felt today.

The Deepwater Horizon incident also had significant policy implications, leading to calls for increased safety regulations and stricter oversight of the offshore oil drilling industry. The incident highlighted the need for improved safety practices and emergency response

capabilities, and the importance of ensuring that companies responsible for offshore drilling take responsibility for the consequences of their operations. Ultimately, the Deepwater Horizon incident serves as a reminder of the importance of protecting our natural resources and the environment, and the need for responsible and sustainable practices in all industries.

PIPER ALPHA

The Piper Alpha incident is considered one of the deadliest offshore oil disasters in history. On July 6, 1988, a fire broke out on the Piper Alpha oil platform, located in the North Sea off the coast of Scotland. The fire was caused by a gas leak from a faulty pump, which ignited and spread rapidly through the platform. The resulting explosions and fire caused the deaths of 167 of the 229 workers on board, including two rescue workers. The incident had a profound impact on the offshore oil industry, leading to significant changes in safety regulations and practices.

The Piper Alpha incident had numerous causes, including design flaws, maintenance issues, and inadequate safety measures. The platform had been in operation since 1976, and over time, modifications and changes had been made to the platform's structure and equipment, which ultimately contributed to the disaster. The platform's emergency shutdown system also failed to prevent the disaster, and the crew was not adequately trained in emergency procedures.

Following the incident, investigations found numerous safety failures, including inadequate training, poor communication, and a lack of effective safety systems. The incident led to significant changes in safety regulations and practices in the offshore oil industry, including the development of new safety standards, better training and communication protocols, and improvements to emergency response plans.

The Piper Alpha incident also had a significant impact on the families of the victims and the wider community. The disaster highlighted the risks associated with offshore oil production and the importance of ensuring the safety of workers in the industry. It also led to significant

changes in attitudes towards workplace safety, with a greater emphasis placed on preventing accidents and ensuring worker safety.

Today, the Piper Alpha incident serves as a stark reminder of the importance of workplace safety and the need for companies to prioritize the safety of their workers above all else. It is a tragic reminder of the human cost of industrial accidents and the importance of maintaining the highest standards of safety in all industries. The legacy of the Piper Alpha incident is a commitment to improving safety practices and preventing similar disasters from occurring in the future.

C.P. BAKER DRILLING BARGE- June 30 1964

On June 30, 1964, the C.P. Baker Drilling Barge, which was engaged in drilling operations in the Gulf of Mexico, was struck by Hurricane Gladys, a Category 2 hurricane. The barge was being towed by two tugboats, but they were unable to keep the barge in place in the face of the hurricane's 80 mph winds and 20-foot waves. The barge ultimately capsized and sank, resulting in the loss of 22 lives. The incident led to changes in hurricane preparation and response for offshore oil and gas operations.

BOHAI 2 OIL RIG – 25 November 1979

The Bohai 2 Oil Rig disaster occurred on November 25, 1979, when a gas blowout caused a fire on the rig, which was located in the Bohai Bay in northeastern China. The fire burned for more than three months, and 74 lives were lost. The disaster was caused by a failure to follow proper safety procedures, and it led to changes in safety regulations in China's offshore oil and gas industry.

ALEXANDER L. KIELLAND DRILLING RIG – 27 March 1980

The Alexander L. Kielland drilling rig was a semi-submersible platform located in the North Sea off the coast of Norway. On March 27, 1980, a sudden wave hit the rig, causing it to capsize and sink. Of the 212 crew members on board, 123 lost their lives in the disaster. The cause of the wave is still unknown, but it is believed to have been a combination of weather conditions and structural issues with the rig.

OCEAN RANGER OIL RIG – 15 February 1982

The Ocean Ranger was a semi-submersible drilling rig located off the coast of Newfoundland, Canada. On February 15, 1982, the rig was hit by a severe storm, causing it to capsize and sink. All 84 crew members on board were killed in the disaster. The incident led to changes in safety regulations for offshore drilling operations in Canada.

GLOMAR JAVA SEA DRILLSHIP – 25 October 1983

The Glomar Java Sea was a drillship that was operating in the South China Sea when it was hit by Typhoon Clara on October 25, 1983. The storm caused the ship to capsize, resulting in the loss of 81 lives. The incident led to improvements in typhoon forecasting and safety procedures for offshore drilling operations.

Causes of Disasters:

Offshore oil and gas operations are complex and involve multiple hazards. Understanding the common causes of accidents is crucial for preventing incidents and ensuring safety on offshore rigs. The causes of offshore accidents can be broadly categorized into technical, natural, physical, and behavioral factors (Jabbour, Santos, Nagano, & de Oliveira, 2018).

Technical causes of offshore accidents include blow-outs, explosions, gas leaks, sudden build-up of high pressure in wells, ageing of equipment, cables, anchors, blocks & tackles, pipeline blasts/leakage, accidents, continuance of operations with obsolete

systems/machines/infrastructures, and faulty and poorly maintained equipment (Datta & Chakraborty, 2018). Negligent or improperly trained workers can also contribute to technical causes of accidents.

Natural causes of offshore accidents include extreme weather events such as wind velocity, lightning, cloud burst, tornadoes, floods, storms, tsunamis, and earthquakes (Kundu, 2019). High tides and hurricanes are also included in natural causes of accidents.

Physical causes of offshore accidents include slips, falls, trips, and other accidents that result from the physical environment of offshore rigs (Soo & Bong, 2019).

Behavioral causes of offshore accidents include casualness towards health, safety, and environment (HSE) practices, miscommunication, non-sharing of inputs on tasks or ongoing procedures during shift changes, overconfidence, lack of technological upgrades, attitude/response, and inadequate training and awareness for emergencies (Jabbour et al., 2018).

Preventing offshore accidents requires a combination of measures that address all of these factors. Safety training, regular equipment maintenance and upgrades, communication protocols, and emergency response plans are all critical to preventing offshore accidents (Datta & Chakraborty, 2018). Addressing technical issues such as ageing equipment and pipeline integrity, as well as improving safety culture and behavior, can also help prevent offshore accidents.

In conclusion, offshore accidents can have devastating consequences, and it is essential to understand the common causes of such accidents to prevent them. Technical, natural, physical, and behavioral factors can all contribute to offshore accidents, and a comprehensive approach that addresses each of these factors is necessary to ensure safety on offshore rigs.

1.4. Manmade Causes

Man-made disasters in the oil industry can often occur due to human error or negligence. These types of incidents can have catastrophic consequences and can lead to the loss of life, extensive damage to equipment and infrastructure, and significant environmental impacts.

One common example of man-made disasters in the oil industry is oil spills, which can occur both onshore and offshore. Oil spills can be caused by a range of human factors, such as equipment failure, inadequate maintenance, or human error during drilling or transportation. These spills can have devastating environmental consequences, harming marine life, contaminating water sources, and damaging ecosystems.

Another example of man-made disasters in the oil industry is explosions or fires at oil refineries or storage facilities. These incidents can be caused by a range of human factors, such as inadequate safety protocols, improper handling of hazardous materials, or equipment failures. Explosions and fires can cause significant damage to facilities, infrastructure, and nearby communities, and can lead to loss of life and long-term health impacts.

To prevent these types of disasters, it is crucial for the oil industry to prioritize safety and invest in comprehensive safety protocols, regular maintenance and inspection of equipment, and ongoing training and education for workers. Additionally, regulatory bodies can play an important role in ensuring that industry practices meet safety standards and that appropriate penalties are imposed for violations. Overall, a proactive approach to safety and risk management is essential for preventing man-made disasters in the oil industry.

Man-made disasters in the oil industry are not just a matter of negligence or carelessness; they are the result of individuals and organizations putting profits above people and the environment. The devastating consequences of these disasters leave a trail of destruction that is felt for years to come, both physically and emotionally.

The human impact of these disasters cannot be overstated. Lives are lost, families are torn apart, and communities are left devastated. The psychological toll on survivors can be immense, with many experiencing trauma, depression, and anxiety. Those who have lost loved ones may struggle to cope with the grief and the sense of injustice that comes with preventable disasters.

Moreover, the environmental impact of man-made disasters in the oil industry can be catastrophic. Oil spills, gas leaks, and explosions can cause irreparable damage to ecosystems, killing wildlife and polluting water sources. The long-term effects of these disasters can be felt for generations, as communities struggle to clean up and rebuild.

It is imperative that we hold those responsible for these disasters accountable, not only to ensure justice for the victims and their families, but also to send a message that profits cannot come at the expense of people and the environment. We must demand that companies in the oil industry prioritize safety, implement strict regulations, and invest in technologies that minimize the risk of disasters.

As individuals, we can also play a role in preventing man-made disasters in the oil industry. We can support renewable energy sources, reduce our reliance on fossil fuels, and hold our elected officials accountable for enacting policies that prioritize the safety of people and the environment over corporate profits.

In short, man-made disasters in the oil industry are a tragedy that no one should have to endure. It is our collective responsibility to take action to prevent these disasters and to ensure that those responsible are held accountable for their actions.

1.5. Effects of Disasters

Human

Disasters can have significant impacts on human life. The loss of life due to disasters is a major concern in the oil and gas industry. For instance, the Deepwater Horizon explosion resulted in the loss of eleven lives (Bureau of Ocean Energy Management, 2016). In addition to fatalities, disasters can also result in physical injuries and emotional trauma to those affected (Greenberg, 2013). Workers who survive these incidents may suffer from PTSD and may require long-term psychological treatment. Disasters also result in the loss of experience and talent, as skilled workers may be lost, thereby hindering the efficiency of the operation (Pickett, 2015).

Loss/Damage to Rigs/Platforms

Disasters also cause significant damage to rigs, platforms, and other infrastructure. Damage to equipment such as pumps, valves, and motors can lead to well closure and loss of production. Pipelines can also be damaged, which can cause oil spills and lead to environmental pollution (Baines & Thomas, 2014). For instance, the explosion on the Piper Alpha platform led to the destruction of the facility and the loss of production of 300,000 barrels of oil per day (HSE, 2018).

Financial/Monetary Losses

The financial and monetary losses due to disasters include compensation to affected employees and stakeholders, production losses, and the cost of replacing damaged equipment. Disasters can also affect the industry as a whole, leading to a burden of imports and reduced production output, which in turn can have a significant impact on the economy (Sena, 2015). For example, the explosion on the Deepwater Horizon platform resulted in a loss of $61.6 billion in shareholder value for BP (Ritchie, 2016).

Environmental Damage

Environmental damage and ecological destruction due to disasters is also significant. Accidents such as oil spills can lead to ecological imbalances and contamination of water resources, which

can harm aquatic life and affect human health (Nadakavukaren, 2014). The effects of environmental damage and ecological destruction can last for years or even decades, resulting in long-term consequences. For instance, the Exxon Valdez oil spill in Alaska in 1989 had long-term impacts on the environment and wildlife (National Wildlife Federation, 2019).

Impact on Reputation/Brand Image

Disasters can also have an adverse impact on a company's reputation and brand image. In today's age of social media, the news of an accident or disaster can spread quickly, leading to a negative perception of the company among the public. Companies can mitigate this impact by taking prompt action and being transparent about the incident, thereby establishing trust and demonstrating their commitment to safety (Raman, 2018). For example, BP implemented various measures, including a $500 million marketing campaign, to rebuild its reputation after the Deepwater Horizon incident (Walker, 2012).

1.6. Operational definitions

Upstream Onshore Oil and Gas Sector: The upstream onshore oil and gas sector involves the exploration, development, and production of oil and gas resources on land, including drilling wells, constructing and operating production facilities, and managing the associated environmental and safety risks (Bain, 2021).

Process deployed in managing disaster: The process deployed in managing disaster refers to the sequence of steps taken to respond to a disaster event, including risk assessment, emergency planning, mobilization of resources, response actions, and recovery efforts (Coppola, 2015).

Organization involved in managing disaster: The organization involved in managing disaster refers to the group of individuals, agencies, and entities responsible for coordinating

and carrying out disaster management activities, including emergency responders, government agencies, non-governmental organizations, and community groups (FEMA, 2017).

Technology used in managing disaster: The technology used in managing disaster includes a range of tools and systems used to support disaster management, such as early warning systems, remote sensing technologies, communication systems, and data management platforms (UNISDR, 2015).

Framework for Boundary management: The framework for boundary management refers to the approach used to identify, establish, and manage boundaries between different phases or areas of disaster management, including pre-disaster, during disaster, and post-disaster phases, to ensure effective communication and coordination among different actors and stakeholders (Paton et al., 2017).

Pre-Disaster phase of Disaster Management: The pre-disaster phase of disaster management refers to the period of time before a disaster occurs, during which activities are undertaken to reduce the risk of disaster, such as hazard mapping, risk assessment, emergency planning, and capacity building (Coppola, 2015).

During Disaster: The during disaster phase of disaster management refers to the period of time when a disaster event is occurring, during which emergency response actions are taken to protect lives, property, and the environment, and to stabilize the situation (FEMA, 2017).

Post Disaster phase of Disaster Management: The post-disaster phase of disaster management refers to the period of time after a disaster event, during which activities are undertaken to support recovery and reconstruction efforts, including damage assessment, debris removal, community rebuilding, and economic revitalization (UNISDR, 2015).

1.7. Motivation and Research Gap

In their study, the researcher analyzed various disaster management (DM) documents, including Standard Operating Procedures (SOPs) and government guidelines, to understand disaster dynamics. However, the study revealed that these documents failed to incorporate the critical role of human behavior in managing disasters. Despite extensive research on the significance of human behavior in disaster management, there is a lack of attention given to this aspect in the oil and gas industry (OGI), which is highly prone to disaster risks.

The literature review conducted by the researcher revealed that human behavior plays a crucial role in managing emergency situations, and it regulates the organizational response to disasters. The researcher found a paucity of research studies on Upstream Onshore disaster management that cover the vital aspect of human behavior. The lack of concern for human behavioral facets in managing disasters is a significant gap in the OGI's disaster management plan.

According to Dey (2019), the OGI is highly process-oriented, technology-intensive, and manpower-heavy, and the behavioral aspects of human resources are not adequately covered in its disaster management plans. The study found that there is negligible literature available on behavioral issues concerning the OGI, which is a cause for concern.

In conclusion, the behavioral response to disaster dynamics is critical, and it should be given due consideration in disaster management plans. The OGI needs to address the gap in its disaster management plans and focus on incorporating the behavioral aspects of human resources to manage disasters effectively. Failure to do so may result in significant human and economic losses.

1.8. Research Objectives

1. To study the Processes, Organization and Technology in Upstream Onshore Oil and Gas Industry (UOOGI) in India

2. To identify the themes for the development of UOOGI scale for Human Behaviour
3. To analyse the human behaviour for organisational response (HB-FOR)
4. To suggest the significance of behavioural response to UOOGI as an important facet for disaster management

1.8. Research Questions

The following research question stirred-through this study:

Q1: Are there any authorised literature: documents, policies, guidelines, orders / instructions / CMP / local orders with respect to Human Behaviour Facet of Organizational Response (HB-FOR) for managing disasters?

Q2: What are the important Criteria, Key indicators and Parameters, to be deployed for the efficient and effective Organizational Response related to Human Behaviour aspect?

Q3: Why does a manpower heavy, process based, highly prone to disasters with closely bound man-machine operational practices oriented Oil and Gas Industry does not accord attention to Behaviour Response for managing disaster?

Q4: Why is it necessary to address the behavioural responses facet of OGI human resources for disaster management?

1.9. Sections and Chapters

Chapter 1: Introduction

Chapter 2: Review of Literature

Chapter 3: Research Methodology

Chapter 4: Analysis, Results and Discussion

Chapter 5: Findings, Implications and Conclusion

Bibliography

CHAPTER II
REVIEW OF LITERATURE

Chapter 2

REVIEW OF LITERATURE

2.1. Introduction

The upstream onshore oil and gas industry (UOOGI) plays a significant role in the economic growth of India. However, disasters in this industry can have severe consequences, both in terms of environmental damage, human casualties and ecological destruction. In the event of such disasters, an organization's response is critical in minimizing the impact of the incident. One critical aspect of the organizational response is the study of human behavior facets of organizational response (HBFOR). Empirical research in this area can provide insights into how individuals and organizations react to disasters and how these reactions can be improved to prevent and mitigate the effects of such events.

Research on HBFOR in UOOGI disasters in India is a relatively under-explored area, but recent incidents highlight the urgency and importance of investigating this topic. The 2020 Assam oil well blowout and the 2021 ONGC barge accident are examples of recent disasters that have caused significant environmental, ecological and human impact. Therefore, a thorough empirical study of HBFOR is crucial to understand how individuals and organizations react to such disasters and to develop effective strategies to prevent and mitigate their effects.

Empirical research on HBFOR has gained considerable attention in recent years, with many scholars exploring the topic. A study by Cui et al. (2021) investigated the influence of employee behavior on organizational disaster resilience. The authors found that employee behavior is positively related to organizational resilience in the face of disasters. Another study by Li et al. (2020) focused on the effects of leadership on the behavior of employees during crisis situations. The authors found that effective leadership can improve employee behavior during crises, which, in turn, can enhance organizational resilience.

Similarly, Wang et al. (2020) explored the role of trust in shaping individual and organizational behavior during disasters. The authors found that trust is a critical factor in shaping behavior during crises and can contribute to effective disaster response. Research has also highlighted the importance of organizational culture in shaping employee behavior during disasters. A study by Kozlowski et al. (2020) examined the relationship between organizational culture and safety performance. The authors found that a positive safety culture can improve safety performance and reduce the risk of disasters.

Another study by Ahsan et al. (2019) explored the impact of organizational culture on safety behavior in the oil and gas industry. The authors found that a positive safety culture is essential for improving safety behavior, reducing accidents, and minimizing the impact of disasters. Similarly, research has also focused on the role of individual factors, such as personality and motivation, in shaping behavior during crises. A study by Li et al. (2021) found that personality traits, such as emotional stability and openness to experience, can affect individual behavior during disasters.

Research has also highlighted the importance of communication and decision-making during disasters. A study by Yan et al. (2020) examined the effects of communication on individual and group behavior during disasters. The authors found that effective communication can

improve individual and group behavior during crises, which can contribute to effective disaster response. Another study by Li et al. (2019) focused on the influence of decision-making on organizational performance during crises. The authors found that effective decision-making is critical for improving organizational performance and reducing the impact of disasters.

Moreover, research has highlighted the importance of training and preparedness in shaping behavior during disasters. A study by Wu et al. (2021) explored the effectiveness of training programs in improving employee response during crises. The authors found that well-designed training programs can improve employee response during crises and enhance organizational resilience. Another study by Ahmadi et al. (2019) investigated the role of preparedness in shaping behavior during natural disasters. The authors found that preparedness can improve behavior during disasters and reduce the risk of casualties, environmental damage and ecological destruction.

2.2. Bibliometric Information

Fig 2.1 Word Occurrence Network

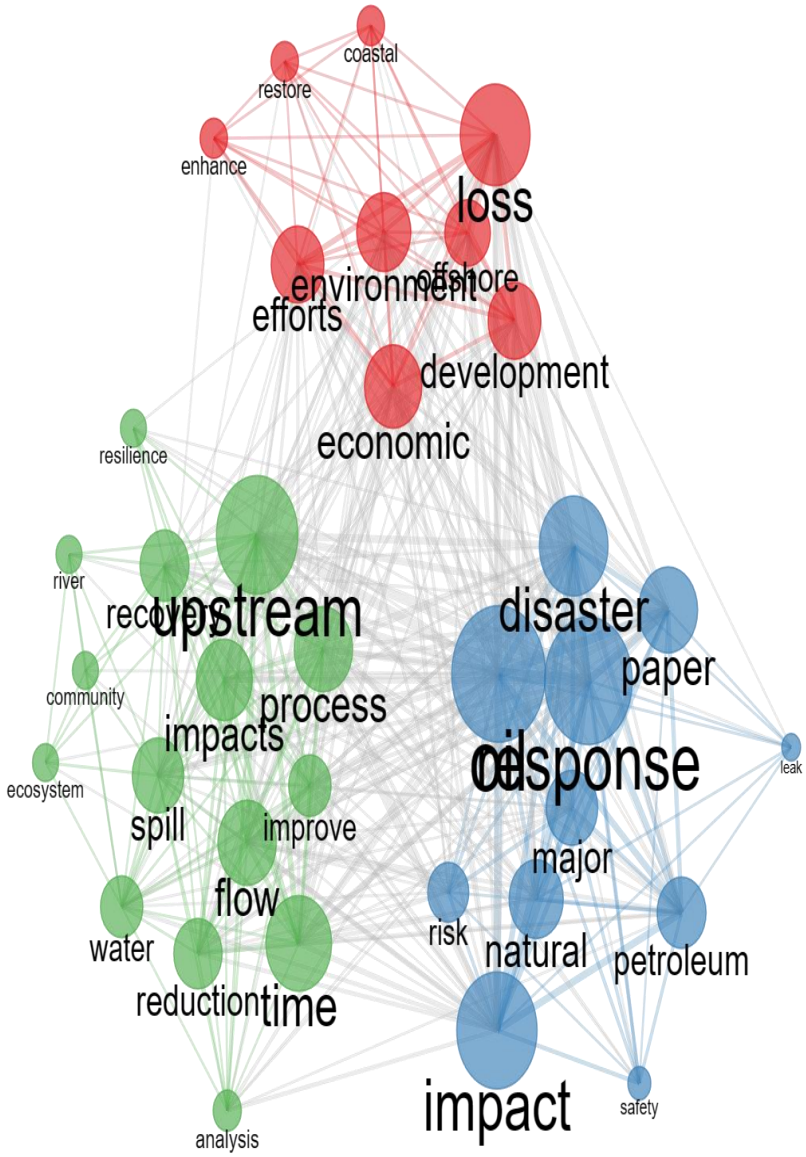


Fig 2.2 Most local cited authors

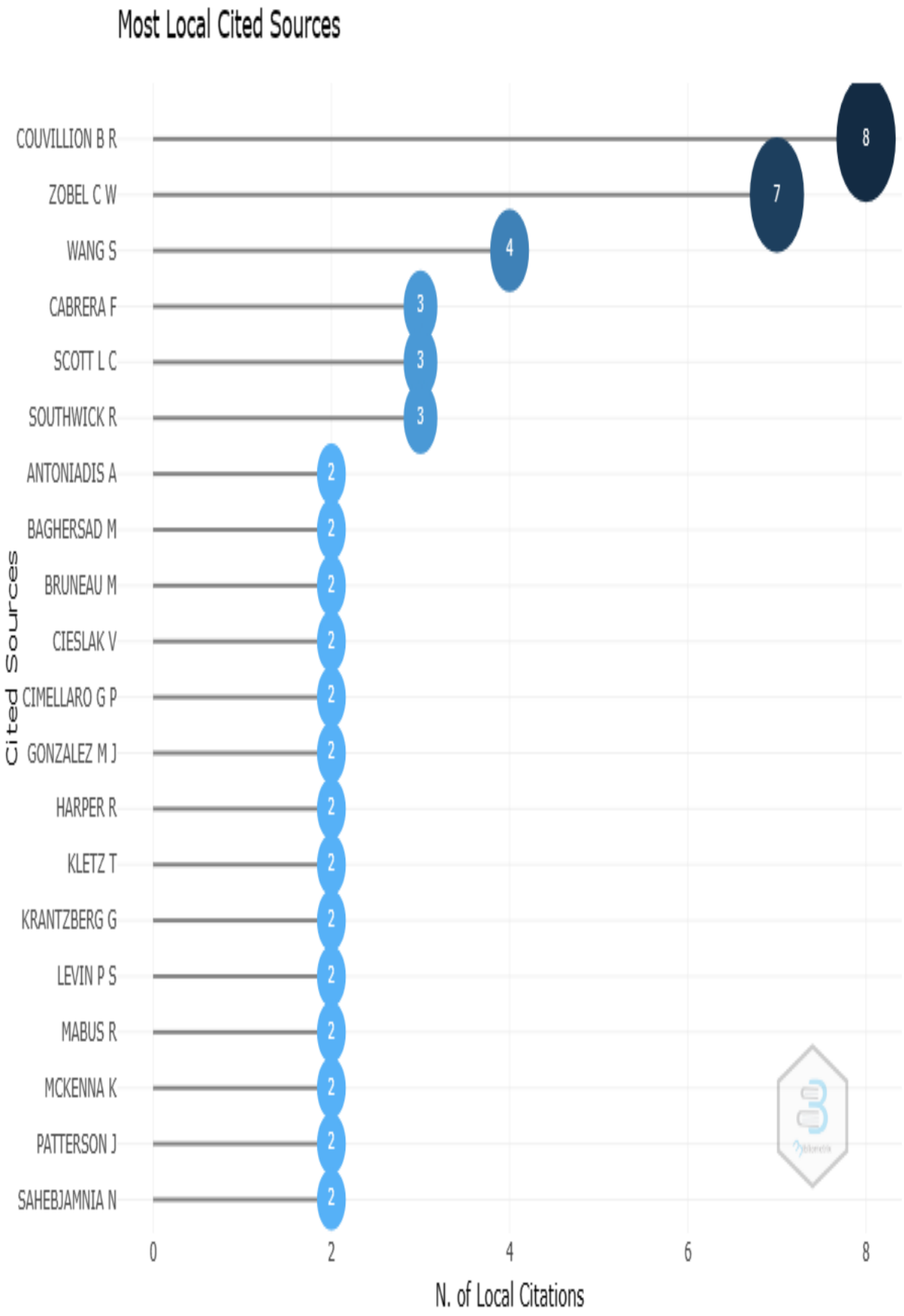


Fig 2.3. Most relevant Keywords

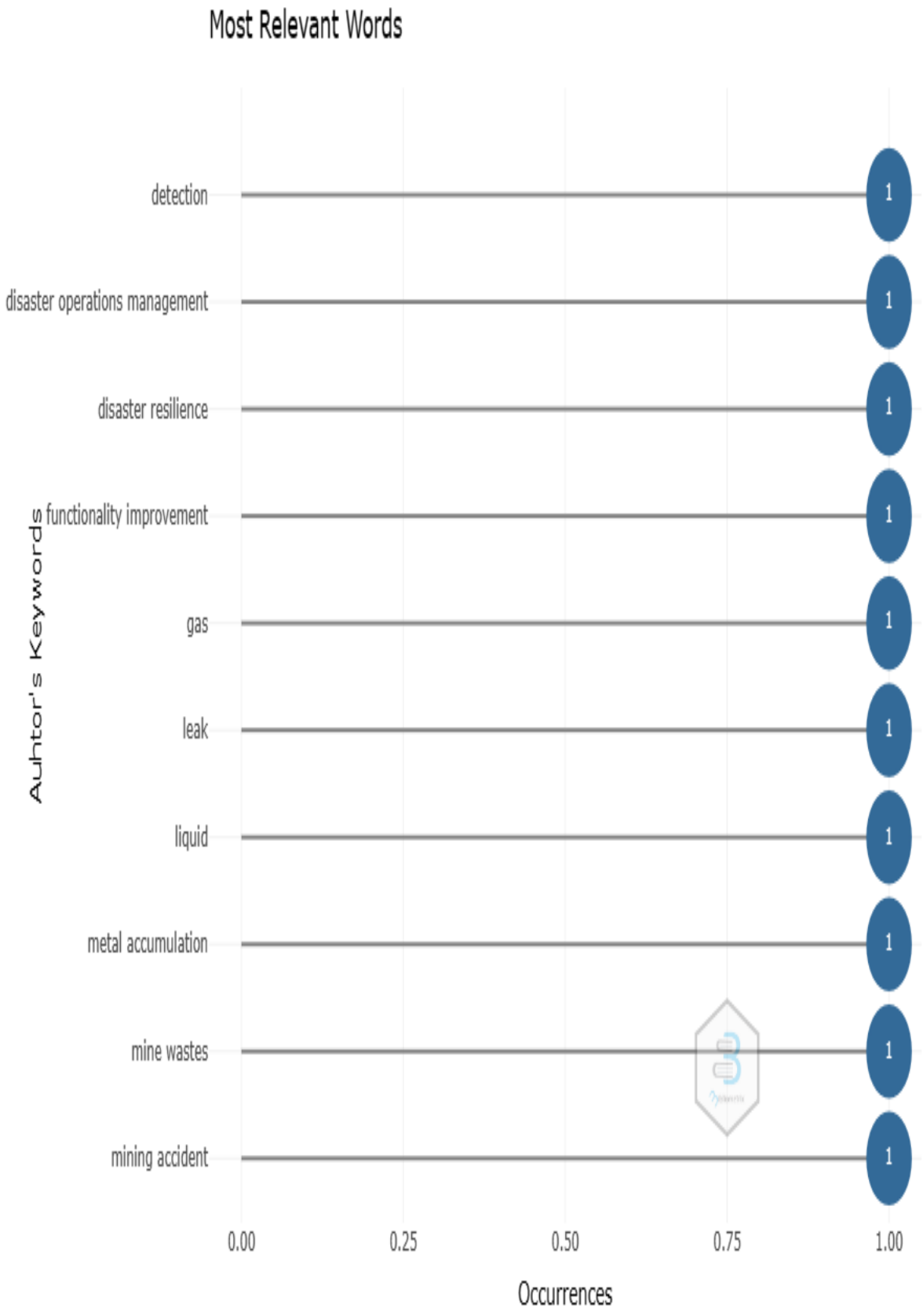
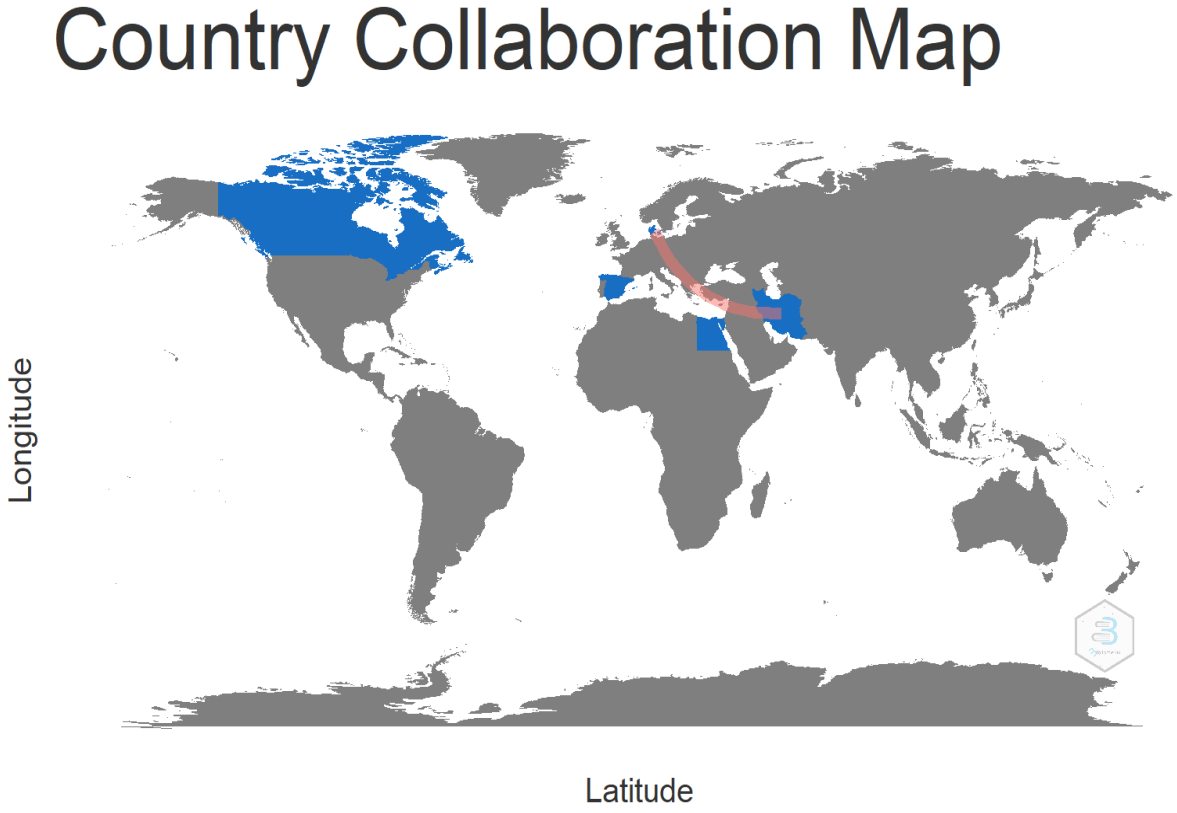


Fig 2.4. Specific KeyWord Cloud

Fig. 2.5 Country Collaboration Map



2.3. Literature Overview in Indian Context

In the Indian context, the upstream onshore oil and gas industry (UOOGI) has played a significant role in the country's economic development. However, the industry's growth has also come with significant environmental and social risks, particularly in terms of the potential for disasters that can have severe consequences.

For instance, the Baghjan oil well blowout that occurred in May 2020 in Assam, India, led to the death of four firefighters and resulted in severe environmental damage and ecological destruction to the surrounding area. The incident also highlighted the need for a better understanding of the human behavior facet of organizational response (HBFOR) to such disasters in the UOOGI sector.

Previous studies have examined various aspects of HBFOR in the Indian context. A study by Sengupta and colleagues (2018) investigated the role of organizational culture in shaping safety behaviors in the Indian oil and gas industry. The study found that organizations with a positive safety culture were more likely to have employees who demonstrated safe behaviors during hazardous situations.

Another study by Jha and colleagues (2019) examined the impact of trust and communication on organizational resilience in the Indian oil and gas industry. The study found that trust and communication were critical factors in developing resilience during crises, and that organizations with higher levels of trust were better able to recover from disasters.

Similarly, a study by Upadhyay and colleagues (2020) explored the role of leadership in shaping safety culture and behaviors in the Indian oil and gas industry. The study found that transformational leadership was positively associated with safety culture, and that leaders who were seen as ethical, supportive, and empowering were more likely to have employees who demonstrated safe behaviors.

Research has also highlighted the importance of employee training and preparedness in the Indian context. A study by Dubey and colleagues (2020) examined the effectiveness of safety training programs in the Indian oil and gas industry. The study found that training programs that focused on practical, hands-on activities were more effective in improving safety performance than those that relied solely on theoretical knowledge.

Another study by Kumar and colleagues (2020) investigated the impact of disaster preparedness on employee behavior in the Indian oil and gas industry. The study found that employees who perceived their organization to be well-prepared for disasters were more likely to engage in safe behaviors during emergencies.

Overall, these studies highlight the importance of understanding HBFOR in the Indian context and developing effective strategies to improve disaster response and minimize the impact of such events. Factors such as organizational culture, leadership, trust, communication, training, and preparedness can all play a critical role in shaping employee behavior during crises in the UOOGI sector in India.

2.4. Overview of Literature in International Context

Several studies conducted in international contexts have also focused on the empirical study of human behavior facets of organizational response (HBFOR) in disasters in the upstream onshore oil and gas industry (UOOGI). A study by Gill and colleagues (2018) examined the impact of organizational culture on safety performance in the oil and gas industry, finding that positive safety cultures were associated with better safety outcomes. Another study by Parker and colleagues (2019) investigated the role of leadership in shaping safety culture and employee behavior in the offshore oil and gas industry, highlighting the importance of leadership commitment and involvement in safety initiatives.

Similarly, research has also explored the role of communication in shaping behavior during disasters in the oil and gas industry. A study by Wu and colleagues (2019) examined the impact of communication on safety performance in offshore oil and gas operations, finding that effective communication was associated with better safety outcomes. Another study by Huang and colleagues (2019) focused on the influence of communication on employee behavior during emergency situations in the oil and gas industry.

Research has also highlighted the importance of training and preparedness in shaping behavior during disasters. A study by Ho and colleagues (2020) investigated the effectiveness of training programs in improving safety behavior in the oil and gas industry, while another study by Zang and colleagues (2020) explored the role of preparedness in shaping behavior during crises in the offshore oil and gas industry.

Moreover, research has focused on the influence of individual factors on behavior during disasters in the oil and gas industry. A study by Yang and colleagues (2018) examined the role of personality traits in shaping safety behavior among oil and gas workers, while another study by Chen and colleagues (2021) focused on the influence of work stress on safety behavior in the oil and gas industry.

Research on the empirical study of human behavior facets of organizational response (HBFOR) in disasters in the upstream onshore oil and gas industry (UOOGI) has been conducted in both Indian and international contexts. Previous research has highlighted the importance of organizational culture, communication, leadership, training, preparedness, and individual factors in shaping behavior during crises. This literature review highlights the urgent need for a comprehensive empirical study of HBFOR in UOOGI disasters in India to improve disaster response and minimize the impact of such events in the future.

Research in the area of human behavior facets of organizational response (HBFOR) in upstream onshore oil and gas industry (UOOGI) disasters has gained significant attention in recent years, both in India and internationally. One study by Papacharalampous and colleagues (2021) investigated the role of safety culture and employee behavior in the oil and gas industry in Greece. The study found that safety culture was positively related to safety behavior, and that safety behavior positively influenced safety performance.

Another study by Li and colleagues (2021) explored the role of organizational learning in improving safety performance during disasters in the Chinese oil and gas industry. The study found that organizational learning positively influenced safety performance, and that the positive relationship between organizational learning and safety performance was stronger during disasters than during normal operations.

Similarly, a study by Rezakhani and colleagues (2021) focused on the role of leadership and culture in shaping the behavior of employees during crisis situations in the Iranian oil and gas industry. The study found that transformational leadership and a safety culture positively influenced safety behavior, while authoritarian leadership had a negative impact on safety behavior.

Moreover, research has also highlighted the importance of individual factors, such as psychological traits and emotions, in shaping behavior during disasters. A study by Wang and colleagues (2021) explored the influence of emotional intelligence on employee behavior during crises in the Chinese oil and gas industry. The study found that emotional intelligence positively influenced employee behavior, which in turn positively influenced safety performance during crises.

Another study by Huang and colleagues (2020) focused on the role of risk perception and personality traits in shaping employee behavior during crises in the Chinese oil and gas

industry. The study found that risk perception and personality traits, such as conscientiousness and emotional stability, positively influenced safety behavior during crises.

In conclusion, empirical research on HBFOR in UOOGI disasters is crucial to develop effective strategies to prevent and mitigate the impact of such events. Research has highlighted the importance of organizational culture, leadership, individual factors, and communication in shaping behavior during disasters. Moreover, research in international contexts has also contributed valuable insights into the topic, emphasizing the importance of safety culture, organizational learning, emotional intelligence, and risk perception in shaping behavior during crises in the oil and gas industry.

Table 2.1. Literature Table

Sr. No.	Authors & Article	Country	Purpose	Type of Source	Summary of Points
	EL Quarantelli How Individuals and Groups React during Catastrophic Events	USA	Studies in social science have consistently demonstrated that in highly stressful situations such as disasters, there is no superior approach to effectively prepare for or handle such events compared to relying on assumptions about the situation.	Preliminary Paper #I38 Paper presented at National Disaster Medical Systems National Conference Jun 28,	The research highlighted the following points: (a) Disasters are not only quantitatively but also qualitatively distinct from everyday and minor emergencies. (b) Disasters and Catastrophes, which are two types of collective stress situations, are also qualitatively and

			If these assumptions are correct, then the planning and management of the disaster will probably succeed. However, if the assumptions are incorrect, the opposite is more likely to occur. Consequently, when examining the research-based understanding of human and social behavior during disasters, the accuracy or inaccuracy of the assumptions made becomes a crucial factor.	1989 in Denver, Colarado, USA	quantitatively unique. The study briefly categorized their impacts at both individual and organizational levels. (c) In a disaster, the impact may be absorbed by the portion of the community that is not directly affected, but this may not be the case in a catastrophe. (d) The larger the scope and magnitude of a disaster or catastrophe, and the greater the number of responders or population affected, the more severe the impact on organizational response, reducing the likelihood of success.
	Damiennw Provitolo, Edwig Dubos-Pillar and Jean-Pierre Muller Emergent Human Behaviour during a Disaster: Thematic vs	Austria	The researchers examined the reactions of societies concerning particular human actions during times of disaster or catastrophe. These actions may indicate either vulnerability or, on the other hand, social resilience. The first	Proceedings of EPNACS 2011 within ECCS'11 Emergent Properties in National and Artificial Complex	The authors have put forward the following points: (a) A categorization of actions that are evident during catastrophic occurrences, regardless of whether they are of natural or technological origin or

	Complex Systems Approaches		section outlines a classification of behaviors that are evident during catastrophes and identifies characteristics shared by all of them. Sections two and three examine whether these behaviors that deviate from everyday behaviors and can be observed both individually and collectively during catastrophes can be described as emergent behavior.	Systems, Vienna, Austria – September 15, 2011	whether they occur locally or more widely. (b) The categorization is established based on a time continuum that includes the pre-catastrophe phase, the catastrophe phase, and the impact phase. (c) The identification of three characteristics common to all of the phases mentioned above: non-traditional or novel actions that are short-lived and differ from typical or customary norm-based behavior. (d) The introduction of distinct characteristics for emergent human behavior.
	Nitesh Bharosa, JimKyu Lee, Marijin Janssen Challenges and Obstacles in sharing and coordinating	Netherland USA	By analyzing available literature and conducting a series of multi-agency disaster management exercises, this study examined various obstacles and challenges. The study also surveyed	Journal: Inf Syst Font (2010) 12:49-65 DOI: 10.1007/s10796-009-9174-z	The authors discovered that there is no single factor that either hinders or aids information sharing and coordination. Information sharing and coordination are influenced by obstacles that are present within and between the

	information during multi-agency disaster response: Propositions from field exercises		participants and made observations to emphasize the importance of information sharing for the success of both the organization and the exercise. The sharing of information is influenced by community, agency, and individual factors. The research discovered that relief workers are more interested in obtaining information from others than providing it to those who could benefit. The findings led to the development of six grounded propositions that can be used by policymakers and system designers for further research.		community, agency, and individual levels. All three levels have both institutional and technological components, and resolving these obstacles at a single level is unlikely to improve information sharing and coordination. Multi-agency disaster management will enhance its performance when the appropriate obstacles are addressed simultaneously at the various levels. Nevertheless, due to institutional factors, some individuals neglected these systems.

	Jori, Kalkman Boundary Spanners in Crisis Management	Netherland	In managing crises, it is becoming more and more necessary to have cooperation and coordination among multiple organizations, which entails having dedicated members who can bridge the gaps between these organizations (i.e., boundary spanners). The study's objective is to outline the characteristics that make the job of boundary spanners/players easier in the context of crisis management.	Journal: International Journal of Emergency Services Mar 2020 DOI: 10.1108/IJES-08-2019-0042	There are five characteristics: Long-term association, Sensitivity to civilian concerns, Discretion, Political savvy, and Influence, that when combined, can facilitate improved disaster management practices. (a) Having a long-term association or deployment generally results in an increased sense of loyalty towards civilian partners. (b) When political skill and discretion are used together, they can enhance the influence of boundary spanners within their organization. This increased sensitivity to partner concerns and organizational influence, in turn, leads to more effective boundary-spanning efforts.

Sr. No.	Authors & Article	Country	Purpose	Type of Source	Summary of Points
	Krakowska, Monika Information Behaviour in Crisis Situations	Poland	The article provides an overview of the existing research on information behaviour during disasters, conflicts, and crises. It includes a theoretical examination of the subject, identifying various information activities and defining and describing different crisis situations. This article is the first to offer a conceptual and theoretical analysis of information behaviour in crisis situations. It explores the different types	DOI: 10.36702/zin.716	This paper emphasizes the importance of the following points: (a) Catastrophic events, such as crises, conflicts, natural disasters, accidents, terrorist attacks, and problems of social, economic, political and psychological nature, are significant. (b) Crisis situations have a profound impact on individual and collective actions, including information-related activities. (c) Crises and disasters disrupt established routines, which affects information behavior.

			of crises and information activities associated with them, laying the groundwork for future research on information behaviour in these situations.		(d) Information behavior during a crisis is often unpredictable and influenced by various factors, including anxiety, emotions, and time sensitivity. A crisis is usually unexpected and can be both an experience and an event. (e) Information behavior during a crisis involves quickly assessing the situation and responding to it.
	Nwankwo, Chizaram D. Arewa, Andrew O. Theophilus, Stephen C. Esenowo, Victor N. Analysis of accidents caused	United Kingdom	This study seeks to investigate the reasons for catastrophic accidents in the oil and gas industry by examining the human causal factors involved. The research utilizes the Human Factors Analysis and Classification System for the oil and gas industry (HFACS-OGI) framework	Journal: International Journal of Occupational Safety and Ergonomics (IJOSE) DOI: 10.1080/10803548.2021.1916238	The leading cause of catastrophic accidents in the OGI is human factors, and the study aimed to examine these factors from 2013 to 2017 using the HFACS-OGI framework. The framework was used to code the causal factors of these accidents. The results of the $\chi 2$ test indicate that the root causes of these accidents stem from the failures in national and

	by human factors in the oil and gas industry using the HFACS-OGI framework		to analyze the factors contributing to accidents. These causal factors were then categorized using the HFACS-OGI framework.		international regulations influenced by the personnel operating the systems. Additionally, the study confirms that the HFACS-OGI framework is a valuable tool for thorough accident analysis of human factors in the oil and gas industry.
	Theophilus, S, Esenowo, V, Arewa, A, Ifelebuegu, A, Nnadi, EO & Mbanaso, F Human factors analysis and classification system for the oil and gas industry (HFACS-OGI)	USA	The OGI has experienced numerous catastrophic accidents, with many of them being blamed on human errors related to organization and operation. The current HFACS, which was developed for aviation, is inadequate to analyze both regulatory failures and emerging violations, such as sabotage, in the oil and	Paper presented at the International Petroleum Technology Conference 2008 DOI 10.1016/j.ress.2017.05.036	The majority of OGI disasters are attributed to human factors, and some of the investigation tools and methods used were not strong enough to prevent accidents in a high-risk industry. The HFACS framework identifies system failures at four levels: (a) organizational failures, (b) unsafe supervision, (c) unsafe acts, and (d) pre-conditions for unsafe acts. The current HFACS is effective in

			gas industry. Therefore, this paper attempts to enhance the current HFACS investigation tool and introduces a new system called the Human Factors Analysis and Classification System for the Oil and Gas Industry (HFACS-OGI).		analyzing human factors related to safety culture, management commitment, safety leadership, organizational drift, technical failures/aging equipment, and operator knowledge or competency. However, there is currently no HFACS designed specifically for the OGI, making a customized HFACS framework for OGI accident analysis particularly advantageous.

Sr. No.	Authors & Article	Country	Purpose	Type of Source	Summary of Points

	Jarle Eid, Kathryn Mearns, Gerry Larsson, Jon Christian Laberg, Bjørn Helge Johnsen Leadership, psychological capital and safety research: Conceptual issues and future research questions	Norway Sweden UK	This study investigates the impact of leadership and positive organizational behavior (POB) research on understanding the human mechanisms that affect safety outcomes. Authentic leadership theory suggests that a leader's self-awareness and self-regulation processes play a critical role in the leader-follower relationship. Drawing on recent research on authentic leadership, the study argues that the values, attitudes, and behaviors of production management are linked to safety climate and safety outcomes in safety-critical organizations (SCOs). Additionally, recent management theories propose that "psychological capital" -	Journal: Safety Science, 2011 DOI: 10.1016/J.SSCI.2011.07.001	Here are some paraphrased study highlights: (a) The way leaders behave is an important factor that influences safety climate in organizations. (b) There is a connection between a high performance work system and safety performance, as measured by how individuals prioritize their personal safety. (c) A positive safety climate is linked to better safety outcomes, while a negative safety climate is associated with worse outcomes. (d) A good safety climate is likely to encourage people to report near misses, while also decreasing the perception of risk related to injuries and incidents at work.

			which includes four distinct aspects - is connected to desirable organizational outcomes and high-quality individual performance. The study proposes a research model and five research propositions, suggesting that authentic leadership directly impacts safety outcomes by promoting positive safety climate perceptions.		

	Mohammed Ismail Iqbal, Ibrahim Alrajawy, Osama Isaac, Ali Ameen Study the Impact of Safety Awareness Program (SAP) as Moderating Variable for Reduction of Accidents in Oil and Gas Industry– A Proposed Framework	Malaysia	The IOGP report has revealed that accidents in the drilling domain are the second highest in the OGI industry. The industry provides various products that benefit people's daily lives. However, accidents in the hydrocarbon sector are mostly due to the failure of barriers, which is related to human behavior. To understand the factors affecting safety in relation to human attitude, this study aims to propose a framework that considers personal and job-related factors, as well as unsafe acts and conditions. Furthermore, a Safety Awareness Program (SAP) has been developed to improve work and individual	Journal: International Journal of Management and Human Sciences (IJMHS) Vol. 5 No. 1 (2021)	OGI accidents are often caused by the failure of safety barriers, which can be attributed to human behavior. Inherent factors that contribute to accidents include unpredictable work patterns, shift rotations, work overload, fatigue, stress, poor living conditions, pay cuts during economic downturns, working offshore, and physical conditions in the workplace. Other factors include job insecurity, lack of training opportunities, changes in the business environment, and inadequate safety training. To better understand these factors and their impact on safety, a self-structured questionnaire will be used to analyze individual behavior and attitudes towards

			performance, with the goal of reducing accidents and fatalities in the industry.		accident prevention, major accident theories, and a proposed conceptual framework and research methods. The goal is to develop a Safety Awareness Program that will improve work performance and reduce accidents and fatalities in the OGI industry.

	Paté-Cornell, M. Elisabeth Learning from the Piper Alpha Accident: A Post-mortem Analysis of Technical and Organizational Factors	USA	In July 1988, a tragic accident on the offshore platform Piper Alpha caused the death of 167 people and led to massive property damage amounting to billions of dollars. The cause of the accident was not a sudden, unforeseeable event, but rather a culmination of errors and questionable decisions made over time. These mistakes were mostly due to problems within the organization, such as issues with its structure, procedures, and culture. This paper seeks to examine the accident through the lens of a risk analysis framework, pinpointing the human decisions and actions that contributed to the basic events leading up to the accident, and then identifying the underlying	Journal: Risk Analysis, 1993 DOI: 10.1111/j.1539-6924.1993.tb01071.x	The following key points are highlighted: (a) Design flaws in guidelines and practices, such as tight physical couplings or insufficient redundancies (b) Misguided management priorities (c) Trade-offs between productivity and safety (d) Personnel management blunders (e) Judgment errors in processes (f) Application of financial pressures on the production sector and the definition of profit centers by oil companies leading to deficiencies in inspection and maintenance operations (g) Escalation of operator-supervisor errors to a process safety incident and a historical disaster (h) Meetings and briefings on the platform lacking a safety minute at the beginning

			organizational factors that led to those decisions and actions.		(i) The Offshore Installation Manager (OIM), who was the leader of the platform, reportedly panicked and failed to issue evacuation orders, likely resulting in increased fatalities.
	A. Antonovsky, C, Pollock, L. Straker Identification of the Human Factors Contributing to Maintenance Failures in a Petroleum Operation	Perth Australia	The objective of this study was to identify the human factors that most frequently contribute to maintenance-related failures within a petroleum industry organization. Understanding the commonalities between these failures would aid in comprehending the reliability of maintenance processes,	Journal: The Journal of Human Factors and Ergonomics Society Mar 2014	The research findings highlight the following significant human factors that contribute to maintenance failures in Petroleum Operations: (a) On average, 9.5 factors per incident were identified from the investigated cases. (b) Assumption (79% of cases), Design & Maintenance (71%), and Communication (66%) were the three

			consequently preventing accidents in high-risk domains. The context of maintenance in the petroleum industry presents a unique perspective in investigating the impact of human factors on outcomes. The research analyzed maintenance-related failures in a petroleum company (N=38) through structured interviews with maintenance technicians. The interviews followed the Human Factor Investigation Tool (HFIT) which is based on Rasmussen's Model of Human Malfunction.		most common human factors contributing to maintenance failures. (c) The Human Factor Investigation Tool (HFIT) was a beneficial instrument for identifying the human factor pattern. (d) Failures caused by assumptions and communication were found to be frequent, particularly in situations with a high level of autonomy and geographical distribution.

CHAPTER III

RESEARCH METHODOLOGY

Chapter-3

RESEARCH METHODOLOGY

The motivation behind this study stems from the personal experiences of the researcher as a Military leader, who has been a victim, onlooker, rescue works coordinator, DM-Team Leader/Manager in various major disasters. These experiences have given the researcher a unique insight into the importance of preparedness and effective response to the disasters. Additionally, the researcher has worked as a Front-Line Manager (FLM) in the Oil and Gas Industry, where he gained an awareness of OGI-Disasters and has directly interacted with employees affected by disasters such as the Sagar-Samrat Rig Fire at Bombay High North. Furthermore, the researcher has been exposed to emergencies and disasters in upstream onshore operations at India's largest basin and asset and has interacted with top OGI crisis handlers. These experiences have highlighted the critical importance of appropriate behavioural response culture amongst people against disasters, including boundary players. The researcher has observed a lack of individual and group-level preparedness for emergencies in an industry highly prone to disasters. Therefore, this study seeks to highlight the significance of the human behaviour facet of organisational response (HBFOR) and its role as a causal agent for more than 70% of UOOGI accidents or disasters. The study aims to impart awareness amongst OGI human resources through behavioural mutation, to act and approach dangerous situations with an alert, cool, and composed-self, taking the right decisions instead of panicking, surrendering or giving up to adverse situations. By nurturing an appropriate behavioural response culture amongst people, the study aims to mitigate the risk of disasters and ensure the safety of personnel working in the field, the environment, and assets in Oil & Gas Operations.

3.1. Problem Statement

According to Iqbal et. al. (2021), oil and gas operations pose a high risk not only to the personnel working in the field but also to the environment and assets. Globally, there are approximately 40,000 oil fields and 6 million people who live or work near these fields (Johnston, Lim, and Roh, 2019). However, the biggest challenge facing this disaster-prone industry is that these human resources are not appropriately trained for their response behavior towards survival, prevention, and management in the event of an imminent disaster. While studies have been conducted on the human factor in disaster response in other sectors such as the aviation industry (Darabont, Badea, and Trifu, 2020), the oil and gas industry has received little attention in this regard (Nwankwo et al., 2021). Analysis of the human behavioral response facet is recognized as a prominent causal factor in man-made and hybrid disasters in the oil and gas industry. The behavioral response of human resources is critical to the operations of the industry, as any error, violation, or non-compliance with processes can be a recipe for disaster. Thus, it is essential to develop a desired behavioral framework and impart necessary skills, experience, and knowledge for appropriate decision-making to strengthen the energy soldiers and ensure their alertness for tackling unforeseen adverse situations, just as a combatant soldier does in life-and-death situations during war.

3.2. Purpose of the Study

The objective of this study was to emphasize the importance of human behavior as a critical component of organizational response in the oil and gas industry. Human behavior is responsible for more than 70% of the accidents or disasters in the industry, making it a significant factor that requires attention. Therefore, there is a pressing need to raise awareness amongst the human resources of the OGI sector, as well as to promote behavioral change so that they can respond appropriately in dangerous situations. Such behavioral changes would

enable them to remain calm and composed, and make informed decisions instead of panicking or feeling overwhelmed in the face of an adverse situation. This would significantly contribute to the prevention and management of OGI disasters, and ultimately enhance the overall safety and efficiency of the industry

3.3. Research Design

The study has been done with mixed research design includes both qualitative and quantitative research designs can be seen from fig. 2.1.. The research study started with the experts interview and literature review followed by the quantitative assessment with the factor identification and scale development.

Mixed-method research design is considered good for several reasons, as it combines the strengths of both quantitative and qualitative research methods. Some of the key benefits of mixed-method research design include:

Comprehensive understanding: By combining the quantitative data (numbers, statistics) with qualitative data (opinions, experiences), mixed-method research design can provide a more in-depth and comprehensive understanding of a research question or problem.

Validation and triangulation: Using both quantitative and qualitative data collection methods helps to cross-verify the findings, which can increase the overall validity and reliability of the study. This process is called triangulation, and it enables researchers to explore different perspectives and confirm or refute their findings.

Flexibility: Mixed-method research design offers more flexibility to the researcher in terms of data collection and analysis techniques. The researcher can adapt their approach based on the insights gained during the study, which can lead to a more nuanced understanding of the research question.

Complementarity: Quantitative and qualitative methods can complement each other by providing different perspectives on the same phenomenon. Quantitative methods often focus on the generalizability of findings, while qualitative methods emphasize understanding the context and the meaning behind the data. By combining these two approaches, researchers can gain a richer understanding of the research problem.

Enhanced credibility: Combining multiple methods in a single study can increase the credibility of the research findings. This is because using different methods to collect

Fig. 3.1. Depiction of Mixed Method Approach (Qualitative and Quantitative)

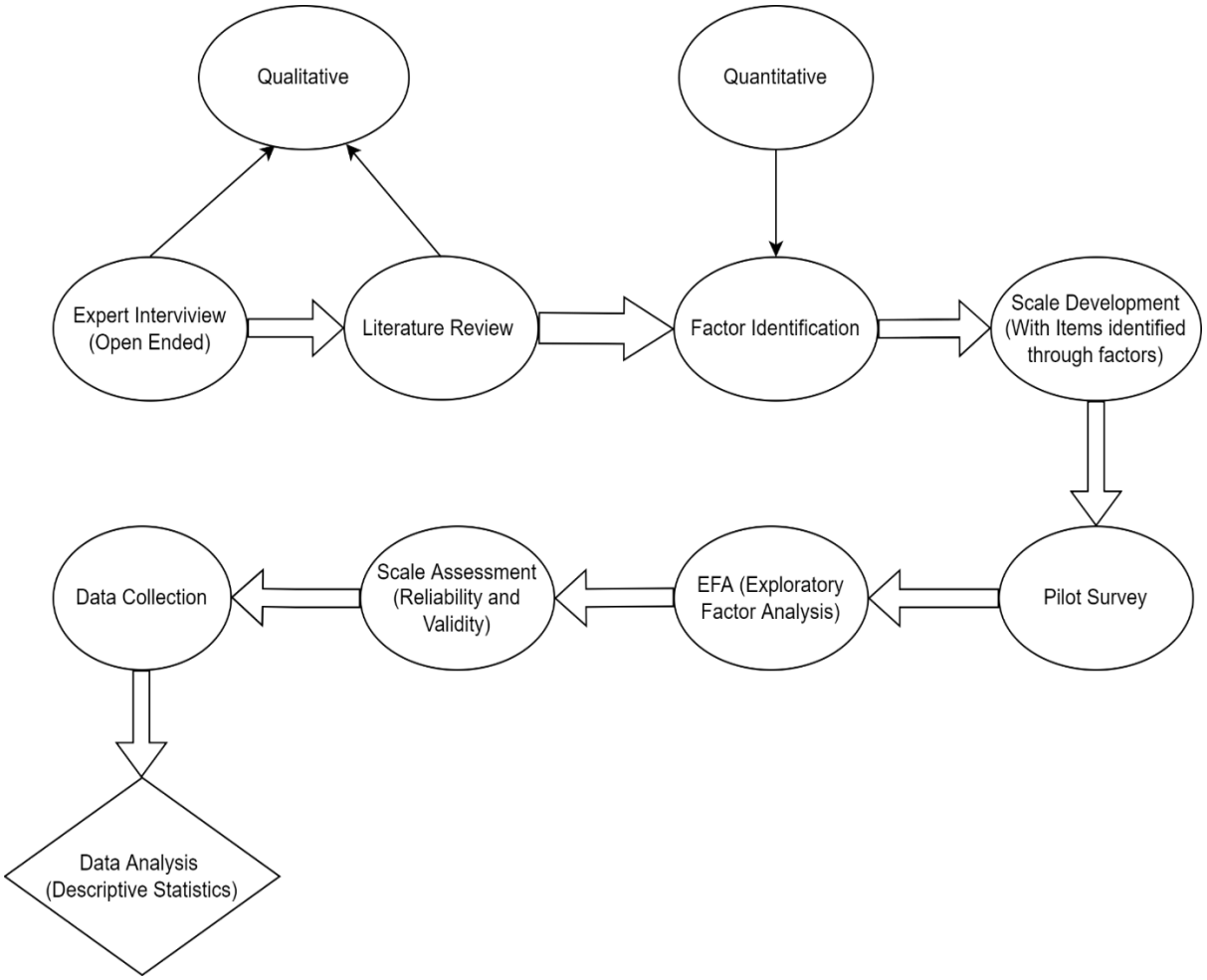


Fig 2.2 the process and the steps integrated the qualitative research technique. The systematic approach is followed which included the scientific method of theme identification given by Braun & Clark (2006). We also validated these code by the formulae given by boyaztis.

Fig. 3.2. Depiction of Qualitative Research Design

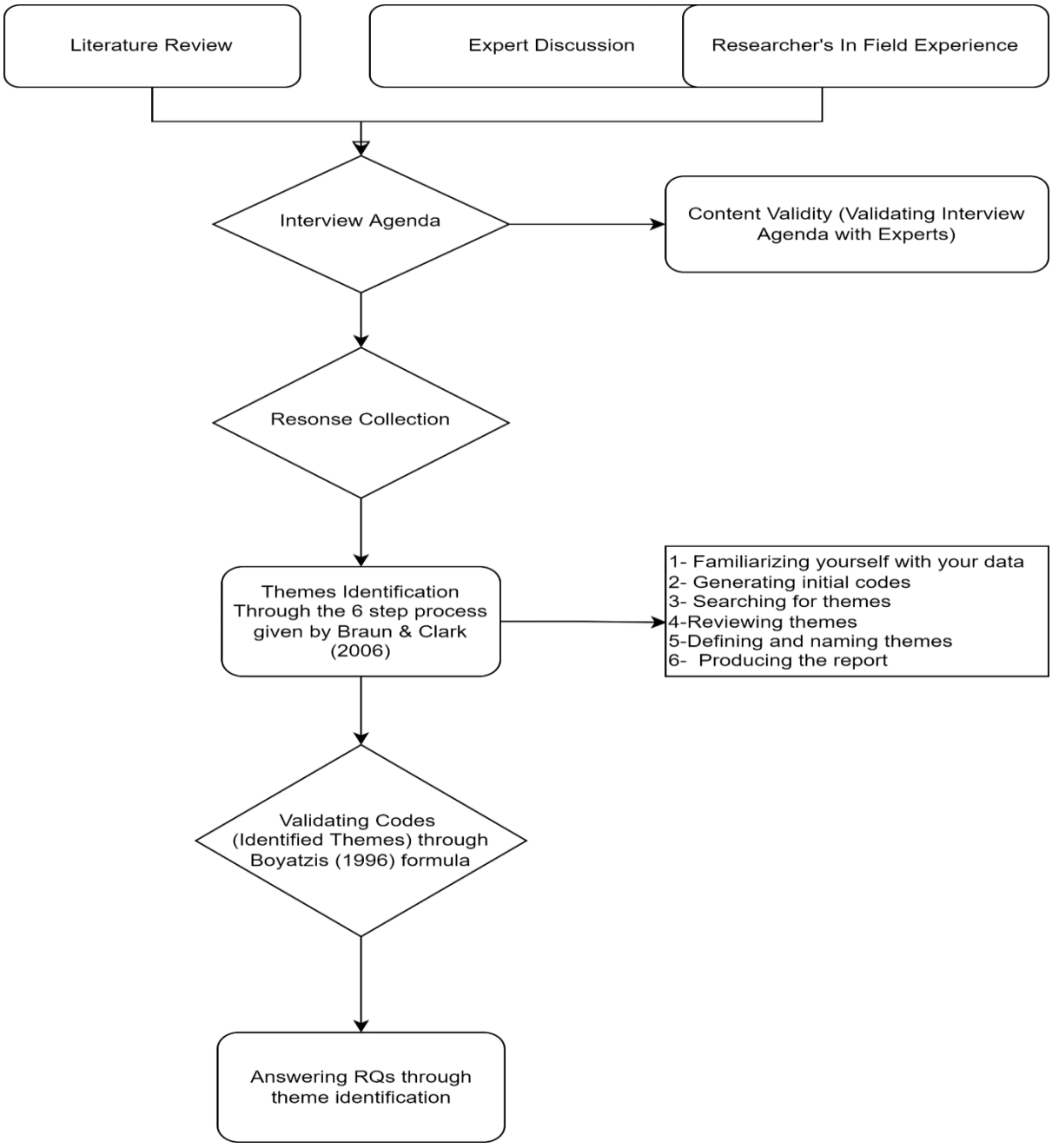
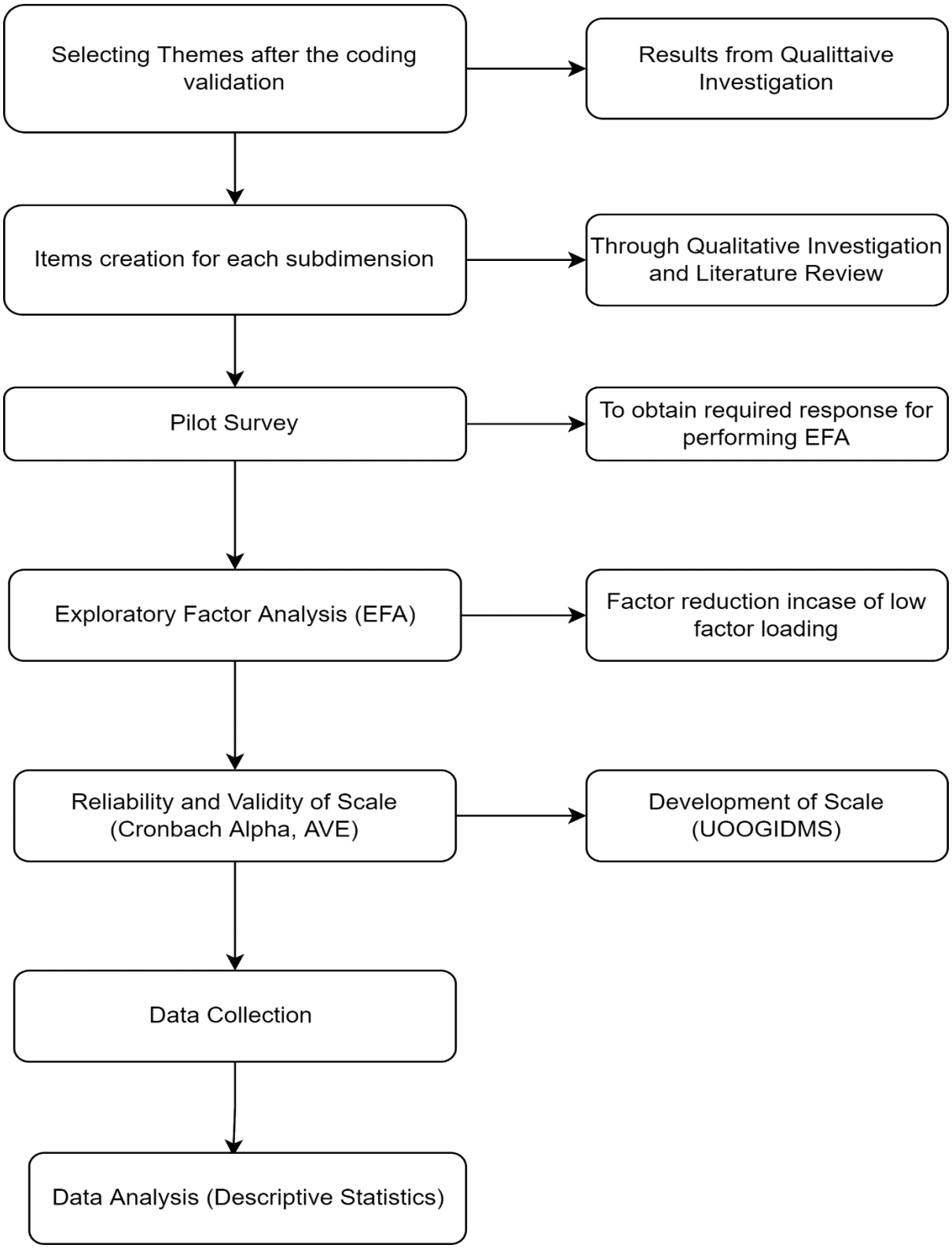


Fig. 3.3. Depiction of Quantitative Research Design



3.4. Investigations

The adopted both qualitative and quantitative sampling studies for ascertaining sample structure as described below.

3.4.1. Qualitative Investigation

The study utilized the "snowball sampling" method and recruited a total of 30 participants. Snowball Sampling is a non-probability sampling technique which relies referrals from initial participants to recruit additional participants. The initial participants were recruited through "purposive sampling" where the researcher had selected the participants based on pre-decided criteria, such as their experience or knowledge related to the research topic. These initial participants were then asked to refer other individuals who in turn meet the same criterion for the study. The process was continued till the desired sample size of 30 participants is achieved.

The qualitative analysis part of this study utilizes a "snowball sampling" method to recruit a total of 30 participants.

a. Snowball Sampling. A non-probability sampling technique, relies on referrals from initial participants to recruit additional participants
b. The initial participants were recruited through "purposive sampling"
c. Purposive Sampling. where the researcher selected participants based on certain criteria, such as their experience or knowledge related to the research topic.
d. These initial participants will then be asked to refer other individuals who also meet the criteria for the study.
e. This process continued until the desired sample size of 30 participants is reached.

Fig. 3.4. Quantitative Sample Selection

Region	East & NE	South	West	North	Population	Samples Selection
Areas	BASINS					
	(a) Assam & Assam Arakan Basin (b) Frontier Basin (c) MBP Basin, Kolkata	(a) KG-BP Basin, (b) Cauveri	(a) Western Offshore Basin, (b) Western Onshore Basin (c) Rajasthan Basin	(a) Forward Base-Dehradun (b) Vindhya Basin		
	ASSETS					
	Assam, Jorhat, Kachhar, Bokaro, Tripura, Digboi, Duliajan, Manabhum (AP), Lakhimpur	Rajamundari, EOA Kakinada, Karaikal	Mehsana, Cambay, Ahmedabad, Jodhpur, Ankaleshwer	-		
	PLANTS & MISC					
	-	-	Uran, Hazra & C2C3	Delhi: OVL and , HQs of Upstream Organisations		
Strategic/Policy Makers / Directors Level (Top Management)	21	08	18	35	82	23
Supervisory Level (Middle Management)	78	33	79	81	271	97
Functional Level (Lower Management)	153	83	241	90	567	130
Total	252	124	338	206	920	250

In this, the target population was split in to multi-stage sampling- formed Clusters with Random selection of sample size. For the same, entire Indian UOOGI population was divided into four regions East & North East, South, West and North, then area clusters of operational establishments; Basin, Assets and Plants/Misc were selected and lastly population was divided in three hierarchical levels: policy Makers/Direction level, Supervisory level and functional level. A total of 250 Nos selected for the purpose.

Boyatzis formula for code validation

The Boyatzis formula for theme identification is a process used in qualitative analysis, specifically in analyzing interview or survey data. It involves the following steps:

- Collect and transcribe data: The first step is to collect data through interviews or surveys, and transcribe the audio or written responses into text.
- Code the data: Next, the researcher reads through the transcribed data and identifies meaningful segments or "codes" that capture important ideas or concepts.
- Group the codes: The researcher then groups similar codes together to form "categories" or "themes" that represent broader concepts or ideas.
- Calculate the frequency and intensity of themes: The Boyatzis formula involves calculating the frequency and intensity of each theme. Frequency refers to the number of times a theme appears in the data, while intensity refers to the emotional or descriptive language used to express the theme.
- Determine the most salient themes: Finally, the researcher identifies the most salient themes by selecting those that have the highest frequency and intensity scores.

The formula for calculating frequency and intensity scores is:

Frequency score = number of times a theme is mentioned in the data

Intensity score = average rating of emotional or descriptive language used to express the theme (on a scale of 1-5)

Salience score = Frequency score x Intensity score

The themes with the highest salience scores are considered the most important and relevant to the research question or topic being studied.

CHAPTER IV

ANALYSIS, RESULTS AND DISCUSSION

Chapter-4

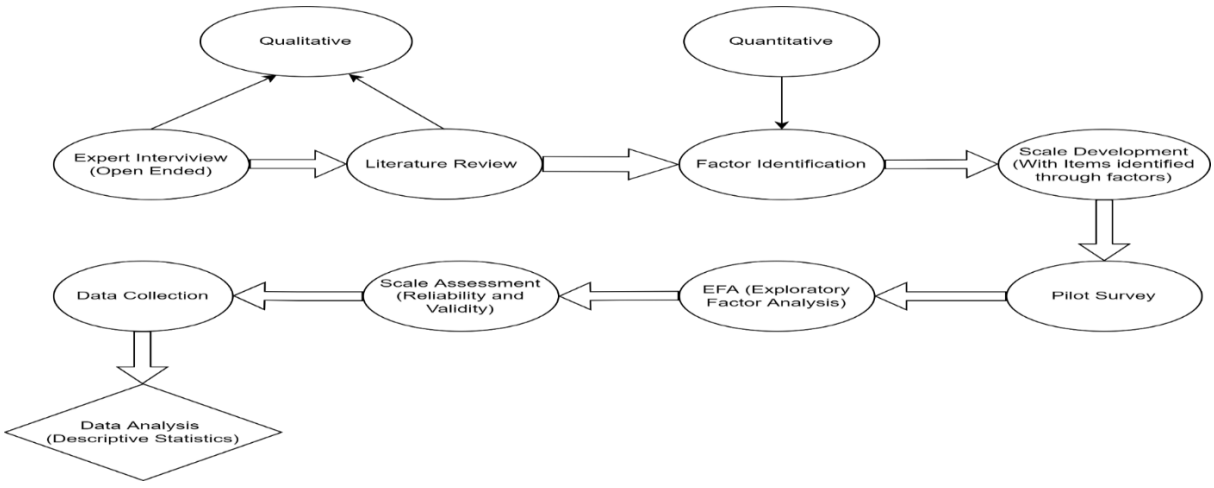
ANALYSIS, RESULTS AND DISCUSSION

4.1. Research Process

The oil and gas industry's upstream sector involves exploration and production activities, which entail locating oil and gas reserves underground (on land or sea) and extracting them for further use. This process involves conducting geological studies, geo-physical field surveys, and drilling wells on potential reservoir sites. Production activities focus on recovering confirmed reserves for commercial use. However, these operations pose significant risks of accidents and disasters, which can endanger the workforce involved.

To conduct a qualitative investigation, the researcher employed snowball sampling to distribute interview agendas to potential respondents. The data collection process ceased when the responses became repetitive. Braun and Clark's (2006) six-step method were used to identify the most relevant and significant responses, which helped to uncover the underlying themes and analysis process given below:

Fig. 4.1 Analysis Process



Source: Author Compilation

(Identified through Braun and Clark, 2006) Theme-1: POLICY & PROCEDURES

Q1. Upstream OGI is a process based industry and possess well established policies and practiced procedures for dealing with accidents / disasters with a view to prevent the injuries / loss of limb or life of manpower, economic, infrastructure and natural resource as well as organisational reputation. What are your views on the existing policy & procedures?

Respondent-1: Well, we lay highly focussed approach for the safety of manpower dealing with the upstream operations, in that every person is required to be donning the full Personal Protective Equipment (PPE) gear whether on land (Onshore) or on sea/oceans (Offshore) upstream activities. The geo-physical (GP) Party personnel executing geo-physical surveys using explosives for blasting holes for data collection are well specialised, trained, experienced and authorised people involved in these tasks.

Respondent-2: To add further on the role and tasks of GP Party personnel who deal with explosives are all specially trained for the tasks are well conversant with the handling, accounting, management, storage, preparing charges (different types) and its firing and finally on seismic data collection. They strictly adhere to the instructions on handling of explosives and remain in direct contact with local civil administration and other concerned authorities for management of mishaps (if any).

Respondent-3: Yes, there are many violations too on the very basic safety shield is PPE- as many people at work-stations people wear it partially due to different pretexts viz; non-issue (NI) of complete items / personal intentionally not wearing complete PPE / one or few of items fully worn-out / damaged and lack of strict compliance to safety. As regards 12 h shift duty pattern- I feel 8 h shifts are more suitable for intense operational task work-stations as it keeps the personnel fresh, agile and active whereas

12 hourly shifts oftenly tends to loss of vigour towards attentiveness and promptness in responses.

Respondent-4: Certainly- handing/taking over of tasks/duties/responsibilities a major event and needs strict execution and requires a voluntary concern amongst parties involved. We, in OGI had a major disaster in the past at an offshore platform where everything got destroyed with huge loss of manpower. Overall, it's a grey area and needs strict attention as well as focus by all for spirited execution.

Respondent-5: My personal take on SOP, Orders, DMP and ERP is that these are well documented, addressing all possible accident / disaster scenarios and emergencies and placed at easily accessible sites at establishments viz; drill-sites, production establishments, plants and installations, but due diligence in strict pursuance and strict compliance a matter of introspection for regular updating, integration of new technologies and scheduled genuine practices with participation of all.

Respondent-6: I strongly feel that the shift change and the handing-taking over event is one of the most essential happenings of any process-oriented industry and needs special attention by all involved especially so where dangerous / critical activities / operations are involved. However- my personal experience on this issue has not been encouraging as both parties are in a rush to finish the formalities of handing/taking over without paying much heed to the seriousness / vulnerabilities of the ongoing processes / actions / operations and oversight / neglect had oftenly been the cause of major disasters in OGI as well as in other spheres.

Respondent-7: I had noticed all through my professional life that upstream OGI operational streams regularly execute mock-drills practicing emergency drills, standard procedures and impart training. But, these practices were more of mandated formality

for documentation than having genuine concern for the stipulated cause and lacked will and motivation for the same.

Respondent-8: My experience on the conduct of mock-drills is- leader's lack of innovation in execution, genuine concern for learning by the participants, imbibing lessons learnt and lack of participation by all present in the establishment.

Respondent-9: Well, all OGI installations prominently display the contact details of all key officials who must be intimated in case of occurrence of an accident / disaster in and are regularly updated whenever any there is a change of contact or official.

Respondent-10: As a driller, I express it explicitly that spud-meeting / conference is a very important and must congregation of all stake-holders and is always held prior to an exploratory drilling.

Respondent-11: I have rarely come across when an Off-Site Mock-Drill was conducted impromptu, else it's conduct has mostly been an orchestrated extravaganza.

Respondent-12: Certainly, I feel that the off-site mock-drills need incorporation of more surprise element innovation- especially for seeking the genuine response of all the stake-holders: government machinery (viz; civil administration, police, medical services, fire services and civil-defence committees) in case of an upstream OGI disaster.

Respondent-13: I feel the maintenance of Drilling / Work-Over Rigs need more focus and concern for ensuring scheduled & regular preventive maintenance tasks & overhauls without any compromise/s with time-schedule.

Respondent-14: Yes, the aging and obsolesce of major equipment and rigs had been the causal factors for occurrence of major accidents / disasters in upstream operations and needs induction of new technologies and infrastructures.

Respondent-15: I agree with the lack of compliance by both the contractual as well as regular employees at shop-floors leading to accidents / disasters, these include compromise with PPE, non-adherence to established orders / procedures by complacency and rarely by ignorance,

Q2 Contractual manpower working in UOOGI partially wear full PPE in operational area

Respondent-1: I completely agree with this grey-area where contractual personnel found lacking in compliances and it's a big challenge for the industry, my experience of this was very bad where I noticed trade-men being casual and complacent towards wearing of PPE even at operational duties.

Respondent-2: The people are generally compliant to PPE norms and wear it.

Respondent-3: I asked one of the person and enquired for partial and improperly worn PPE and his answer was ignorance about its significance, lack of demonstration as how to wear the same

Respondent-7: I noticed a peculiar thing for not wearing PPE was the most of the persons do not know how to be fully attired with all the articles of it then excuse given as discomfort, if a person wears the overall will not wear boots.

Respondent-13: My observation on people shying for not or partially wearing PPE was its care, maintenance and ill-fitting helmets where issuing agency must ensure procurement and providing properly fitting items to all affected.

Q3 GP-Party personnel on explosive duty are especially trained for handling the same

Respondent-1: I fully endorse that not all- but nominated regular persons dealing with the explosives are especially trained for its handling, custody and management

Respondent-5: Though most of the physical handling of the explosive rests with the contractual manpower for this specific role- few core regular supervisory personals are well versed with explosives handling.

Respondent-8: GP-Party field exploration activities are very vital phase of operations where people are out for months in remote and difficult areas and self-contained for the duration, not all- but all nominated regular persons dealing with the explosives are especially trained for the job

Respondent-11: GP-Party most of the personnel are aware of explosives handling, however those directly responsible or on explosives duty are well trained on it.

Q4 Oil & grease smeared floors and hand-rails act as major contributor to the limb injuries of drilling crews

Respondent-4: Drilling-rig floors and platforms are a place where oil & grease reaching /lying on floors and around stairs hand-rails unavoidable and strict compliance ensured for crews be in full PPE with special gloves and foot-wears. Still, it's a grey area and minor injuries oftenly occur.

Respondent-9: Yes- I agree on this menace, oil & grease are culprits for giving injuries to drilling crews

Respondent-15:I agree on this point, in addition even the drilling-rig stair-climbing it-self is a challenge and one got be very careful even if there is no smears of grease / oil

Q5 12-hourly shifts at UOOGI field installations are ideal over 8 h for continuity of operations

Respondent-1: I will go for 8-h shift as it keeps the person fresh with a long meal and short break of refreshment.

Respondent-4: Well, I feel 12 h shift accords more continuity of operations hence go for it.

Respondent-7: Strongly feel 8 h shifts are suitable for all

Respondent-10: I will go for a 12-h long shift for continuity of operations

Q6 Long duty shifts (beyond 8 h) does not adversely impact on the behaviour response of manpower

Respondent-5: I am of the opinion- 8 hourly shift pattern ideal for people deployed on OGI operational tasks as 12-hourly shifts will lead to exhaustion and lacking responses

Respondent-6: Certainly- long duty shifts will definitely affect adversely on employees in extreme OGI operations viz; drilling platforms, surface tasks etc

Respondent-10: I strongly oppose long duty shift for personnel of operational streams

Q7 As a routine the duty persons formally hand / take over the responsibilities/duties with necessary briefs during shift change:

Respondent-1: Procedurally- Yes, shift duty personnel do relieve after formal handing-taking over

Respondent-2: I agree- nobody takes a chance

Respondent-10: I do not fully endorse it, as sometimes dilutions do occur in handing-taking over of responsibilities

Respondent-12: Violations do happen, but rare instances- irrespective of rarity, it's dangerous

Respondent-13: I say it with conviction- after Piper Alpha accident, people are cautious on handing-taking over during shift change of duties

Q8 Contractual persons on night shift duties deployed for manning the critical / dangerous operations along with regular employee

Respondent-1: Yes, they are deployed

Respondent-2: It's unavoidable, the contractual manpower deployed on all tasks integrated with core organisational personals

Respondent-5: Certainly- they are deployed but in consonance with organisational manpower except where entire system has been outsourced to third party

Q9 SoP, Orders, Important contacts details (telephone Nos, email id etc) of all reporting officials responsible for managing the disaster are prominently displayed at field installations

Respondent-1: Yes, these are prominently displayed at the entrance of the installations only

Respondent-3: I agree with the issue

Respondent-5: Totally in agreement- this procedure of display of SOP/Orders etc also ensures these are easily accessible too in case of an emergency

Respondent-10: Yes- 100% these are prominently displayed and updated regularly

Q10 Contact details of all key officials (UOOGI installation/HQ, police, medical etc for handling emergency are regularly updated on occurrence

Respondent-4: I fully endorse this practice.

Respondent-5: Absolutely maintained regularly with necessary updated on occurrence of any changes

Respondent-8: I agree to this practice in letter and spirits

Respondent-11: It's a routine practice

Respondent-15: I fully support this point

Q11 Mock-drills are regularly conducted.

Respondent-1: Not in all operational streams, however- drilling, security and fire streams are particular in regular conduct of mock-drills

Respondent-4: I don't fully support the regularity

Respondent-5: Yes, mock-drills are regularly conducted

Respondent-8: If I say- on paper regularly conducted for official record keeping

Respondent-11: I will admit- it's a grey area

Respondent-13: Yes- no compromises on their conduct

Q12 Mock-drill is conducted with realism and innovation.

Respondent-7: Well- these factors are very essential for successful conduct of mock-drills, not always incorporated

Respondent-8: Yes- the conduct is generally regular but innovation not always possible

Respondent-9: My take is different- in a dangerous, fire-sensitive OGI industry, practicing realism is very risk-prone. However, during On-Site Mock-drill practices- it is endeavoured to make it as real as possible

Respondent-12: I will admit- realism and innovation not always possible specially in oil / gas production installations due inherent dangers

Respondent-15: With precautions- mock-drills are conducted with realism and innovations too

Q13 The off-site mock-drill practice is conducted at field installation in coordination with all stake-holders

Respondent-2: Yes, all state-holders and boundary players are involved for the execution of off-site mock-drills

Respondent-3: Off-site mock-drills well-coordinated affair with involvement of all stake-holders for managing a disaster viz; local & reserve police forces in addition to departmental security, civil administration, fire services (organisational and govt fire-fighting departments), organisational and civil medical services/hospitals (casualty-evacuation and management), local garrison, Air-Force/Commercial air services, local govt officials, public representatives, village Sarpanch / counsellors etc

Respondent-7: I agree with the requirements for incorporating stake-holders

Respondent-12: Stake-holders participation a must for an OGI Off-site mock-drill and their physical participation a must

Q14 Spud-Meeting of all stake-holders is a must requirement prior to exploratory drilling.

Respondent-1: Yes, it is a standing practice

Respondent-3: Very important to seek participation of stake-holders

Respondent-5: I agree in totality

Respondent-7: Fully endorse this point

Respondent-9: I used to ensure full participation of all stake-holders for the spud-meeting

Q15 Rigs and essential equipment are regularly maintained including their periodic maintenance scheduled tasks

Respondent-1: Yes, very much

Respondent-2: All routine maintenance tasks are executed in-situ, however scheduled-tasks required complete dismantling and requires long time period. Though ensured to stick to time-schedule- violations due occur for meeting production targets etc

Respondent-3: Well, essential equipment maintenance schedules generally adhered to and ensured too. However, drilling rig – a challenge for strictly adhering to time-lines of maintenance schedule and that's a reality

Respondent-13: Maintenance schedules are generally adhered to with their time-lines and dilutions (if any) are exceptions

Respondent-15: Maintenance schedules generally adhered to

Q16 Obsolete drilling / work-over rigs are the main cause of fatal accidents at upstream onshore operations

Respondent-4: Not exactly, sometimes such unfortunate accidents do occur due to obsolescence of rigs / equipment

Respondent-6: Yes.

Respondent-9: I will- these are the facilitators

Respondent-11: Agree with it

Respondent-15: I partially endorse this point

Q17 The delayed induction of new technology / equipment is cause of concern for vulnerability in UOOGI operations.

Respondent-3: A cause of concern- agree with it

Respondent-4: Fully endorse this view-point

Respondent-5: I fully subscribe to this experience and there exists urgent need to phase-out all old technology which more than 30 years old

Respondent-7: I support this view and already flagged this matter many times with the higher-ups

Respondent-10: Agree with it

***(Identified through Braun and Clark, 2006) Theme*-2: AWARENESS ON DISASTER**

Q1. Natural disasters (earthquake/floods/ tsunami/cloud-bursts) cause of concerns for UOOGI operations/installations

Respondent-1: I qualify my statement that it is man-made disasters, we in oil industry more concerned with, as in human-machine combine, it is the human factor more relevant in causation of an accident / disaster

Respondent-2: I do not support view-point as I am not aware of any natural disaster had ever affected UOOGI operation/installation

Respondent-3: Rarely- it may happen that an earthquake of >7.5 having its epicentre at or near an UOOGI installation cause damage

Respondent-4: Well- act of God not the main cause of concern for UOOGI

Respondent-6: My experience- Natural disasters upstream onshore operation / installation not heard.

Respondent-9: According to me- it's always man-made factors cause disasters in UOOGI

Q2 Flood unleashed as a result of technical failure in Oil India Limited (OIL) gas well blow-out in Baghjan (Tinsukia) Assam in year 2020 caused a disaster

Respondent-1: Yes, I had observed the entire issue of Baghjan from distance as well as physical visit too, and say with conviction a man-made disaster which triggered a small natural disaster too

Respondent-2: May be

Respondent-3: Quite likely

Respondent-4: No idea

Respondent-6: It caused lot of damage to local aquatic life and social disorder in area with serious environmental pollution due to continuous fire for months

Respondent-11: In recent times- a big man-made disaster in Indian upstream OGI sector

Respondent-13: No comments

Q3 Most of the disaster in UOOGI fall in the category of Hybrid type of disaster

Respondent-1: I don't agree with this statement

Respondent-4: Well- sometimes, like the recent one in Baghjan blow-out, Tinsukia

Respondent-6: Not always

Respondent-8: UOOGI disasters are mainly man-made in nature

Respondent-10: Yes, oil industry disasters are general fall into Hybrid category as rarely it had happened wherein an onshore establishment suffered due an earthquake/ landslide/flood

Respondent-14: I do not agree

Q4 Blow-out disasters are an outcome of human failure.

Respondent-1: In my professional life, I have come across many blow-out incidents and say it with authority of experience and handling such emergencies that occurrence of well blow-outs are largely due to human factor

Respondent-4: I agree

Respondent-6: Predominantly- human factor the causal phenomenon

Respondent-9: Yes, very much

Respondent-12: Agree with it

Respondent-15: Very much- human factor

Q5 UOOGI mainly suffer Manmade disasters

Respondent-2: Yes, man-made disasters are the principal reason in UOOGI

Respondent-4: Yes, agree

Respondent-6: Largely man-made accidents, but offshore upstream OGI suffered badly by natural disasters too

Respondent-8: Very much man-made only

Respondent-13: I strongly support this view-point

***(Identified through Braun and Clark, 2006) Theme* -3: CULTURE & MANAGEMENT PERCEPTION**

Q1 Revision/ updating of Standard operating procedures (SoP), emergency response plans (ERP) and disaster management plan (DMP) are UOOGI management top concerns.

Respondent-6: I am very sure of 100% compliance to updating of all orders, SoP, guidelines and instructions for dealing with emergency situations in practice

Respondent-8: Yes

Respondent-10: I, strongly endorse it

Respondent-13: Of course- a major concern towards dealing with a potential disaster

Q2 Complacency is a cause of concern towards strict compliance of established processes leading to accidents / disasters in UOOGI.

Respondent-1: Lack of job-rotation and long stays cause of concern in UOOGI, also a factor for complacency- I was very concerned of these practices at installations and insisted for instituting changes

Respondent-2: Well, it's a serious matter. As workers oftenly takes things for granted and take matter casually

Respondent-5: I was concerned with this practice

Respondent-8: It's dangerous state to face complacency amongst OGI work-force

Q3 UOOGI installations ensure safety of local population against potential dangers of oil spills / gas leakages in area of operation.

Respondent-1: Very much, a social responsibility and we accord top concern

Respondent-4: Yes, the local population, govt reps/offices in the in the vicinity of an oil installation or drilling rig operations are always updated on potential dangers, occurrence of spills. Oil & gas leakages at the installations and pipelines. Local installations also take initiatives and conduct awareness drives for the population through talks, lecture and demonstrations with live fire / gas etc .

Q4 Quality of leadership at the helm of UOOGI field installations is a cause of concern for the men affected by the disaster.

Respondent-1: I am sad that Govt PSE undergo this challenge due to many considerations viz; quota, reservations, pressure (political / caste or religion) and compromise with the performance of the organisation

Respondent-4: A point of concern for the organisation as well as Indian industry

Respondent-6: well- it's matter of discontentment

Respondent-10: Adversely affects morale of competent and meritorious persons

In the organisation

***(Identified through Braun and Clark, 2006) Theme* -4: HUMAN BEHAVIOUR FACET & DISASTER**

Q1 Disaster manipulates peoples' response behaviour.

Respondent-1: Yes, very much as it affects the psyche of the person

Respondent-3: I strongly support

Respondent-8: Agree with it

Q2 An impending disaster adversely affects the behavioural responses of UOOGI manpower.

Respondent-1: Yes- as the fear of unknown sets-in-

Respondent-3: Agree with the point

Respondent-6: I admit- that most of the manpower starts anticipating likely incidents and inherently think adversely instead of positive solutions

Respondent-10: Majorly- it happens in this manner

Respondent-15: I feel- a cause of concern

Q3 Human behaviour can be a causal factor to trigger /catalyse facilitation of a disaster.

Respondent-1: Strongly agree

Respondent-6: I support this- as man is at the core of all the activities

Respondent-10: Yes, very much

Q4 Human behaviour play a vital role for managing an emergency / disaster.

Respondent-1: Yes,

Respondent-3: Very much

Respondent-6: Strongly- Human behaviour does play an important role

Q5 Morale is a factor influencing the behaviour of personnel.

Respondent-2: Undoubtedly- it affects the behaviour

Respondent-7: No doubt- Morale is a most important factor in life and especially those working or operating in dangerous places or always exposed to imminent dangers

Respondent-11: Fully endorse it

Q6 Meeting operational timelines take precedence over safety protocols & compliances.

Respondent-1: I feel concerned- many instances where time-lines and financial considerations led to major disasters

Respondent-5: Yes, meeting time-lines do compromise the safety parameters

Respondent-13: Very much a reason compromising safety and inviting troubles for all

Q7 Management policies / perceptions affect the people's behaviour in UOOGI?

Respondent-3: Yes- as the policies of the management dictate the work-culture, ethics and priorities for conduct at the last man level, accordingly people in the organisation adopt their behavioural response for good / bad / neutral

Respondent-6: Agree with the statement

Respondent-12: Fully endorse the view point

Q8 Safe infrastructures, new technologies, modern machines/ equipment/ gadgets, suitable accommodation and welfare measures at UOOGI field installations act as motivators and behaviour response multipliers.

Respondent-1: Agree with it.

Respondent-4: Yes, very much.

Respondent-10: I feel these measures enhance the moral, technical efficiency & proficiency leading to improved skills instilling high levels of motivation and positive attitude with favourable behavioural response

Respondent-14: Strongly feel so

Q9 Physical health, mental balance and psychological stability have direct bearing on peoples' behaviour when encountered with a challenging / dangerous / disastrous situation. Is there a requirement to strengthen and address these aspects in UOOGI manpower towards disaster risk reduction?

Respondent-1: Very much- these parameters must be duly addressed by all in the organisation

Respondent-2: I strongly believe in the saying- a sound mind lives in a sound body

Respondent-7: I cannot accept the physically unfit, ill-alert / mentally stressed people in core operational streams

Respondent-9: There is strong requirement to ensure physically fit and mentally / psychologically well-tuned people in operational streams of upstream OGI towards disaster risk reduction.

Respondent-15: UOOGI cannot afford to compromise on physical and psychological

Standards of organisational manpower those in drilling, production, fire, security and other such operations oriented streams.

4.2. Quantitative Investigation

4.2.1. Measurement model

4.2.2. Internal consistency reliability

Internal consistency reliability and validity of scales were examined. Internal consistency reliability included scales' composite reliabilities and coefficient alpha (see Table 4.2). The values of Cronbach's alpha for all the scales were above 0.7, composite reliabilities were above 0.7 (recommended value > 0.7), thus, good reliability was indicated (Hair et al., 2010). Also, the AVE value of the construct is >.50 which is showing a good validity for the scale. It can also be clearly seen that factor loading for all the items are close and above

Table 4.1 Factor Loading, Reliability, Composite Reliability , Validity

Construct		FL	α	CR	AVE
Policy & Procedures (PP)	PP1	0.76	**0.86**	**0.89**	**0.63**
	PP2	0.77			
	PP3	0.68			
	PP4	0.72			
	PP5	0.66			
	PP6	0.78			
	PP7	0.71			
	PP8	0.75			
	PP9	0.73			
	PP10	0.78			
	PP11	0.65			
	PP12	0.66			
	PP13	0.76			
	PP14	0.77			
	PP15	0.74			
	PP16	0.75			
	PP17	0.69			

Awareness on Disaster (AD)	AOD 1	0.76	**0.92**	**0.91**	**0.59**
	AOD 2	0.71			
	AOD 3	0.75			
	AOD 4	0.77			
	AOD 5	0.73			
Culture and Management Perception (CMP)	CMP1	0.77	**0.87**	**0.89**	**0.76**
	CMP 2	0.69			
	CMP 3	0.75			
	CMP 4	0.71			
Human Behaviour Facet and Disaster (HBFD)	HBFD 1	0.71	**0.76**	**0.83**	**0.56**
	HBFD 2	0.76			
	HBFD 3	0.72			
	HBFD 4	0.81			
	HBFD 5	0.83			
	HBFD 6	0.76			
	HBFD 7	0.69			
	HBFD 8	0.77			
	HBFD 9	0.71			

Source: SPSS Output

4.3. Analysis and Discussion

Table 4.2 an all other figures of quantitative investigation represents the detailed representation of frequency distribution. The data provided is a survey of respondents' opinions on various aspects of policy and procedures, disaster awareness, and culture and management perception in the UOOGI organization. The responses range from "Strongly Disagree/Less Likely" (1) to "Strongly Agree/Most Likely" (5).

Looking at the data, it can be seen that the majority of respondents agree that UOOGI organizational manpower should wear full protective equipment (PPE) when working in the operational areas (49.10% Agree and 40% Strongly Agree), and that contractual manpower working in UOOGI should partially wear full PPE in operational areas (45.50% Agree and 16.40% Strongly Agree). However, there is a high level of disagreement (20%) and strongly disagree (9.10%) on the latter statement, indicating that some respondents believe that contractual manpower should also wear full PPE.

Respondents generally agree that GP-Party personnel on explosive duty should be specially trained for handling the same (45.50% Agree and 38.20% Strongly Agree) and that duty persons should formally hand/take over responsibilities/duties during shift changes (61.80% Agree and 20% Strongly Agree). Respondents are neutral on the statement that oil and grease smeared floors and hand-rails act as major contributors to limb injuries of drilling crews (45.50% Neutral), while there is disagreement on whether 12-hourly shifts at UOOGI field installations are ideal over 8 h for continuity of operations (25.50% Agree and 18.20% Strongly Agree) and whether long duty shifts (beyond 8 h) adversely impact the behavior response of manpower (29.10% Agree and 12.70% Strongly Agree).

In terms of disaster awareness, respondents are most likely to agree that contact details of all key officials (UOOGI installation/HQ, police, medical, etc. for handling emergency) are

regularly updated on occurrence (54.50% Agree and 36.40% Strongly Agree) and that mock drills are regularly conducted (45.50% Agree and 47.30% Strongly Agree). Respondents are neutral on whether most of the disasters in UOOGI fall in the category of hybrid types of disasters (53.70% Neutral), while there is disagreement on whether flood unleashed as a result of technical failure in Oil India Limited (OIL) gas well blow-out in Baghjan (Tinsukia) Assam in year 2020 caused a disaster (18.50% Agree and 16.70% Strongly Disagree).

Finally, in terms of culture and management perception, respondents generally agree that the revision/updating of standard operating procedures (SoP), emergency response plans (ERP), and disaster management plan (DMP) are UOOGI management top concerns (44.40% Agree and 40.70% Strongly Agree) and that complacency is a cause of concern towards strict compliance of established processes leading to accidents/disasters in UOOGI (51.90% Agree and 34.10% Strongly Agree).

In conclusion, the survey responses suggest that UOOGI has several areas where it can improve its policies and procedures, disaster awareness, and culture and management perception. The data shows that while some statements have high levels of agreement, others have a high level of disagreement or are neutral, indicating that UOOGI should focus on addressing these areas to ensure the safety and wellbeing of its employees and stakeholder

Table 4.2 Frequency Distribution for Scale Responses

UPSTREAM ONSHORE OIL & GAS INDUSTRY BEHAVIOURIAL RESPONSE DISASTER MANAGEMENT SCALE (UOOGIBRDMS)						
	(Strongly Disagree/Less Likely) 1	**(Disagree)2**	**(Neutral) 3**	**(Agree) 4**	**(Strongly Agree/Most Likely) 5**	**Total**
POLICY & PROCEDURES						
UOOGI organisational manpower wear full protective equipment (PPE) when working in the operational areas	1.80%	7.30%	1.80%	49.10%	40%	100%
Contractual manpower working in UOOGI partially wear full PPE in operational area	9.10%	20%	9.10%	45.50%	16.40%	100%
GP-Party personnel on explosive duty are especially trained for handling the same	3.60%	1.80%	10.90%	45.50%	38.20%	100%
Oil & grease smeared floors and hand-rails act as major contributor to the limb injuries of drilling crews	3.60%	18.20%	21.80%	45.50%	10.90%	100%
12-hourly shifts at UOOGI field installations are ideal over 8 h for continuity of operations	10.90%	18.20%	27.30%	25.50%	18.20%	100%

Long duty shifts (beyond 8 h) does not adversely impact on the behavior response of manpower	7.30%	29.10%	21.80%	29.10%	12.70%	100%
As a routine the duty persons formally hand / take over the responsibilities/duties with necessary briefs during shift change	1.80%	7.30%	9.10%	61.80%	20%	100%
Contractual persons on night shift duties deployed for manning the critical / dangerous operations along with regular employee	5.50%	14.50%	25.50%	47.30%	7.30%	100%
SoP, Orders, Important contacts details (telephone Nos, email id etc) of all reporting officials responsible for managing the disaster are prominently displayed at field installations	0%	5.60%	1.90%	38.90%	53.70%	100%
Contact details of all key officials (UOOGI installation/HQ, police, medical etc for handling emergency are regularly updated on occurrence	0%	5.50%	3.60%	54.50%	36.40%	100%
Mock-drills are regularly conducted.	0%	3.60%	3.60%	45.50%	47.30%	100%
Mock-drill is conducted with realism and innovation.	1.80%	12.70%	7.30%	23.60%	54.50%	100%
The off-site mock-drill practice is conducted at field installation in coordination with all stake-holders	0%	1.80%	10.90%	52.70%	34.50%	100%

Spud-Meeting of stake-holders is a must requirement prior to exploratory drilling.	0%	0%	5.50%	40%	54.50%	100%
Rigs and essential equipment are regularly maintained including their periodic maintenance scheduled tasks	0%	10.90%	12.70%	47.30%	29.10%	100%
Obsolete drilling / work-over rigs are the main cause of fatal accidents at upstream onshore operations	11.30%	24.50%	26.40%	26.40%	11.30%	100%
The delayed induction of new technology /equipment is cause of concern for vulnerability in UOOGI operations.	1.80%	12.70%	30.90%	40%	14.50%	100%
Awareness On Disaster						
Natural disasters (earthquake/floods/ tsunami/cloud-bursts) cause of concerns for UOOGI operations/installations	20.40%	11.10%	22.20%	16.70%	29.60%	100%
Flood unleashed as a result of technical failure in Oil India Limited (OIL) gas well blow-out in Baghjan (Tinsukia) Assam in year 2020 caused a disaster	18.50%	16.70%	44.40%	14.80%	5.60%	100%
Most of the disaster in UOOGI fall in the category of Hybrid type of disaster	0%	9.30%	53.70%	29.60%	7.40%	100%
Blow-out disasters are an outcome of human failure.	11.10%	16.70%	31.50%	31.50%	9.30%	100%

UOOGI mainly suffer Manmade disasters	9.30%	1.90%	38.90%	40.70%	9.30%	100%

Culture & Management Perception						
Revision/ updating of Standard operating procedures (SoP), emergency response plans (ERP) and disaster management plan (DMP) are UOOGI management top concerns.	1.90%	9.30%	3.70%	44.40%	40.70%	100%
Complacency is a cause of concern towards strict compliance of established processes leading to accidents / disasters in UOOGI.	1.90%	9.30%	20.40%	48.10%	20.40%	100%
UOOGI installations ensure safety of local population against potential dangers of oil spills / gas leakages in area of operation.	0%	5.60%	7.40%	31.50%	55.60%	100%
Quality of leadership at the helm of UOOGI field installations is a cause of concern for the men affected by the disaster.	9.40%	13.20%	28.30%	35.80%	13.20%	100%
Human Behaviour Facet & Disaster						
Disaster manipulates peoples' response behaviour.	17%	3.80%	22.60%	30.20%	26.40%	100%

An impending disaster adversely affects the behavioural responses of UOOGI manpower.	13.50%	7.70%	23.10%	34.60%	21.20%	100%
Human behaviour can be a causal factor to trigger /catalyse facilitation of a disaster.	0%	15.10%	24.50%	47.20%	13.20%	100%
Human behaviour play a vital role for managing an emergency / disaster.	0%	1.90%	1.90%	22.60%	73.60%	100%
Morale is a factor influencing the behaviour of personnel.	0%	0%	0%	49.10%	50.90%	100%
Meeting operational timelines take precedence over safety protocols & compliances.	7.50%	9.40%	26.40%	37.70%	18.90%	100%
Management policies / perceptions affect the people's behaviour in UOOGI?	2%	1.90%	13.50%	46.20%	36.50%	100%
Safe infrastructures, new technologies, modern machines/ equipment/ gadgets, suitable accommodation and welfare measures at UOOGI field installations act as motivators and behaviour response multipliers.	0%	0%	7.70%	21.20%	71.20%	100%

Physical health, mental balance and psychological stability have direct bearing on peoples' behaviour when encountered with a challenging / dangerous / disastrous situation. Is there a requirement to strengthen and address these aspects in UOOGI manpower towards disaster risk reduction?	0%	2%	3.90%	33.30%	60.80%	100%

Table 4.3 Frequency Distribution responses for Policy & Procedures

POLICY & PROCEDURES	**(Strongly Disagree/Less Likely) 1**	**(Disagree)2**	**(Neutral) 3**	**(Agree) 4**	**(Strongly Agree/Most Likely) 5**	**Total**
UOOGI organisational manpower wear full protective equipment (PPE) when working in the operational areas	1.80%	7.30%	1.80%	49.10%	40%	100%
Contractual manpower working in UOOGI partially wear full PPE in operational area	9.10%	20%	9.10%	45.50%	16.40%	100%
GP-Party personnel on explosive duty are especially trained for handling the same	3.60%	1.80%	10.90%	45.50%	38.20%	100%

Oil & grease smeared floors and hand-rails act as major contributor to the limb injuries of drilling crews	3.60%	18.20%	21.80%	45.50%	10.90%	100%
12-hourly shifts at UOOGI field installations are ideal over 8 h for continuity of operations	10.90%	18.20%	27.30%	25.50%	18.20%	100%
Long duty shifts (beyond 8 h) does not adversely impact on the behaviour response of manpower	7.30%	29.10%	21.80%	29.10%	12.70%	100%
As a routine the duty persons formally hand / take over the responsibilities/duties with necessary briefs during shift change	1.80%	7.30%	9.10%	61.80%	20%	100%
Contractual persons on night shift duties deployed for manning the critical / dangerous operations along with regular employee	5.50%	14.50%	25.50%	47.30%	7.30%	100%
SoP, Orders, Important contacts details (telephone Nos, email id etc) of all reporting officials responsible for managing the disaster are prominently displayed at field installations	0%	5.60%	1.90%	38.90%	53.70%	100%
Contact details of all key officials (UOOGI installation/HQ, police, medical etc for handling emergency are regularly updated on occurrence	0%	5.50%	3.60%	54.50%	36.40%	100%

Mock-drills are regularly conducted.	0%	3.60%	3.60%	45.50%	47.30%	100%
Mock-drill is conducted with realism and innovation.	1.80%	12.70%	7.30%	23.60%	54.50%	100%
The off-site mock-drill practice is conducted at field installation in coordination with all stake-holders	0%	1.80%	10.90%	52.70%	34.50%	100%
Spud-Meeting of all stake-holders is a must requirement prior to exploratory drilling.	0%	0%	5.50%	40%	54.50%	100%
Rigs and essential equipments are regularly maintained including their periodic maintenance scheduled tasks	0%	10.90%	12.70%	47.30%	29.10%	100%
Obsolete drilling / work-over rigs are the main cause of fatal accidents at upstream onshore operations	11.30%	24.50%	26.40%	26.40%	11.30%	100%
The delayed induction of new technology /equipments is cause of concern for vulnerability in UOOGI operations.	1.80%	12.70%	30.90%	40%	14.50%	100%

Fig 4.2 Policy & Procedures

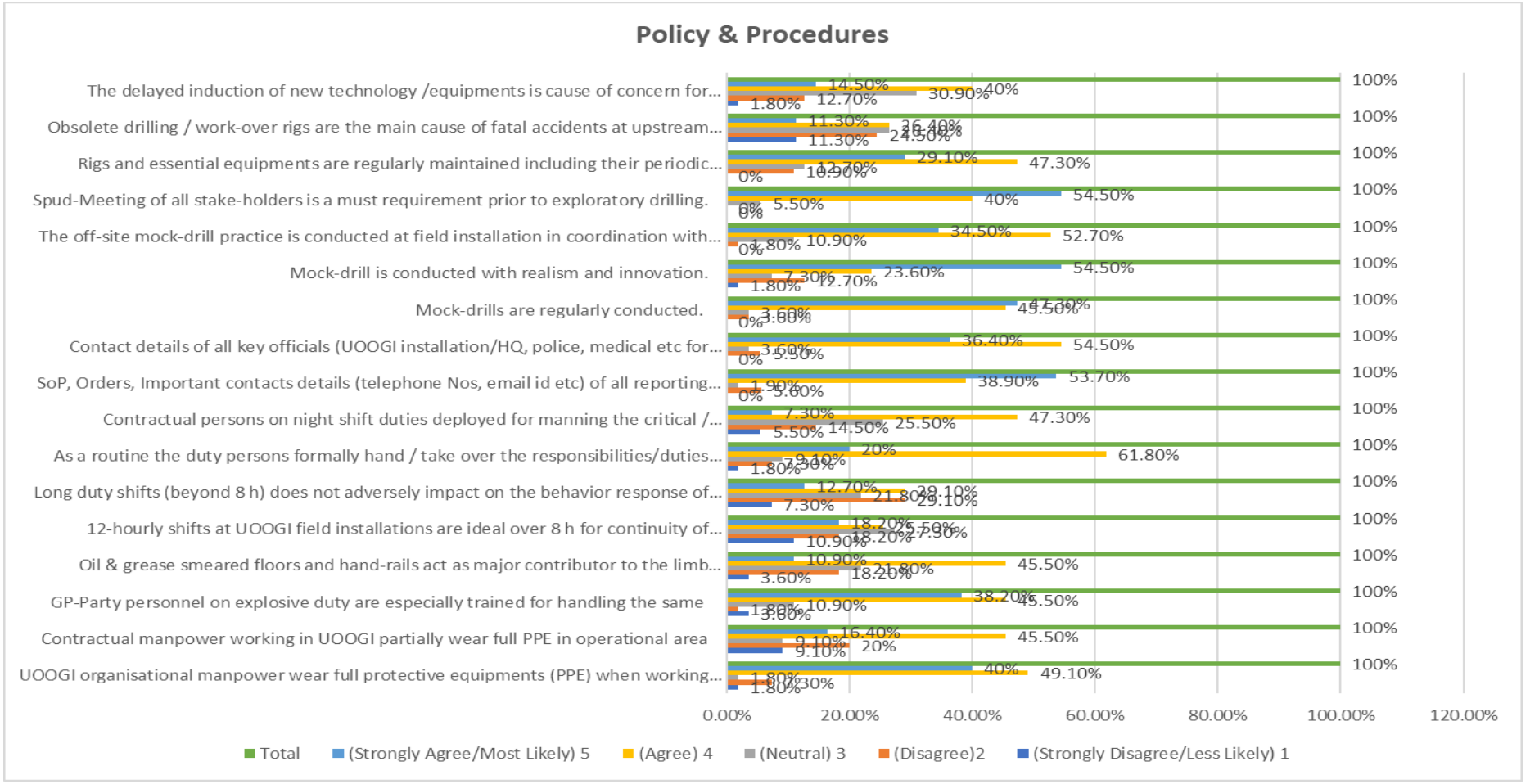


Table 4.4 Frequency Distribution responses for Awareness on Disaster

Awareness On Disaster	(Strongly Disagree/Less Likely) 1	(Disagree)2	(Neutral) 3	(Agree) 4	(Strongly Agree/Most Likely) 5	Total
Natural disasters (earthquake/floods/ tsunami/cloud-bursts) cause of concerns for UOOGI operations/installations	20.40%	11.10%	22.20%	16.70%	29.60%	100%
Flood unleashed as a result of technical failure in Oil India Limited (OIL) gas well blow-out in Baghjan (Tinsukia) Assam in year 2020 caused a disaster	18.50%	16.70%	44.40%	14.80%	5.60%	100%
Most of the disaster in UOOGI fall in the category of Hybrid type of disaster	0%	9.30%	53.70%	29.60%	7.40%	100%
Blow-out disasters are an outcome of human failure.	11.10%	16.70%	31.50%	31.50%	9.30%	100%
UOOGI mainly suffer Manmade disasters	9.30%	1.90%	38.90%	40.70%	9.30%	100%

Fig 4.3. Awareness on Disaster

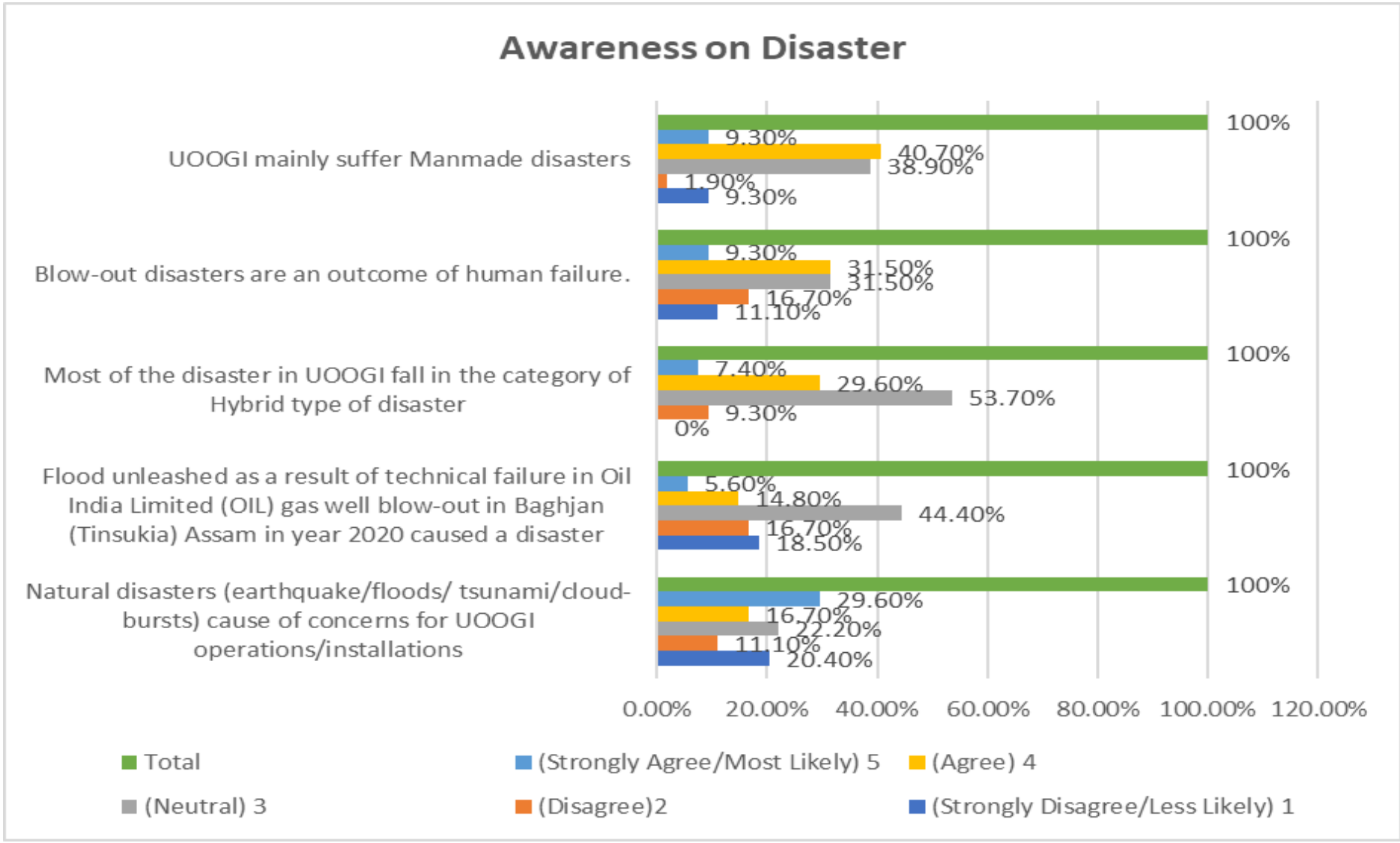


Table 4.5 Frequency Distribution responses for Culture & Management Perception

Culture & Management Perception	(Strongly Disagree/Less Likely) 1	(Disagree)2	(Neutral) 3	(Agree) 4	(Strongly Agree/Most Likely) 5	Total
Revision/ updating of Standard operating procedures (SoP), emergency response plans (ERP) and disaster management plan (DMP) are UOOGI management top concerns.	1.90%	9.30%	3.70%	44.40%	40.70%	100%
Complacency is a cause of concern towards strict compliance of established processes leading to accidents / disasters in UOOGI.	1.90%	9.30%	20.40%	48.10%	20.40%	100%
UOOGI installations ensure safety of local population against potential dangers of oil spills / gas leakages in area of operation.	0%	5.60%	7.40%	31.50%	55.60%	100%
Quality of leadership at the helm of UOOGI field installations is a cause of concern for the men affected by the disaster.	9.40%	13.20%	28.30%	35.80%	13.20%	100%

Fig. 4.4 Culture and Management Perception

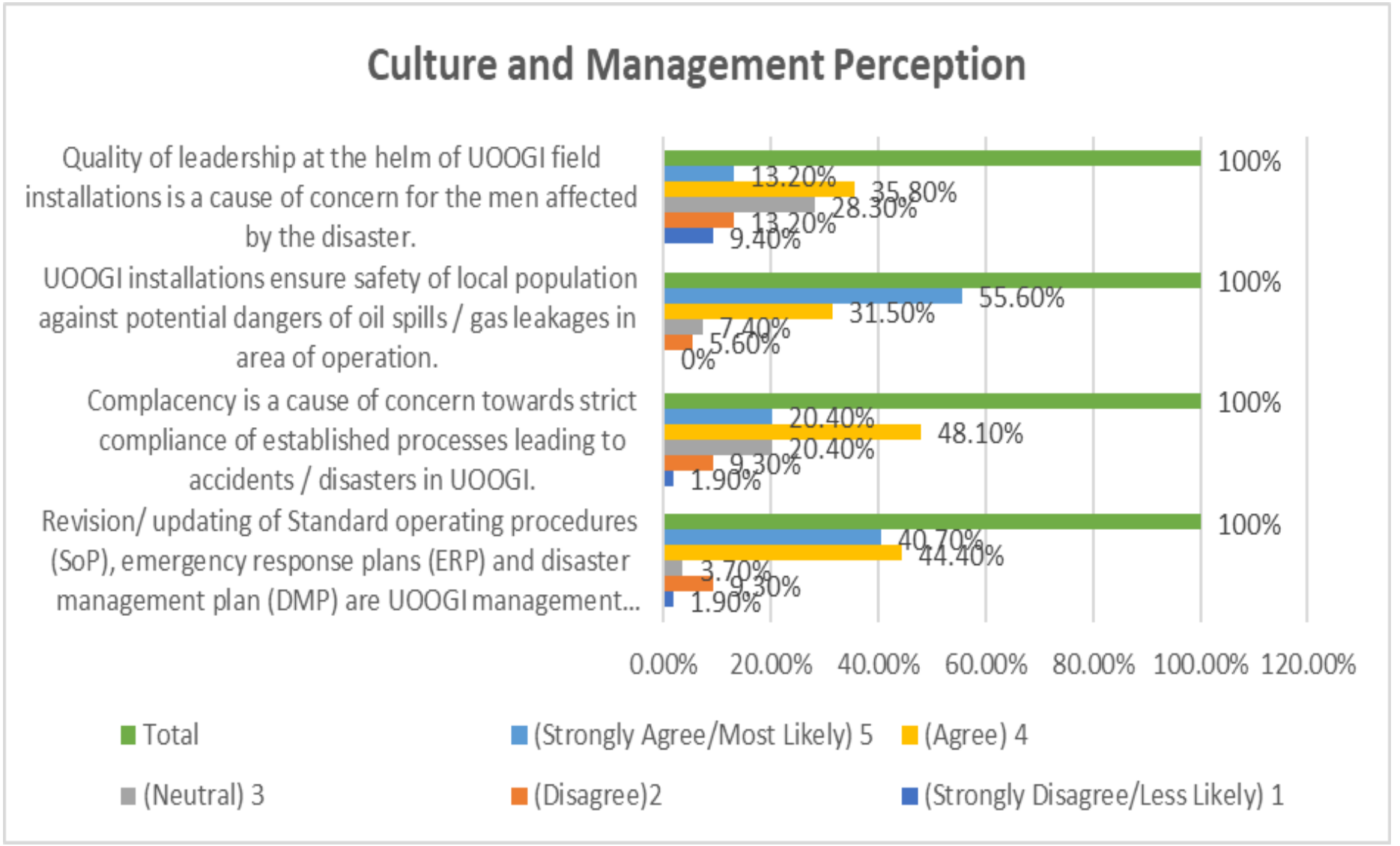
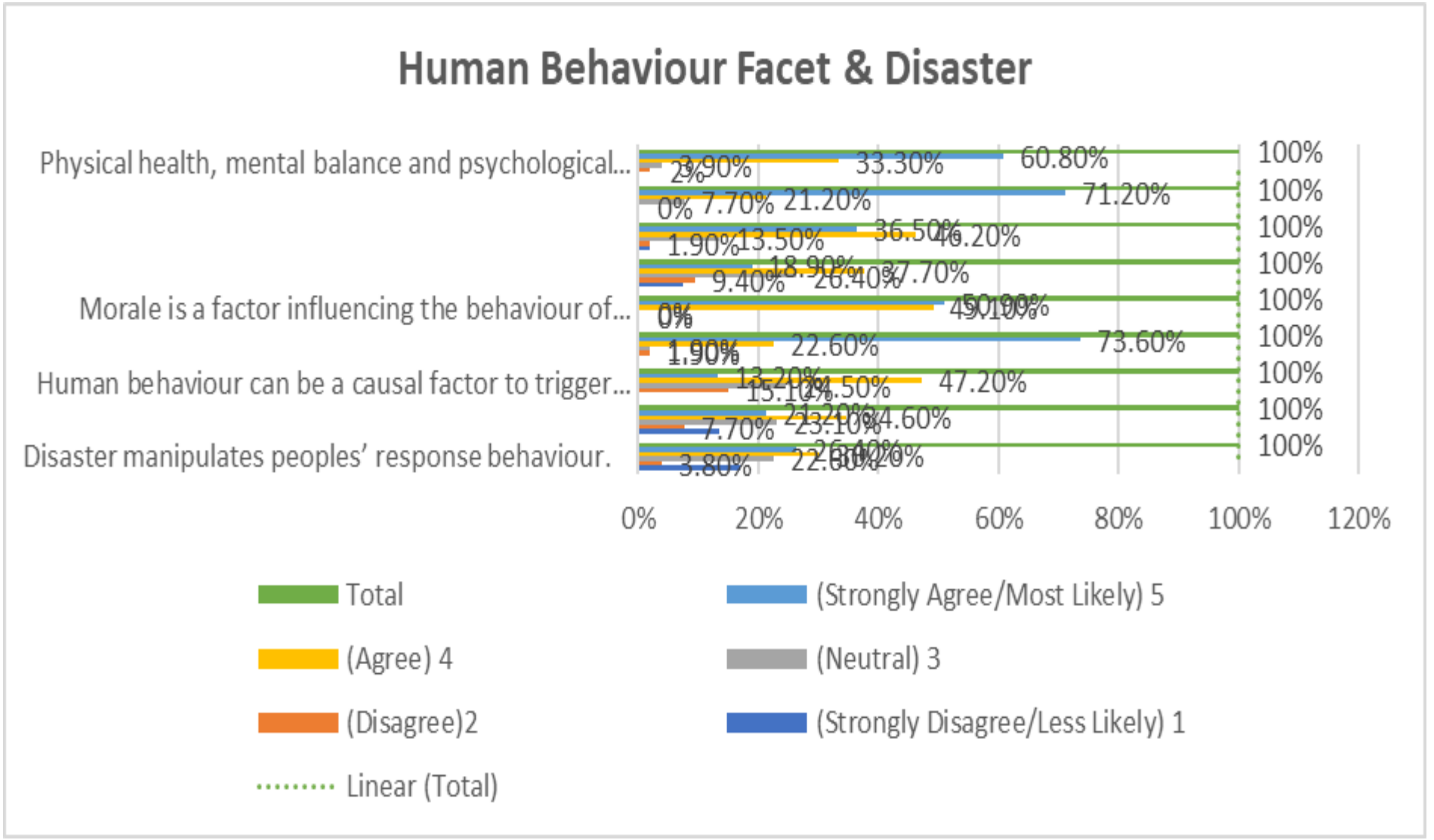


Table 4.6 Frequency Distribution responses for Human Behaviour Facet & Disaster

Human Behaviour Facet & Disaster	(Strongly Disagree/Less Likely) 1	(Disagree)2	(Neutral) 3	(Agree) 4	(Strongly Agree/Most Likely) 5	Total
Disaster manipulates peoples' response behaviour.	17%	3.80%	22.60%	30.20%	26.40%	100%
An impending disaster adversely affects the behavioural responses of UOOGI manpower.	13.50%	7.70%	23.10%	34.60%	21.20%	100%
Human behaviour can be a causal factor to trigger /catalyse facilitation of a disaster.	0%	15.10%	24.50%	47.20%	13.20%	100%
Human behaviour play a vital role for managing an emergency / disaster.	0%	1.90%	1.90%	22.60%	73.60%	100%
Morale is a factor influencing the behaviour of personnel.	0%	0%	0%	49.10%	50.90%	100%
Meeting operational timelines take precedence over safety protocols & compliances.	7.50%	9.40%	26.40%	37.70%	18.90%	100%
Management policies / perceptions affect the people's behaviour in UOOGI?	2%	1.90%	13.50%	46.20%	36.50%	100%
Safe infrastructures, new technologies, modern machines/ equipments/ gadgets, suitable accommodation and welfare measures at UOOGI field installations act as motivators and behaviour response multipliers.	0%	0%	7.70%	21.20%	71.20%	100%

Physical health, mental balance and psychological stability have direct bearing on peoples' behaviour when encountered with a challenging / dangerous / disastrous situation. Is there a requirement to strengthen and address these aspects in UOOGI manpower towards disaster risk reduction?	0%	2%	3.90%	33.30%	60.80%	100%

Fig 4.5. Human Behaviour Facet & Disaster



Discussion

The information provided highlights the importance of studying human behavior in preventing and mitigating disasters in the upstream onshore oil and gas industry (UOOGI) in India. The recent incidents of the 2020 Assam oil well blowout and the 2021 ONGC barge accident have emphasized the urgency and importance of investigating the human behavior facets of organizational response (HBFOR) to such disasters.

Empirical research in the area of HBFOR is relatively under-explored, but previous studies have shown the significance of organizational culture, communication, decision-making, training, and individual factors in shaping behavior during crises. Additionally, the present study's findings have highlighted the human factor's importance, as evidenced through the identified themes of policy and procedures, awareness on disaster, culture and management perception, and human behavior facet and disaster.

The study has developed the UOOGI Behavioural Response and Disaster Management (UOOGIBRDM) Scale to measure the different aspects of behavioral response in the context of disaster management, including preparedness, response, and recovery. The use of this scale in disaster management dynamics can help stakeholders identify areas where employees need more training and support, and improve overall disaster management.

Overall, the discussion emphasizes the need for comprehensive empirical research on HBFOR in UOOGI disasters in India to improve disaster response and minimize the impact of such events in the future. The study's findings and the development of the UOOGIBRDM scale contribute to the current body of knowledge in disaster management and highlight the importance of studying human behavior in disaster prevention and mitigation.

The upstream onshore oil and gas industry (UOOGI) is an important sector that contributes significantly to India's economic growth. However, disasters in this industry can have severe consequences, both in terms of environmental damage, ecological destruction and human casualties. One

critical aspect of the organizational response to such disasters is the study of human behavior facets of organizational response (HBFOR). Empirical research in this area can provide insights into how individuals and organizations react to disasters and how these reactions can be improved to minimize the impact of such events.

Research on HBFOR in UOOGI disasters in India is a relatively under-explored area, but recent incidents highlight the urgency and importance of investigating this topic. The 2020 Assam oil well blowout and the 2021 ONGC barge accident are examples of recent disasters that have caused significant environmental and human impact. Therefore, a thorough empirical study of HBFOR is crucial to understand how individuals and organizations react to such disasters and to develop effective strategies to prevent and mitigate their effects.

Empirical research on HBFOR has gained considerable attention in recent years, with many scholars exploring the topic. A study by Cui and colleagues (2021) investigated the influence of employee behavior on organizational disaster resilience. Another study by Li and colleagues (2020) focused on the effects of leadership on the behavior of employees during crisis situations. Similarly, Wang and colleagues (2020) explored the role of trust in shaping individual and organizational behavior during disasters.

Furthermore, research has also highlighted the importance of organizational culture in shaping employee behavior during disasters. A study by Kozlowski and colleagues (2020) examined the relationship between organizational culture and safety performance, while another study by Ahsan and colleagues (2019) explored the impact of organizational culture on safety behavior in the oil and gas industry. Similarly, research has also focused on the role of individual factors, such as personality and motivation, in shaping behavior during crises.

Research has also highlighted the importance of communication and decision-making during disasters. A study by Yan and colleagues (2020) examined the effects of communication on individual and group behavior during disasters, while another study by Li and colleagues (2019) focused on the influence of decision-making on organizational performance during crises.

Moreover, research has highlighted the importance of training and preparedness in shaping behavior during disasters. A study by Wu and colleagues (2021) explored the effectiveness of training programs in improving employee response during crises, while another study by Ahmadi and colleagues (2019) investigated the role of preparedness in shaping behavior during natural disasters.

In conclusion, disasters in the upstream onshore oil and gas industry can have severe consequences for humans, environment and the ecological. Empirical research on HBFOR is crucial to understand how individuals and organizations react to disasters and to develop effective strategies to prevent and mitigate their effects. Previous researches have highlighted the importance of organizational culture, communication, decision-making, training, and individual factors in shaping behavior during disasters. Therefore, a comprehensive empirical study of HBFOR in UOOGI disasters in India is essential to improve disaster response and minimize the impact of such events in the future.

CHAPTER V

FINDINGS, IMPLICATIONS AND CONCLUSION

Chapter – 5

FINDINGS, IMPLICATIONS AND SUGGESTIONS

5.1. Findings

The present study aimed to analyze the role of human behavior in the occurrence of disasters in the upstream oil and gas industry (UOOGI). The data analysis and findings indicated that the human factor plays a significant role in the occurrence of UOOGI disasters. The identified themes highlighted the key findings of the study. The policy and procedures category revealed that UOOGI organizations strictly comply with policies, guidelines, and orders of the government of India and the upstream governance regulators. Wearing personal protective equipment is mandatory for all employees and visitors within the installations. However, mock drills lack realism, innovation, and the element of surprise. Maintenance task schedules and execution are challenging due to production targets. The awareness on disaster category revealed that the human factor is the main cause of disasters in UOOGI. Upstream disasters cause havoc to the environment, ecology, flora, fauna, land, and population migration. Human error of omission or commission is the cause of blow-out disasters. Man-made acts cause UOOGI disasters instead of natural disasters. The culture and management perception category revealed that complacency of manpower and health parameters is a significant issue. Population awareness campaigns against potential dangers are necessary. The leadership role is a challenge, and the quality of leaders needs review over time-based promotions. The management approach and employees' behavior have a motivational impact. The human behavior facet and disaster category revealed that disaster and mutational behavior is a significant concern. Human behavior triggers disasters and can act as both a causal factor and a savior. The role of morale is crucial, and the compromise between operational deadlines and safety considerations is a significant issue. Mock drills need genuine execution, and

physical/medical and behavioral responses to health are essential. Boundary players, media, and environment management are crucial, and the adoption/rejection of social media is a point of consideration. Overall, the study's findings highlight the importance of studying human behavior to prevent disasters in the UOOGI and develop more effective disaster management strategies.

The findings highlighted the significance of human factor dictated by the human behavioral facet largely responsible for the occurrence of UOOGI disasters as evidenced through the identified themes. The most relevant findings are mentioned category-wise as follows:-

(a) Policy & Procedures

(i) UOOGI Organisations are highly process based and strictly comply to policies, guidelines and orders of the GoI and regulators of the Upstream governance

(ii) Wearing PPE mandatory for all employees, non-employee, VIP, visitors within the installations

(iii) Mock-drills for practicing emergency response regularly conducted by all streams, lack realism, innovation and element of surprise

(iv) Drilling-Rigs & Other Important Machines/Equipment. Maintenance task-schedules and execution a challenge with production targets

(b) Awareness on Disaster

(i) Human Factor- main cause of disaster in UOOGI

(ii) Upstream Disaster: In addition to human casualty, cause havoc to environment, ecology, flora, fauna, land and migration of population as was recently reported in OIL Baghjan gas-well blow-out at Tinsukia in Assam in May 2020

(iii) Blow-out disasters- Human error of omission / commission

(iv) Natural Disaster- Earthquake, flood, Tsunami etc, instead Man-made acts cause UOOGI disaster

(c) Culture & Management Perception

(i) Complacency of manpower & health parameters

(ii) Population Awareness Campaigns against potential dangers

(iii) Leadership Role. Merit versus Considerations- a Challenge

(iv) Quality of leaders heading Work-Centre & Departmental Heads / Incharge (Asset / Basins / Plants and)- needs review over time-based promotions Flow vs Merit and Assignments

(v) Management approach & employees behaviour: Motivational impact

(d) Human Behaviour Facet & Disaster

(i) Disaster & Mutational Behaviour

(ii) Human Behaviour- Trigger for disaster: causal factor v/s Saviour

(iii) Role of Morale

(iv) Compromise: operational deadlines v/s safety considerations

(v) Mock-Drills: Mandate or Genuine executions

(vi) Health: Physical/Medical & Behaviour Response

(vii) Boundary players, Media & Environment Management

(viii) Social media- Adoption/Rejection?

5.2. Contributions

The development of a scale for measuring the behavioural facet of Upstream Onshore Oil and Gas Industry (UOOGI) disaster response and management is of great significance in the prevention and effective management of disasters. The importance of behavioural response as a critical tool in the overall disaster management process cannot be overstated. It is widely acknowledged that the human factor plays a significant role in the occurrence and management of disasters. However, the role of behavioural response in disaster management dynamics has not been given the attention it deserves, and there is a research gap in this area. By focusing on the behavioural response of employees in the UOOGI sector, this study aims to fill this gap and contributes to the current body of knowledge in disaster management. The UOOGI Behavioural Response and Disaster Management (UOOGIBRDM) Scale has been developed as a criterion for measuring the different aspects of behavioural response in the context of disaster management. This scale has been designed to capture the diverse range of behavioural responses of UOOGI employees during disaster management, including preparedness, response, and recovery. The use of the UOOGIBRDM scale in disaster management dynamics will enable stakeholders to identify areas where employees need more training and support, and will help to improve overall disaster management. The development of this scale will also help to enhance the understanding of the role of behavioural response in disaster management, and will provide a framework for further research in this area. Overall, this study highlights the importance of behavioural response in disaster management, and emphasizes the need to explore and develop strategies for enhancing the behavioural response of UOOGI employees.

5.3. Limitations and Future Scope of Study

The present study is primarily focused on investigating the relationship between human behavior and disaster management, using a single independent variable. However, future

research endeavors could expand on this by examining the correlation between this independent variable and various dependent variables of disaster management. For instance, the magnitude of the disaster, as measured by indicators such as the number of deaths and extent of damage incurred, the efficiency and efficacy of response and recovery efforts, the level of preparedness of the affected community or organization before the disaster, the level of resilience displayed by the affected community or organization after the disaster, and the long-term social, economic, and environmental consequences of the disaster. In addition to this, future research designs may consider utilizing a longitudinal research design and collecting data through multiple waves to provide more comprehensive and unbiased results.

Furthermore, the study is specifically focused on the oil and gas industry. However, similar studies can be conducted in other disaster-prone sectors such as agriculture (drought, flood), energy (power plants), and chemical industry, among others. By expanding the scope of research in these areas, a deeper understanding of the relationship between human behavior and disaster management can be achieved. Ultimately, the findings of such research can help in developing more effective and efficient disaster management strategies, which can minimize the damage caused by disasters and reduce the risks of such events occurring in the future.

Overall, the examination of the relationship between human behaviour and disaster management is crucial for improving disaster prevention, response, and recovery efforts. By identifying the independent variables that are most strongly correlated with successful disaster management, policymakers and disaster management professionals can develop more effective strategies and interventions to reduce the impact of disasters on individuals, communities, and society as a whole. Moreover, the use of longitudinal research designs and multiple waves of data collection can help to provide a more comprehensive and unbiased understanding of the relationship between human behaviour and disaster management over time. Furthermore, while this study focuses on the oil and gas industry, similar research can be conducted in other sectors

that are also prone to disasters, such as agriculture, energy, and chemical industries. By expanding our understanding of the relationship between human behaviour and disaster management across different industries, we can develop more comprehensive and effective disaster management strategies that can be applied across a range of contexts.

5.4. Practical Implications

The study aimed to analyze the role of human behavior in the occurrence of disasters in the upstream oil and gas industry (UOOGI). The findings indicate that the human factor plays a significant role in the occurrence of UOOGI disasters and highlights the importance of studying human behavior to prevent disasters and develop more effective disaster management strategies.

For organizations, the study suggests that they should focus on the human behavior aspect when it comes to disaster management. The study recommends to have realistic mock drills and to review the quality of leaders. It also highlights the importance of population awareness campaigns, the role of morale and the need to find a balance between operational deadlines and safety considerations.

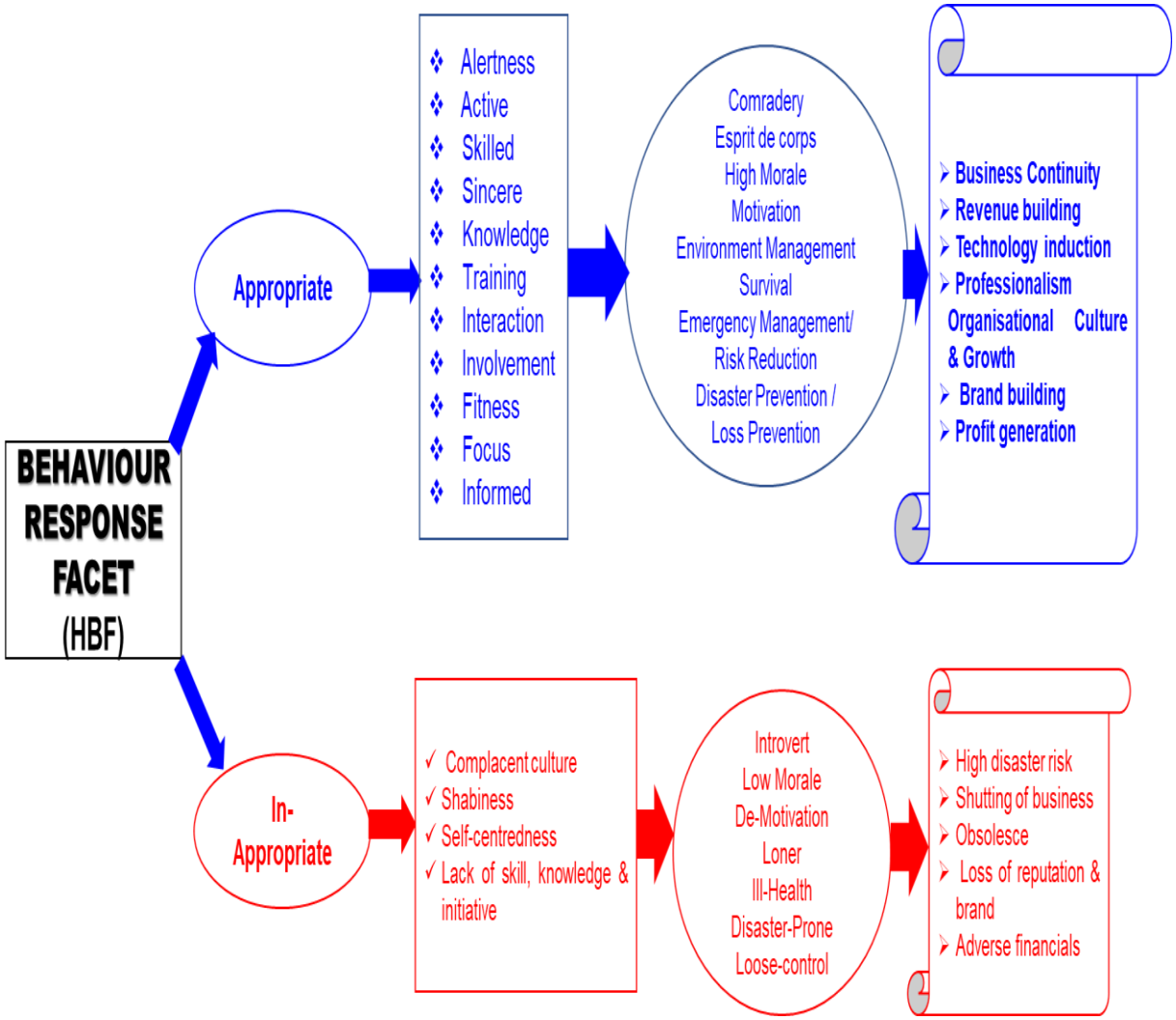
For disaster management professionals, the study highlights the significance of human behavior in disaster management and the need to incorporate behavioral response as a critical tool in the overall disaster management process. The study also recommends the use of the UOOGI Behavioural Response and Disaster Management (UOOGIBRDM) Scale to measure the different aspects of behavioral response in the context of disaster management.

For researchers, the study highlights the need for further research in the area of human behavior and disaster management, and suggests future research designs that consider the relationship between human behavior and multiple dependent variables of disaster management. It also

suggests conducting similar studies in other disaster-prone sectors to expand our understanding of the relationship between human behavior and disaster management.

Overall, the study emphasizes the importance of understanding the relationship between human behavior and disaster management, and the need to develop effective disaster management strategies to minimize the impact of disasters.

Based on the body of research in this study- the behaviour response were modelled in to two categories; Appropriate and In-Appropriate behaviours and does each one impact taking into sub-factors which have emerged from the findings. The sub-factors translated into projected behaviour accruals for both categories separately and resultantly imply for the good or bad to the organisational response when faced with an adversity or disaster. Same is depicted in the figure below:-



5.5. Conclusion

The Oil and Gas Industry (OGI) has a rich history that dates back to the 19th century and is now a critical source of energy worldwide. However, the Exploration and Production (E&P) sector of the industry is fraught with danger and prone to disasters. These disasters result from a complex mixture of human and technological elements, as well as highly flammable oil and gas, and toxic substances and chemicals. Despite the number of human casualties and billions of dollars in damage caused by human error, the importance of human behavior in disaster management has not received adequate attention in the Upstream Onshore Oil and Gas Industry (UOOGI). Over the past 130 years, UOOGI has been hit by numerous disasters, including 10 major offshore disasters, such as the devastating Piper Alpha Platform fire in 1988 that resulted

in 167 deaths due to human behavior failures. The lack of emphasis on human behavior as a critical trait for strengthening OGI and managing disasters calls for a focus on the human behavior facet for organizational response (HBFOR). The recent disaster at the Baghjan oil fields of OIL in Assam in May 2020, which resulted in four deaths, displacement of about 10000 people, death of fresh water dolphins, and environmental damage, highlights the need for further examination of human behavior in disaster management. Future research should investigate the correlation between human behavior and various factors related to disaster management, such as the magnitude of the disaster, response and recovery efficiency, preparedness of affected communities or organizations, resilience, and long-term social, economic, and environmental impacts. Longitudinal research designs and multiple data collection methods can provide a more comprehensive understanding of the issue. Similar studies should also be conducted in other disaster-prone sectors, such as agriculture, energy, and chemical industries. In conclusion, the importance of considering human behavior responses as a crucial aspect of disaster management, particularly in the UOOGI sector, must be acknowledged to prevent future catastrophic events.

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