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A Critical Analysis of the Effectiveness of Systems Safety and Environmental Risks Management Policies and Strategies in Averting Upstream Disasters – Lessons for Guyana

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Abstract

Emerging oil and gas production nations continually sought for opportunities to boost economic development while ignoring the risks that are associated with the industry especially the environmental risks that can have long lasting and detrimental effects on its citizens' lives and livelihood. Hence, the researcher was propelled to focus its research on A critical analysis of the effectiveness of systems safety and environmental risks management policies and strategies in averting upstream disasters in the oil and gas industry – Lessons for Guyana. The overall objective of this study is to systematically review and analyse the Risk Management Frameworks adopted in the industry, with the aim to understand the effectiveness of systems safety and environmental risks management policies and strategies in averting upstream disasters and provide recommendations to the Government of Guyana. This study utilises the Systematic Review Framework to evaluate the effectiveness of risk management policies and strategies in averting upstream disasters while, taking into consideration the role corporate governance and transformational leadership plays in the adoption of those policies and strategies. Reliable and valid contemporary secondary academic sources published between the years 2010 to 2021 were used to arrive at evidence-based conclusions.

Keywords: *CSR, System Safety, Enterprise Risk Management, E&P, O&G, Risk Management.*

Introduction

Background

The oil and Gas (O&G) industry have agreed that fossil fuels will continue to play a vital role in the global energy mix [42, 77]. However, the challenge is that easily accessible O&G are no longer in the equation, consequently, most future Exploration and Production (E&P) will be from geographic remote areas such as ultra-deep waters offshore sites and subarctic climate zones [94, 80]. Thus, extraction will be more complex and riskier [16, 38, 73, 85, 25, 65, 92, 96]. Hence, Risk Management (RM) has become an unavoidable feature of the industry [89, 16].

Guyana is an emerging O&G production nation. According to [94] Guyana have become one of the top twenty largest O&G reserve holders in the world following a series of substantial discoveries offshore starting in 2015. Its upstream activities are taking place in the deep-waters [29] 18,000 feet into the seabed [52].

In recent years, the O&G industry has been operating without significant incidents despite not having proper Process Safety Information, Process Hazard Analysis and Management of Change Programs [66]. This industry is associated with low probability/high impact risks [12]. The 2010 Deepwater Horizon Oil Spill was a surprise. Mexico had placed much confidence in BP's Risk Management

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Frameworks, BP gave federal officials assurance that an oil spill disaster of this magnitude could not occur [56]. Public enquiries, research studies, and investigations highlighted that better organisational practices and regulatory oversight could have prevented major accidents in the upstream [36].

Significance of the Study

Guyana is an emerging O&G production nation that holds one of the top twenty world's largest oil reserves [94]. Currently, its upstream activities are taking place in the deep-waters [52]. However, it does not have direct legislation, policies or Commission to administer the O&G companies' operations [40, 64, 29]. Dejectedly, it heavily depends on the Risk Management Frameworks (RMFs) and Corporate Social Responsibility (CSR) agenda of the O&G companies' operating in Guyana.

Additionally, Guyana is vulnerable to flooding due to heavy rainfalls and rising sea levels. Ninety percent of its population lives below sea level [46] and seventy-five percent of its economic activities are conducted along the coastal plains [68]. Its economic activities are driven by agriculture and mining and quarrying. Notably, these economic activities will be affected by the aforementioned environmental vulnerabilities. Further, Guyana is closely surrounded by three neighbouring countries. Thus, any upstream disasters will adversely affect Guyana and its neighbouring countries.

Scope

The first and foremost important decision in preparing a systematic review is to determine its focus. Up-front scoping will help authors to define sensible boundaries for their reviews [88]. Thus, this study utilises the Systematic Review Framework to evaluate the effectiveness of risk management policies and strategies in averting upstream disasters. Reliable and valid contemporary secondary academic sources published between the years 2010 to 2021 will be used to arrive at evidence-based conclusions.

The key aspects are risk management policies and strategies developed, implemented and monitored by the industry to avert upstream disasters and the role of corporate governance and transformational leadership in this process.

Aim

This study aims to systematically review and analyse the effectiveness of Risks Management policies and strategies adopted by the O&G industry and to provide suitable recommendations to the Government of Guyana.

Objectives

The overall objective of this study is to systematically review and analyse the Risk Management Frameworks adopted in the industry, with the aim to understand the effectiveness of systems safety and environmental risks management policies and strategies in averting upstream disasters and provide recommendations to the Government of Guyana. The extensive objectives are:

1. To analyse the theoretical aspects of Risk Management in Upstream (system safety and environmental risk).
2. To examine the role corporate governance and transformational leadership plays in the adoption of the policies and strategies.

Method of Analysis

Systematic review applies a range of methods to conduct research using existing research. It focuses on specific, practice-relevant questions with similar aims and purposes for answering specific questions [18]. Fundamentally, the method of analysis for this study is a systematic review aiming to answer the question – *"How the effective management of Systems Safety and Environmental Risks policies and strategies can avert upstream disasters in the O&G industry?*

Evidence/Data

To successfully research and present an outcome on the objectives of this study, secondary data analysis was used. Secondary data analysis is data collected by someone else for another primary purpose [49]. The Google Scholar, ProQuest Central, ResearchGate, Emerald Insight and ScienceDirect (Elsevier) research engines were the means of accessing research relating to 'Upstream Risk Management in the O&G Industry'. Data was gathered on areas such as; risk management, upstream disasters, systems safety and environmental risks and transformational leadership. Notably, only research published in the years 2010 to 2021 were utilised.

Reliability and validity are concepts used to evaluate the quality of research. Reliability is about the consistency of a measure, and validity is about the accuracy of a measure. To ensure reliability and validity of the evidence collected, efforts were made to answer [49] Evaluation of Dataset questions, such as:

1. What was the purpose of the study?
2. What methodology was employed in obtaining the data?
3. How consistent is the information obtained from one source with information available for other sources?

These measures reduced the possibility of capturing inaccurate and bias research information. The ultimate objective is to provide policy and strategy directions for Guyana, an emerging O&G production nation. Therefore, accurate and unbiased research conclusions are critical.

At the time of this research, there are no studies conducted on the systems safety and environmental risk management of upstream activities and its environmental effects on Guyana. However, despite this gap in the research, the new norm of E&P activities is taking place in ultra-deep-waters which is a similar activity around the globe in the industry. Thus, the learning from this research can be applied to Guyana.

This study will systematically review and analyse the effectiveness of systems safety and environmental risk management policies and strategies adopted by the industry to avert upstream disasters. From the review and analysis, recommendations will be provided to the Government of Guyana.

Literature Review

Global demand for Oil and Gas (O&G) continues to upsurge [92, 39], and Governments and upstream companies are increasing Exploration and Production (E&P) to meet the global demand. However, there is the challenge of accessibility due to easy oil reserves being depleted [73, 65]. Thus, Governments and O&G companies have embarked on E&P activities in geographic remote areas, which increases E&P risks [65, 16, 44, 97]. Consequently, risk management in O&G industry has become unavoidable.

Overview of the Oil and Gas Upstream Operations

According to the Sustainable Development Scenario (SDS) put forward by the International Energy Agency (IEA), O&G are set to continue playing a vital role in meeting the world's energy needs, accounting for nearly half of the primary energy mix in 2040. Governments and international organisations around the world, including the UK, EU, and China have all announced plans to achieve net zero emissions within the next three to four decades. This is worth noting because, these countries are the drivers of the clean energy agenda.

Brief History of the Industry

In 1855, looking for a more efficient replacement for asphalt-based kerosene, George Henry Bissell and a group of investors formed the Pennsylvania Rock Oil Company. They hired Edwin Drake, who completed the first drilled oil well—often seen as the beginning of the modern oil era—at Oil Creek

near Titusville, Pennsylvania on 27 August 1859.

With the introduction of electricity in 1882, natural gas and oil were no longer needed to fuel light. The natural gas industry shifted to heating and cooking applications, and the oil industry found demand in the newly invented automobile [20]. The energy from fossil fuels started the Industrial Revolution [77].

While the global demand for O&G continues to escalate [92, 39], two main challenges arose. Firstly, much of the world's 'easy oil' are already consumed and secondly, the upstream O&G companies are forced to invest in sophisticated technologies, have a capable and knowledgeable workforce and provide an all-inclusive Corporate Social Responsibility (CSR) agenda, while finding and producing this resource [73, 65].

Advertently, most future E&P of fossil fuels will be from geographic remote areas [44, 65, 16, 96], which suggest that E&P operations will become complex and riskier.

Upstream disasters over the last ten years (2010 to 2020) – Causes and Effects

As global E&P becomes more complex, upstream operations continue to attract a range of imperative risks to workers, people from neighbouring communities and countries, and for the environment [4, 69]. Table 1 illustrates upstream disasters over the last ten years (2010 to 2019), their causes and effects.

Table 1. Upstream Disasters over the last ten years (2010-2019)

Year	Effects		Causes							
	Fatalities	**Injuries**	**Lifting**	**Fires**	**Explorations**	**Musters**	**Gas Release**	**Collisions**	**Loss of Well Control**	**Spills 1≥1 BBL**
2019 (CY)	6	222	169	84	4	87	20	10	2	14
2018 (CY)	1	171	111	77	3	82	19	6	1	19
2017 (CY)	0	154	97	71	2	71	9	13	0	10
2016 (CY)	2	174	110	82	0	52	18	6	1	19
2015 (CY)	1	290	138	92	2	69	14	11	3	25
2014 (CY)	1	280	177	121	4	49	10	12	4	21
2013 (CY)	4	310	165	109	1	63	22	18	9	24
2012 (CY)	13	282	143	141	2	41	18	9	4	33
2011 (CY)	2	249	105	106	1	31	16	11	5	10
2010 (CY)	12	220	91	130	4	22	16	8	2	28

Source: *Bureau of Safety and Environmental Enforcement*

The data published in Table 1 above, shows a constant fluctuation of the upstream accidents. This implies that a disaster can occur at any time. The statistics is critical to this research and will be used for future analysis.

Corporate Social Responsibility of the E&P Operating Companies

The O&G sector has been among the leading businesses in advocating Corporate Social Responsibility (CSR). This is mostly due to the obvious antagonistic impacts of disasters caused by its operations and the fact that, its track record in the management of unexpected risks in an integrated and systematic manner is not good [53, 27, 80].

Many studies have concluded that it is difficult to assign a definition to CSR since it means differently to different nations and people. Figure 1 highlights the views of three researchers, who conclusively hold ethics, responsibility, people and the environment as key elements of CSR.

Researchers	Corporate Social Responsibility
Theofilou and Watson	Emphasized that CSR is the response to the needs for ethical business practices.
European Union Commission	Viewed CSR as a concept whereby companies integrate social and environmental concerns in their business operations on a voluntary basis with the aim of achieving commercial success in ways that honour ethical values and respect people, communities and the natural environment
Blowfield and Frynas	Proposed to think of CSR as an umbrella term for a variety of theories and practices that each recognize companies' responsibilities for (i) their impact on society and the natural environment; (ii) the behaviour of others with whom they do business and (iii) managing its relationship with the wider society

Source: Albazu and Nyameh, 2017; and Frynas and Stephens, 2014.

Figure 1. Definitions of Corporate Social Responsibility

The CSR expectations of developed countries are different from emerging, developing and underdeveloped O&G production nations [3, 30, 81]. For the latter, heavy reliance is placed on the CSR agenda of the E&P companies. [30] emphasised that the level of economic development, social, political, cultural and religious differences of the country influences the degree of CSR adoption. Other researchers extensively show that corporate managements conduct themselves differently across countries dependent on the aforementioned characteristics and the public expectations [33]. Therefore, [15] suggestions of addressing CSR issues collaboratively (companies and stakeholders) are well accepted, taking into consideration the intrinsic complex characteristics of the O&G industry, its global reach, and the fact that its operations affect and involve a wide variety of stakeholders.

Overview of Guyana as an Emerging Oil and Gas Production Nation

In May 2015, international joint ventures led by ExxonMobil announced a vast reservoir of commercial recoverable oil [60]. A peer review search on Google Scholar revealed that multiple researches were conducted on Guyana and its new-found resource with focus on economics, legislation frameworks, local contents and governance. However, there is no research on upstream risks and its management, thus, creating the opportunity for this research.

As is habitual for new found O&G production nations to get lost in the economic, infrastructural and social expected developments [69], Guyana is not exempted. However, because of Guyana's geographic and

climate change vulnerability, it is detrimental to ignore the importance of managing upstream risks. Guyana is vulnerable to rising sea levels, the World Bank warned that Guyana is one of the countries that will be affected by global sea-level rise [62]. Noteworthily, ninety percent of its population lives below sea level [46] and seventy-five percent of the main economic activities are concentrated on the low-lying coast [68].

Guyana's upstream activities are taking place in the deep-waters, 18,000 feet into the seabed [52], which according to National Oceanic and Atmospheric Administration, deeper drilling increases dangers such as: higher risk of accidents, spills and fires [61].

Generally, there are no direct legislation, policies or Commission to administer the O&G companies' operations [40, 64, 29]. According to IDB 2020 report, there is the immediate need to rapidly build Guyana's regulatory and management frameworks for an optimal operation of the emerging O&G sector. Additionally, it mentioned the disharmony of the current legislative frameworks. [28] in her research supports the fact that there is a need for laws to specifically regulate the new emerging petroleum sector. By extension, the upstream safety and environmental risks management are in a similar situation.

Alarmingly, Guyana has no full national Disaster Risk Management (DRM) system nor comprehensive programme; all developed systems and programmes are in draft stages [91, 35]. This shows that Guyana is more vulnerable than one can imagine even without the additional exposure of upstream activities, thus, creating a greater desire and opportunity to conduct this research.

The official Environmental Impact Assessment (EIA) for Guyana's Environmental Protection Agency noted that, there is a five to ten percent probability of any oil reaching the Guyana coast. However, according to [82], the figure does not factor in the effectiveness of an oil spill response. Guyanese conservationist Annette Arjoon-Martins points out; Guyana is not prepared for an oil spill [62]. It is worth noting, the economic and environmental impact of oil spills are enormous. Studies conducted by an array of researchers prove this [6, 23].

Examination of Systems Safety and Environmental Risks Management Policies and Strategies adopted in the Oil and Gas industry over the last ten years

There are four approaches adopted by governments to minimise the upstream operations on the environment, these are: Command-and-control, Market-based, Voluntary Agreement and Self-regulatory approaches [11]. Figure 2 highlights elements of each approach.

Source: Ponzi and Bowyer, 2018

Figure 2. Policies Implementation Approaches adopted by Governments

The researcher concurs with [10] who mentioned the approach adopted by various countries were dependent on their uniqueness. For instance, the UK and Norway were successful using the Self-regulation approach, while Canada, Sweden, Denmark and Australia

have applied different approaches differently but was successful in minimising environmental impacts in the upstream sector. Nigeria, Ghana and other African countries used the Command-and-Control approach; however, there is a research limitation on its success.

Ref. [10] mentioned that the Command-and-control approach requires more government oversight, is not technologically friendly, and brings friction between the industry and the regulators. While, [37] emphasised that the Command-and-control approach is effective based on the strength of the country's laws and regulations. They recommended to the Organization of Economic Cooperation and Development (OECD) countries to promote both types of approaches (Command-and-control and Market-based) with preference to a more stringent Command-and-control approach and a milder market-based approach. [14] concluded that policy instruments that stimulate innovation permit flexibility over time in identifying, developing and demonstrating new technology are likely to be of central interest in the transition towards deep emission reductions.

Empirical studies that considered the presence of specific policy designs, credibility, uncertainty and time strategies suggest there is no single best policy instrument to foster policy compliance and technology adoption in the environmental field [14].

Evaluating the role corporate governance and transformational leadership plays in the adoption of the risk management policies and strategies.

Corporate Governance

There are two categories of corporate governance, internal and external. The basics of internal governance are; the Board of directors, the apex of internal control systems, charged with advising and monitoring management [42]. In the O&G industry, there has been a shift in broad oversight; directors are now holding management more accountable [90] with the aim of ensuring good business performance, accountability towards stakeholders and risk mitigation [42, 57, 58] suggests corporate governance objectives in an emerging O&G industry should be to:

1. Earn and retain public trust and management of public expectations.
2. Increase local contents and benefits to the broader economy.
3. Gradually build up capacity and enable actors to perform their roles.
4. Ensure NOCs participate in the development of the resources; and
5. Increase accountability.

Transformational Leadership

Studies have concluded that leaders in the industry need to demonstrate a new mindset, be nimble, competitive, innovative and be able to lead a diverse workforce, of which the transformational leader exemplified [90, 19].

Of importance, [84] emphasised the need to lead with a Triple Bottom Line (TBL) focus. [81] highlights the fact that companies with a TBL agenda outperform their peers on the stock market. O&G companies should take note, since it adds value, creates company reputation and is socially applaudable.

According to [17], the true power of any initiative is how leaders operationalise and bring things to life on a day-to-day level through the management of their people.

The role corporate governance and transformational leadership play in the adoption of the risk management policies and strategies is critical. It is these two important arms of the company that determine its vision, mission, goals, objectives and the regulatory compliance culture of the O&G companies.

Taking into consideration Guyana vulnerability to the rising global sea-level, its legislative, regulatory, institutional incapability, its inexperience in the industry, the high risk nature of the upstream operations, the economic, social and environmental impact

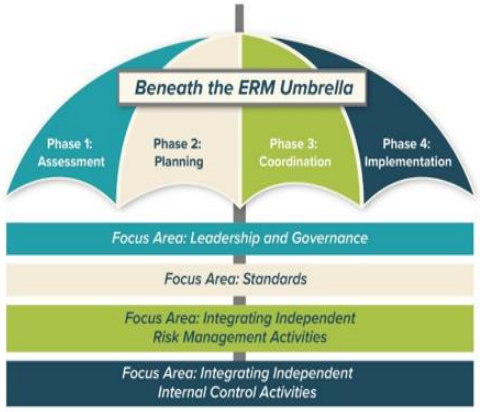
of upstream disasters and most importantly the gap of risk management research on Guyana's new-found resource, it is imperative that this research be conducted and the requisite learning be shared with the policy makers of this beautiful ecosystem and agricultural dependent country, Guyana.

Theory of Risk Management in the O&G Industry

Overview of the Risk Management Frameworks adopted by the O&G Industry

Risk management refers to an interactive process consisting of steps, which, when undertaken in sequence, enable continual improvement in decision making. The aim of risk management is to obtain an understanding of what the risks really are and how they will be managed to improve performance, increase the value of firms and reduce financial distress [71]. Risk management is an integral part of day-to-day business activities in the energy industry [16].

Risk management theories such as: Stakeholder Theory, Modern Portfolio Theory, Sustainable Risk Management, Operational Risk Management and Corporate Risk Management [13, 34, 71] are employed by the industry. However, scrutiny of these theories validates that the Enterprise Risk Management (ERM) Theory are more integrated and holistic. Hereunder, Figure 3 provides a synopsis of ERM.



Source: Kearney and Company, 2021

Figure 3. Synopsis of Enterprise Risk Management

Details review and analysis of Enterprise Risk Management (ERM) in the Oil and Gas industry and its effect on averting upstream disasters

In recent years, ERM has become increasingly relevant and gained the attention of organisations due to globalisation, advancement in technology, innovations in business operations and pressure from regulatory bodies to manage risk holistically [80, 32].

ERM is designed to help corporate governance and leadership develop risks strategy and infrastructure while providing guidance for risk analysis and creating a risk culture that influences its follower's behaviour. See details in Figure 4 below.

Figure 4. Key Elements of the Enterprise Risk Management

The ERM is a process, effects by entity's Board of Directors, management and other personnel, applied in strategy sitting to provide reasonable assurance regarding the achievement of entity objectives [31, 75, 78]. It manages risks in an integrated way and differs from traditional risk management approaches. It advocates a mutual and understandable language and delivers perfect direction and supervision in managing risk to protect and create stakeholders' value [80]. Figure 5 demonstrates the components of ERM.

Figure 5. Components of Enterprise Risk Management

It is claimed by [22] that an effective ERM considers the down-side risk that attempts to enhance a firm's value through evaluation of business opportunities and up-side risk which focuses on business strategies, research and development investment and operational innovations and efficiencies.

Research conducted by [22, 80] noted benefits such as: operational decreased cost, increased revenue by reduced losses and earnings volatility, improved return on capital and shareholder value, performance management, risk adjusted decisions-making and capital efficiencies and higher quality strategic planning, and enhanced board oversight.

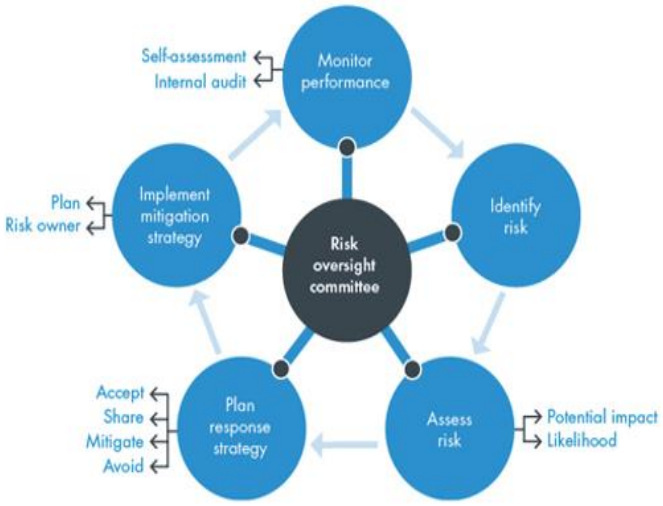
In the O&G industry, research and innovation is the key to its sustainability, of which, [80, 32] noted that ERM plays such a role. On the contrary, there are necessary financial, human resources and IT systems that constitute as an obstacle for ERM [59].

Ensuring the successful implementation, appropriate coordination and functionality of

the ERM system is crucial. [32] emphasised that, a senior executive such as; a Chief Risk Officer (CRO) or a committee of experts should direct the risk management process. They also emphasised the need for establishing a strong risk culture and the development of adequate (compensation) incentive systems.

The National Oil companies have been adopting the ERM theory over the years. According to [78], Chevron has implemented one of the most impressive and comprehensive ERM systems. Chevron's ERM system is among the most developed and complex systems out of the six O&G companies they reviewed.

Figure 6 demonstrates characteristics of the ERM and how it is used.



Source: CGMA, 2013

Figure 6. Characteristics of the Enterprise Risk Management

Why O&G Companies are embarking into ERM

The O&G industry is vulnerable to political, economic, social, technological, legal and environmental changes [87]. Risk exists in every phase of the industry; thus, an integrated management programme is crucial. The ERM provides a guide to systematically assess, treat, monitor and review risks to improve an entity's ability to prepare itself to face the imminent risks (Shad and Lai, 2019). [32] stated that most studies reveal a significantly positive relation between the implementation of an ERM system and the corporate performance or shareholder value.

Taking into consideration Guyana vulnerability to the rising global sea-level, its legislative, regulatory, institutional incapability, its inexperience in the industry, the high risk nature of the upstream operations, the economic, social and environmental impact of upstream disasters and most importantly the gap of risk management research on Guyana's new-found resource, it is imperative that this research be conducted and the requisite learning be shared with the policy makers of this beautiful ecosystem and agricultural dependent country, Guyana.

Presentation of Findings

PRISMA Flow Chart

The flow chart in Figure 7 summarises the information collected and analysed using the PRISMA Method.

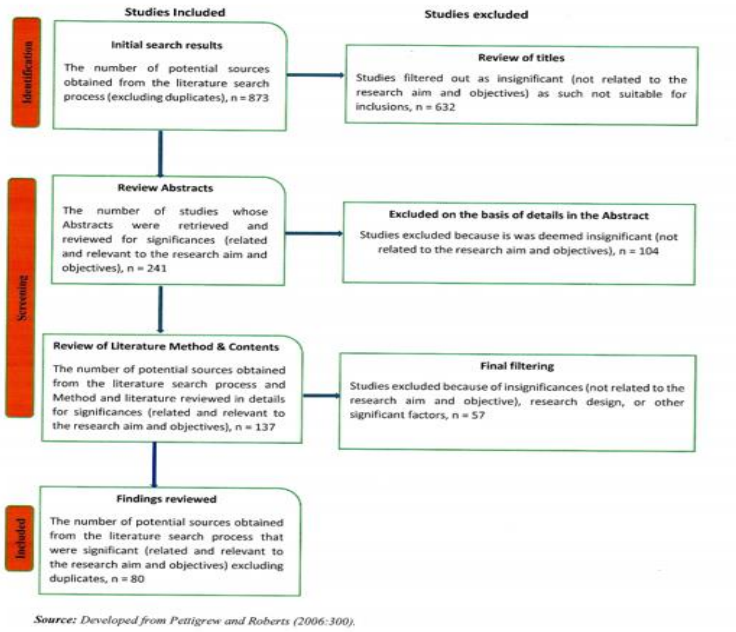


Figure 7. Summary of Information Collected and Analysed using the PRISMA Method

Findings

Exploration and Production (E&P)

Oil and Gas Industry

Humankind dependency on fossil fuels is beyond comprehension; its global demand continues to escalate [92]. Governments and O&G Companies are increasing their production to meet these demands. Figure 8 highlights the projected production for the next twenty years.

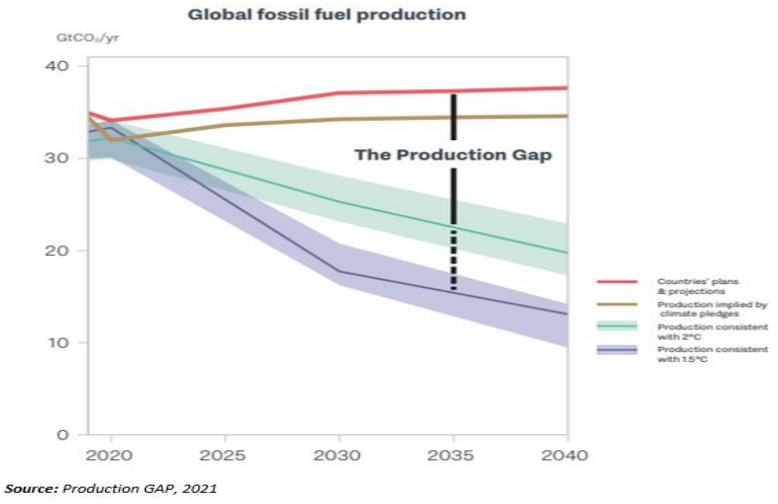


Figure 8. Global Projected Production Characteristics of the Enterprise Risk

The O&G industry has agreed that fossil fuels will continue to play a vital role in the global energy mix [43, 77]. Advertently, most future Exploration and Production (E&P) will be from geographic remote areas such as ultra-deep waters offshore sites and subarctic climate zones. Hence, extraction will be more complex and riskier [16, 38, 73, 85, 25, 65, 92, 96].

Decades of studies have highlighted various causes of upstream disasters. Researchers linked them to the following as shown in Figure 9.

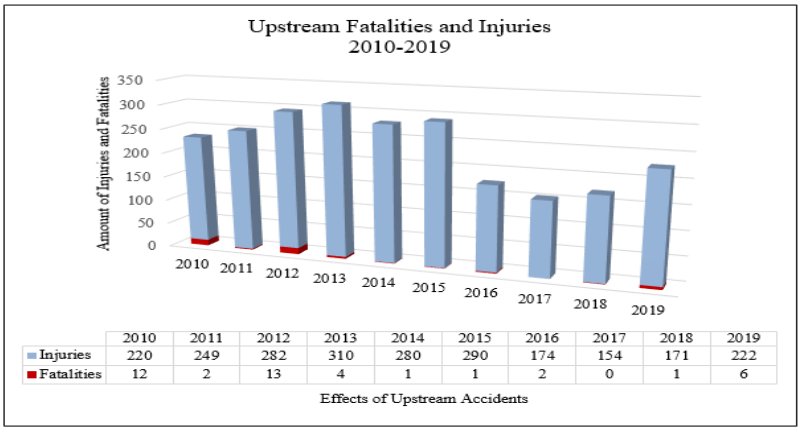
- ✓ Natural disasters.
- ✓ Poor system safety (safety information process hazards analysis, management of change).
- ✓ Poor systematic risk management.
- ✓ Technical failures.
- ✓ Organisational shortcoming.
- ✓ Inappropriate organisational cultures.
- ✓ Weak regulations and enforcements.

Source: *Lee-Ashley (2020), Necci et al. (2019), Planche. et al. 2016, Shuen et. al. (2014), Jahidi et. al. 2017 and Levy & Gopalakrishnan 2010).*

Figure 9. Causes of Upstream Disasters

Ref. [72] convincedly emphasised that upstream disasters have no one root cause and there is a need for the use of risk assessment and safety management principles to review and control risks on a case-by-case basis.

Investigations after major upstream disasters revealed there was no one fixed cause of the disasters. However, upstream disasters have and can occur suddenly, endangering the lives of people and the environment while causing severe financial losses to companies and governments [56, 72]. Between the years 2010 to 2019, the O&G upstream operations recorded forty-two fatalities and 2,352 injuries [21] as illustrated in Figure 10.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Injuries	220	249	282	310	280	290	174	154	171	222
Fatalities	12	2	13	4	1	1	2	0	1	6

Source: **Bureau of Safety and Environmental Enforcement (2021).**

Figure 10. Recorded Upstream Fatalities and Injuries (2010-2019)

Guyana as an Emerging Oil and Gas Production Nation

The production of fossil fuels produces Greenhouse Gas (GHG) emissions, which is a major threat to climate change crisis such as, rising sea levels and increased rainfalls. Guyana, as an emerging O&G production nation, is vulnerable to such a crisis. Ninety percent of its population lives below sea level [46] and seventy-five percent of its economic activities are conducted along the coastal plains [68]. Guyana's economic activities are driven by agriculture and mining and quarrying. Additionally, Guyana has no full national Disaster Risk Management (DRM) system nor comprehensive programmes [91, 35].

There is no direct legislation, policies and Commission to provide oversight to the O&G companies operations in Guyana. Additionally,

there is a disharmony of the current legislative frameworks and there is need for specific policies/regulations for this emerging sector [27, 28, 40].

The Environmental Protection Agency (EPA) stated, that a spill would impact marine resources, air quality, water quality, seabirds and marine mammals. Aside from the risk of oil spills, other environmental concerns include potential impacts on fishing livelihood, management of waste streams and emissions [82].

The Effectiveness of Risk Management Policies and Strategies in Averting Upstream Disasters

Policies

The effectiveness of risk management policies and strategies in averting upstream disasters have caught the attention of many researchers. [47, 79, 1, 11] conclusively agreed that policies in the O&G industry are not completely effective due to policies challenges, institutional and enforcement incapability and negligence by some O&G companies. These three factors are grouped into two categories of responsibilities receptacles, as is shown in Figure 11.

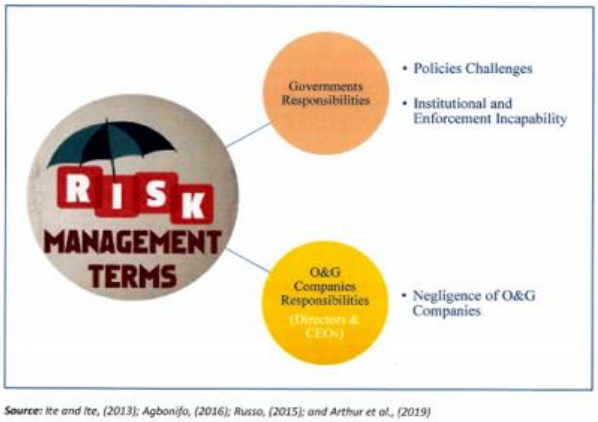


Figure 11. Responsibilities Receptacles for Ineffective Risk Management Policies

The aforementioned Researchers also highlighted nine contributors to risk management policy failures, as is illustrated at Figure 12.

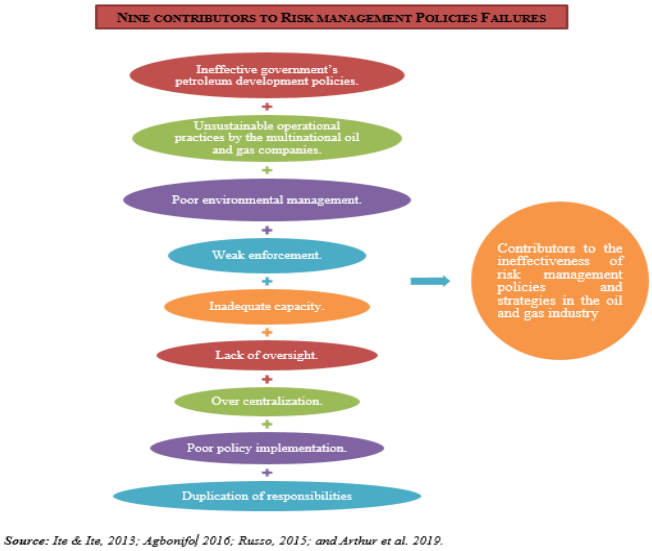


Figure 12. Nine Contributors to the ineffective Risk Management Policies

One unanticipated finding was that eight of the nine contributors or eighty-nine percent of the contributors to risk management policies failures are governments not fulfilling their responsibilities, see Figure 13. However, anticipated support is expected from International Regimes to cushion this effect. Frameworks developed such as: MARPOL, UN Law of the Seas (UNCLOS) and Basel Convention, Montreal Protocol of the Vienna Convention and Paris Agreement were designed to support the O&G production nations and protect the environment [45, 97].

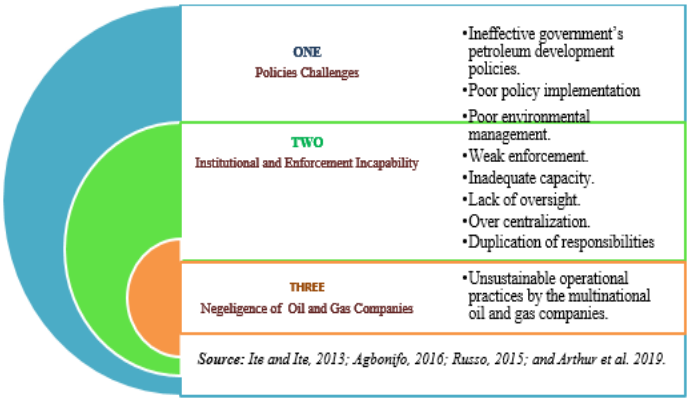


Figure 13. Analysis of the Nine Contributors to Ineffective Risk Management

In addition to the contributors mentioned in Figures 12 and 13, [11] in their research emphasised that even the international frameworks, declarations and treaties developed to combat the challenges associated with protecting the environment have unfortunately proven to be an ineffective method to compel large O&G companies to manage their environmental impact.

Ref. [41] research exemplified nineteen upstream drilling incidents that occurred in a regulatory environment (Norway). Norway is regularly denoted as demonstrating best practices in safety and well control. Alarmingly, eighty-two percent of the incidents were in relation to breach, serious breach and nonconformity to regulations. See Bar Graph at Figure 14.

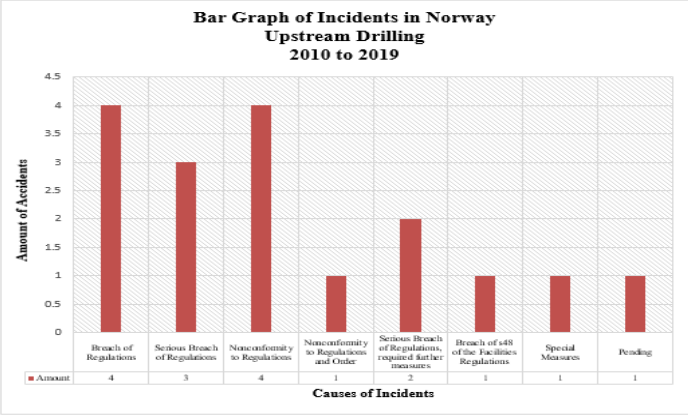


Figure 14. Upstream Drilling Incidents in Norway (2010-2019)

Strategies

Strategies are generally a plan of action designed to achieve overall long-term aims [24]. Empirical studies suggest that there is no one best policy instrument to foster policy compliance in the environmental field [14]. Table 2 highlights the definition, pros and cons of the four-known regulatory/policies implementation strategies.

Table 2. Details of the Four Policies Implementation Approaches Governments' adopt

Process Type	**Description**
Command-and Control Approach	**Definition -** Government commands and control through standards. The statue set the standards and provide enforcement mechanism like criminal sanctions, injunction and civil penalties. It involves centralised uniform determination controls over numerous oil wells.
	PROS – (i) It creates a stable platform for regulatory participants due to dependability it creates for regulators. (ii) Its legitimacy is particularly strong in times of crisis where sentiment demands more perspective, intensive and legalistic rules. (iii) Reduce information and collection costs. (iv) Greater accountability and legitimacy. (v) Enhance accessibility of decisions to public scrutiny. (vi) Reduced opportunities for regulatory capture in response to political behaviour. (vii) Increase the likelihood that regulators will withstand judicial review.
	CONS – (i) Operators are obliged to comply with the checklist which does not provide answers to unpredictable future challenges and innovations. (ii) Governments have to carry out fresh and unpopular initiatives to ensure more controls and make way for economic growth. (iii) It is not technologically friendly. (iv) Creates frictions between industry and the regulators. (v) Most of the regulations are spread out in different pieces of legislations and court decisions which are sometimes inconsistent and in conflict.
Market-based Regulatory Approach	**Definition -** It develops incentives for the upstream operators to integrate control into their routine production decisions. For example, taxes and tradable emission allowances and policies that rely on either performance or technology standards.
	PROS – (i) It embraces preventative principles under the environmental laws. (ii) It provides incentives with the aim of determining how much pollution they have the right to emit. (iii) To have upstream operators integrate pollution control measures into their production decisions which results in innovation that is cost effective. (iv) It limits purchases of goods linked with emission. (v) Reduces enforcement and compliance cost.
	CONS - (i) It is subject to legal uncertainties. (ii) Breaches result in increased cost to operators.
Voluntary Agreements' Approach	**Definition -** Industry groups adopt measures to improve environmental standards. One example, the E&P forum unilaterally complied a set of environmental guidelines that would be described as 'best practices' for oil and gas companies. NGOs through advocacy also influence companies to voluntarily comply with available best practices.
	PROS – (i) Flexibility, (ii) Cost-effectiveness compared to traditional regulation and economic instruments, (iii) Overcome inefficiency caused by asymmetry between the industry and the government.

	CONS – (i) It is almost impossible to setup differentiate objectives that suits the specific condition of each company, (ii) Weak capacity to enforce regulations negatively affects this approach, (iii) Does not spur abatement without strong background regulatory pressure and design features that leverage this pressure (iv) does not make way for SME's compliance.
Self-regulatory Approach	**Definition -** This approach requires risk analysis by the operators in respect to emergency preparedness in upstream activities.
Self-regulatory Approach	**PROS –** (i) Operators are required to define their own safety objectives to manage activities, (ii) it requires high competence and willingness to improve continuity, (iii) the industry is more likely to know how most effectively to control and manager the activities of their peers than outsiders. (iv) it brings about positive changes in the corporate structure and management of IOCs. And (v) it bleeds a corporate culture of compliance.
	C**ONS –** (i) it requires risk analysis by operators in respect of emergency preparedness in upstream activities, (ii) Operators wield enormous industry power in terms of technical capacity, research, information, financial muscles which may not be within the regulators reach.

Source: Cornelis 2019; Wang et al., 2017; Kim & Liu 2020; O'Sullivan & Flannery, 2011; and Tang et. al., 2020.

The literature has revealed that developed economies are leaning towards the Market-based and Voluntary Approaches, developing and emerging economies to a mixture of Command-and-control and Market-based approaches, while, underdeveloped or third world countries are leaning to Command-and-control approach, as strategies to foster effectiveness [10, 26, 51, 67, 76].

Empirical studies concluded that the Command-and-control Approach is costly to Governments, impedes technological advancements, requires heavy Government interventions and directions and it has a negative effect on innovation [10, 86].

Conclusively the researchers highlighted that the Market-based and the Voluntary approaches both require some level of Government regulations and enforcements, which are attributes of the Command-and-control Approach [10, 51].

Refs. [74, 93] suggested that Governments can implement a mix of policies and regulations stringent enough to ensure compliance, predictable enough to engender long-term investments and flexible enough to adjust to changing circumstances, especially new technologies. Both economy-wide and sector-targeted policies are required to enable structural and behavioural change among producers and consumers.

The reality is, risk management policies and strategies vary from jurisdiction to jurisdiction; however, they all have one commonality – the requirement for barriers to prevent disasters from occurring. Thus, a strong regulator with vast experience in regulating the environmental, process safety and well aspects of E&P operations are critical for the prevention and containment of risks and harms associated with upstream activities [41, 95].

Refs. [8, 41] help answer the following questions - What; When; and Why to implement a strategy that would create an avenue and foster policies effectiveness in the O&G industry? Additionally, they presented the anticipated results of implementing such a strategy. Figure 15 highlights full details.

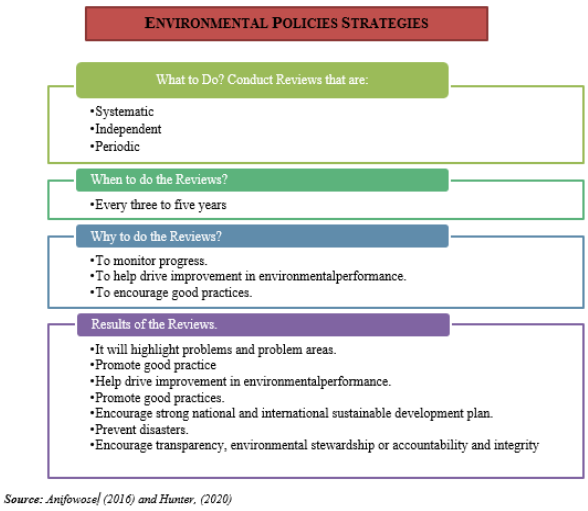


Figure 15. Environmental Policy Strategies to Enhance its Effectiveness

Ref. [47] emphasised that in order to achieve risk management policies effectiveness, both the government and multinational oil companies need to adopt environmentally friendly approaches.

The Role Corporate Governance and Transformational Leadership plays in Implementing the Policies and Strategies in Averting Upstream Disasters

The role corporate governance and transformational leadership plays in the adoption of risk management policies and strategies is significant, major and critical. [55] highlighted eight common factors in major accidents (Figure 16). It is found that these factors are all linked to organisational management philosophies. Studies have identified that a large number of organisations have performed with lesser or greater environmentally friendly behaviors when compared to the requirements of the governing mechanism [2].

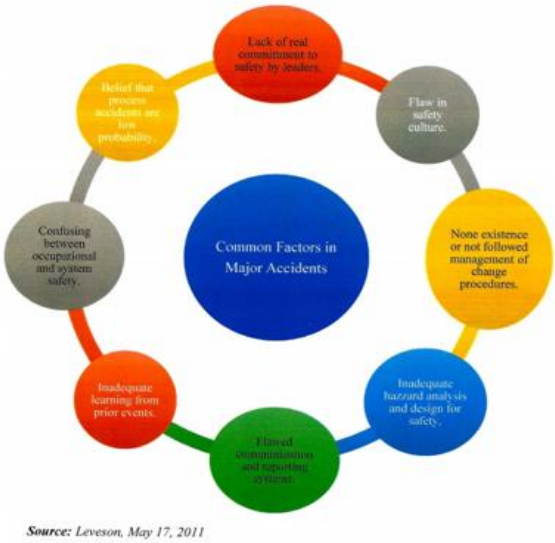


Figure 16. Eight Common Factors in Major Accidents.

An analysis of these eight factors revealed that there is a correlated relationship effect which stems from the belief of the corporate governance and transformational leadership. See illustration at Figure 17.

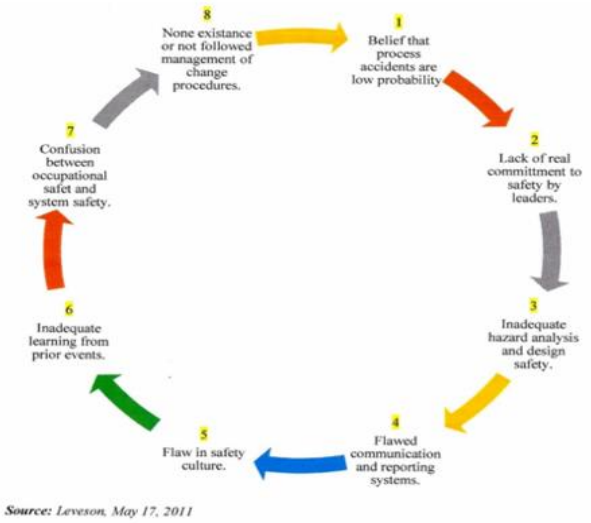


Figure 17. Correlation of the Eight Common Factors in Major Accidents

Directors are the core component of corporate governance. Their role is vital in all decision-making processes; thus, they decide on operational and strategic agendas of the company, including those that involve environmental issues. Therefore, as the central decision-making authority, they are responsible for environmental strategies and enforcement [2]. The corporate governance influences the enforcement of environmental policies, technological innovation, delegation of responsibility for environmental issues (Corporate Social Responsibility Committee) and the organisational compliance culture [2, 70].

Moreover, the distinguished qualities of transformational leaders [42, 58, 57] propel them to lead with a Triple Bottom Line (TBL) focus [84]. TBL expresses the expansion of the environmental agenda in a way that integrates the economic and social lines [5]. Studies have demonstrated the outcomes of transformational leadership which include effectiveness and commitment of followers [50].

Noteworthy, the country's Environmental Regulatory Frameworks, the good governance and worse governance concepts and the corporate structure are also contributors to the role corporate governance plays in implementing policies and strategies in averting upstream disasters [7, 70].

This research noted that under high stringent environmental regulations, the impact of environmental corporate governance mechanisms would not be pertinent. Companies strive to meet minimum compliance to remain legitimate and do not go beyond the legal environmental standards. While, with a more flexible Environmental Regulatory Framework allows firms to adopt efficient and productive technologies to combat environmental issues, it bleeds a corporate culture of compliance and it encourages upstream operators to integrate control measures into their production decisions [70, 10, 86, 67].

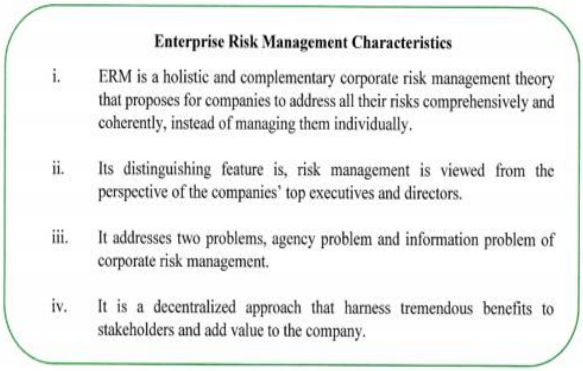
Ref. [13] states that good corporate governance influences the practice of a more holistic management approach in addressing both financial and non-financial risks. They emphasised the importance of corporate governance through the adoption of sustainable risk management practices in maximising economic, environmental and social performance. Contrastingly, the worse governance concept leads to significantly lower innovative responses to environmental policies and strategies compliances and innovation [7].

However, regulatory reformers have argued that by focusing on compliance, many existing regulatory strate-

gie s have failed to facil 19t ate or r eward beyond-compliance behavior or have even inadvertently dis cou raged it

Enterprise Risk Management (ERM) as Tool in Upstream Risk Management

There are numerous researches surrounding ERM, both positive and negative. Nevertheless, decisively, researchers noted the following characteristics of ERM as mentioned in Figure 18.



Source: Dornberger, 2014; Jankensgard, 2019; Meidell and Kaarboe, 2017; Lundqvist, 2015; Carroll, 2016; McShane, 2011; Bromiley et al., 2015; Callahan and Soileau, 2017; Razali and Tahir, 2011; Shad and Lai, 2019; and Rogers and Ethridge, 2016).

Figure 18. Characteristics of Enterprise Risk Management

Risks associated with the O&G industry cannot be treated individually; as such it is prudent to implore ERM as a tool to assist in averting upstream disasters, taking into consideration the intrinsic complex characteristics of the O&G industry, its global reach, and its operations effect on a wide variety of stakeholders [15].

The ERM key components will assist O&G operators in Guyana to establish risks management frameworks that are unique to Guyana and suitable for performance, accountability and business continuity.

Notably, using ERM as a tool requires knowledge of the various types of risks associated with the upstream operations (Figure 19), which will, provide an opportunity for risk analysis, extension development and implementation of risk management policies and strategies from an organisational perspective [95].

Figure 19. Risks associated with the Upstream Operations

Additionally, it is also found that O&G companies used Management/Boards and members of the Audit Committee to handle enterprise risks [78]. Thus, the awareness and understanding of ERM will be useful to corporate governance and leadership in formulating policies and evaluating organisational performances [80].

Discussion

This research is grounded on Risk Management in the Oil and Gas (O&G) Industry, with emphasis on the effectiveness of systems safety and environmental risks management policies and strategies in averting upstream disasters in the O&G industry. It aims to systematically review and analyse the effectiveness of Risks Management policies and strategies adopted by the O&G industry and provide suitable recommendations for the Government of Guyana. This discussion will be presented under three themes.

1. Exploration and Production activities in the O&G industry, taking into consideration Guyana as an emerging production nation.
2. The effectiveness of Risk Management Policies and Strategies in averting upstream disasters.
3. The role Corporate Governance and Transformational Leadership plays in implementing the policies and strategies in averting upstream disasters.

Exploration and Production Activities in the Oil and Gas Industry

The Oil and Gas Industry

Refs. [65, 16, 96] agree with the findings that fossil fuels will continue to meet the world's energy needs and the future Exploration & Production (E&P) will be geographically remote, complex and riskier. The days of easy oil is over, as the easy oil reserves are now depleted.

Advertently, as the demand for fossil fuels increases, Governments and O&G companies embark on increased production. History of the O&G companies' upstream disasters makes Governments and the O&G upstream companies aware of upstream risks and its unfavorable effects; this fact is supported by researchers [56, 72].

Noteworthy, the causes of upstream disasters range from natural to human errors to management shortcomings to weak regulations and enforcements, as is illustrated in Figure 10, [54, 63, 83, 48, 56]. As [12] stated, this industry is associated with low probability/high impact risks meaning, disasters do not happen regularly, but it is costly when it does.

Taken together, these results suggest that:

1. as E&P becomes remotely accessible, complex and riskier; and as Governments and O&G companies increase production, upstream risks will continue to grow;
2. there is no one cause of upstream disasters;
3. there is no one known way to avert upstream disasters because of the peculiarity and unpredictability of the O&G industry upstream activities; and
4. upstream disasters can occur unexpectedly and its effects are unfavourable.
5. Consequently, the results also indicate that Governments and O&G companies have to prepare themselves for the consequences of the increased E&P of fossil fuels and its risks.

Guyana as an Emerging O&G Production Nation

The current study found that Guyana is vulnerable to environmental crisis and currently its legislation and policies are inadequate and there is no oversight Commission for the O&G companies operating in Guyana. These findings are endorsed by [28, 29, 40, 68].

This suggest that the Government of Guyana, will be heavily dependent on the risk management frameworks and CSR agendas of the O&G companies operating in Guyana. Additionally, it suggests that minimal efforts will be made to develop, implement and monitor the upstream activities of these

companies in the short-term, which can have adverse effects on the companies' compliance to policies established in the long-term.

Alarmingly, despite the vulnerabilities of Guyana and the adverse effects of fossil fuels production, Guyana as an emerging O&G production nation is consumed with the economics, a noted trend in newly found O&G nations [9, 69]. Moreover, unbelievably, Guyana does not have a full National Disaster Risk Management (DRM) system, nor a comprehensive DRM programme; all developed systems and programmes are in draft stages [91, 35]. This shows that Guyana is more vulnerable than one can imagine. Thus, system safety and environmental risk management should be of priority for Guyana.

The Effectiveness of Risk Management Policies and Strategies in Averting Upstream Disasters

Firstly, this research identified that risks management policies and strategies are not completely effective in averting upstream disasters due to policies challenges, institutional and enforcement incapability and negligence by some O&G companies. The finding of the current study is consistent with those of, [11, 1, 79, 47].

Policies Challenges, Institutional and Enforcement Incapability and Negligence by some O&G Companies

As is noted in Figure 11, the three causes are grouped into two responsibilities receptacles.

1. Governments responsibilities - policies challenges and institutional and enforcement incapability.
2. Corporate Governance (Directors) and Transformational Leadership (CEO) responsibilities - negligence of O&G companies.

The root cause of policies challenges stems from poorly designed policies [48], which could be a lead factor to institutional and enforcement incapability. Regulators not having the appropriate knowledge of the industry and the skills to develop policies that are correlated, attainable and unambiguous pose a challenge to policies effectiveness. For instance, enforcement agencies are unable to enforce poorly designed policies which create opportunities for inappropriate practices, long legal or court battles, and antagonistic relationships between regulators and upstream operators. [41, 95] suggestion that a strong regulator with vast experience in regulating the environmental, process safety and well aspects of E&P operations are worthy to this discussion.

The negligence by some O&G companies could have arrived from the low-probability of upstream disasters, which creates the philosophy (belief) that an upstream disaster is impossible, despite the historic evidence of such incidents. A classic example is BP (2010 Deepwater Oil Spill), who, according to [56] was aware that investing in safety measures would have reduced the risk of an accident, and they lacked a satisfactory contingency plan in case one did occur. Nevertheless, BP was confident enough to give federal officials all assurance that an oil spill disaster of such magnitude could not occur. In addition, not using the basic and appropriate safety engineering technologies and practices which according to [55] is a root cause of upstream disasters.

Consequently, in order for countries to achieve effectiveness in their policies and strategies in averting upstream disasters both Governments and O&G companies need to work together. [47] support this concept by emphasising, both the Government and multinational oil companies need to adopt environmentally friendly approaches.

Factors that Influences or Affects the Effectiveness of Risk Management Policies and Strategies

Secondly, it is observed that there are numerous factors that influences or affects the

effectiveness of risk management policies and strategies.

Refs. [1, 11, 47, 79,] highlighted nine contributors to policies failures, as is illustrated in Figure 13. Notably, all nine contributors relate to poor policies development, enforcement challenges and negligence by O&G companies. As was expressed, unexpectedly, eighty-nine percent of the policies failures contributors relate to Governments not fulfilling their responsibilities.

This suggests that Governments need to be watchful to the design of their policies and have strategies to monitor their vulnerability [48]. [37] reinforced that the policies need to be well-designed to gain effectiveness, while [14] allude that Governments pay less attention to policies compliance processes, thus, failure becomes inevitable.

Remarkably, countries whose risk management policies and strategies that proved to be effective have well-designed policies, flexible regulatory approaches and strong legal and institutional frameworks for enforcement. This supports the concept that the quality of the policy-design and the institutional strength for enforcement are critical to policies and strategies effectiveness [37, 74].

Environmental Policies Strategies

Thirdly, this research noted that having environmental policies strategies are essential to fostering policies and strategies effectiveness. [11, 1, 79, 47] noted similarly in their research. The four known environmental policies strategies are: Command-and-control, Market-based, Voluntary Agreement and Self-Regulatory Approaches.

According to [26, 93, 51, 67, 86], the Market-based, Voluntary Agreement and Self-regulatory approaches yields more fruitful results than the Command-and-control Approach. It is argued that operations in highly regulated jurisdictions strive to maintain their legitimacy; but does not go beyond the legal requirements, which impedes innovation and creativity. While, the flexible approaches allow firms to adopt strategies that combat environmental issues, bleeds a corporate culture of compliance and encourages upstream operators to integrate control measures into their production decisions [70, 10, 67, 86].

The aforementioned views have merited some consideration, through the example of UK and Norway who adopted the Self-regulatory approach and was successful. However, there are other countries such as Canada, Sweden, Denmark and Australia who applied a mixture of approaches differently and was successful [10].

Irrefutably, this research indicates that some attributes of the Command-and-control Approach is needed for the effectiveness of the other approaches, as is also noted by [10, 51] research.

The Command-and-control approach is effective based on the strength of the country's laws and regulations and the strong legal and institutional frameworks for enforcement [37, 74]. Nigeria, Ghana and other African countries used the Command-and-control Approach [10], however, there is no conclusive result of its success or failure.

According to [11] the international frameworks, declarations and treaties developed to combat the challenges associated with protecting the environment have unfortunately proven to be an ineffective method to compel large O&G companies to manage their environmental impact. However, the current frameworks have regulatory gaps at the national, regional and international levels. [97] emphasized the reality that the O&G industry is regulated primarily by national legislation.

Therefore, [10] suggestion that the adoption of any approach is linked to the uniqueness of the countries provides legitimate reasoning. [76] noted similarly through its research of China, where the effects in the central region are strong when Command-and-control and

Market-based approaches are used while in the western region, Market-based and Voluntary approaches are comparatively weak.

Ref. [14] also made similar observations and concluded that there is no one best policy instrument to foster policy compliance in the environmental field. The reality is that Governments should use policy instruments to stimulate innovation, creativity and the appetite for compliance.

The Role Corporate Governance and Transformational Leadership plays in Implementing the Policies and Strategies in Averting Upstream Disasters

Firstly, [69] put forward eight common factors in major accidents as was discussed in Chapter Three (Figure 17). It is interesting to note that all eight factors are linked to organisational management philosophies. This suggests, there is a correlated relationship effect which started with the philosophy (belief) of corporate governance and transformational leadership. See full analysis at Chapter Three (Figure 17).

The philosophies of companies' management will determine the company's response to risk management policies and strategies. Good corporate governance philosophies influence the management approach in addressing companies' risks and the adaptation of sustainable risk management practices in maximising economic, environmental and social performance (Aziz, 2015). While, worse governance philosophies lead to significantly lower compliance responses to companies' risks including environmental risks [7].

Secondly, it is found, that the corporate governance influences the enforcement of environmental policies, technological innovation, delegation of responsibility for environmental issues (Corporate Social Responsibility Committee) and the organisational compliance culture [2, 70].

The internal corporate governance is the central decision-making authority that are responsible for strategies and their enforcement, inclusive of environmental issues [2]. While, the transformational leaders' qualities encourage follower's commitment as they strive to effectively accomplish the company's vision, mission, goals and objectives [50]. Therefore, the combination of the corporate governance and the transformational leadership suggest that their contribution can positively influence the effectiveness of policies and strategies in averting upstream disasters.

Nevertheless, one cannot ignore the facts that other factors such as; the country's Environmental Regulatory Frameworks, the good governance and worse governance concepts and the corporate structure are also influencers in the role corporate governance and transformational leadership plays in implementing policies and strategies [7, 70].

The literature supports the view that under stringent regulatory frameworks O&G companies stay within their remit of the laws, which hinders creativity and innovation. While flexibility in the regulatory framework fosters creativity, innovation and compliance [70, 10, 86, 67].

Consequently, the question to be answered is – *How corporate governance and transformational leadership can influence the implementation of risk management policies and strategies to avert upstream disasters?* The answer is grounded but not limited to the following.

1. The literature noted that the answers to the What? When? and Why? to implement strategies to foster policies compliance (Chapter Three, Figure 16), creates the results that enable Directors and CEOs roles in averting upstream disasters to be positive and effective. These strategies employed by Directors and CEOs provide technological, systematic and compliance support to the system safety risk management frameworks

which is one key to averting upstream disasters. Additionally, it does the following:

- highlights the problems;
- promote good practices;
- prevent disasters; and
- encourage transparency, environmental stewardship, accountability and integrity [8, 41].

2. The literature also pointed out ERM Theory as a tool in upstream risk management. This theory provides support to Directors and CEOs in dealing with the risks associated with the industry. Thus, the awareness and understanding of ERM will be useful to the corporate governance team in formulating policies and evaluating organisational performances [80]. Additionally, this research found that O&G companies use Management/Boards and members of the Audit Committee to handle enterprise risks [78]. As such, [48] conclusion that it is important for O&G companies to identify which country risks they are exposed to and where those risks exist is critical. Hence, the implementation of ERM by O&G companies as a tool in upstream risk management is commendable and will lead to performance, accountability and business continuity.

Ref. [58] noted that one of the O&G companies' objectives in an emerging O&G production nation is to earn and retain public trust and the management of public expectation. While [57] noted that good business performance, accountability to stakeholders and risk mitigation are the essence of corporate governance, and [50] noted that transformational leadership demonstrates outcomes of effectiveness and commitment of followers. These are essential characteristics for fostering an atmosphere of policies compliance. Hence, governments' can capitalise here and create an environment that propels these companies to be environmentally accountable by introducing key mechanisms for public accountability.

Conclusion

It is concluded that the systems safety and environmental risks management policies and strategies in averting upstream disasters in the O&G industry are not completely effective without strong country's laws, regulations, policies, legal and institutional frameworks for enforcement. Additionally, the role of corporate governance and transformational leadership is indispensable to the successful adoption of policies and strategies developed in averting upstream disasters.

The causes of upstream disasters ranged from natural to human errors to management shortcomings to weak regulations and enforcement and without proper corporate governance structure and leadership, the O&G industries will likely face significant challenges, both internally and externally.

Of great importance is, the relationship that is fostered between the regulators/government and the O&G companies. It is safe to conclude that neither of them individually can avert upstream disasters. As such, Government's responsibility is to ensure policies are well-designed and strategies are in place to influence the Directors and CEOs to adopt its policies and strategies through the creation of an environment that fosters companies' innovation, creativity and compliance. While, O&G companies need to fulfil their legal obligations and social responsibility to all stakeholders, adopt better organisational practices and embrace the basic and appropriate safety engineering technologies and practices.

Guyana is vulnerable to upstream disasters and not having the legal frameworks, the disharmony of the current legislation, not having an independent commission to monitor the upstream activities of the O&G operators in Guyana and the heavy dependence on the systems safety and environmental risk management frameworks and the CSR agenda of the operators in Guyana, exposes the nation to exploitation. In addition, Guyana not having a full National DRM system nor comprehensive

programme exposes the nation to catastrophe. Conclusively, any disaster pertaining to the O&G upstream activities will adversely affect the lives and livelihood of all Guyanese.

Finally, because of the complexity, globalisation and the low-probability/high impact risks associated with upstream disasters in the O&G industry, the traditional risk management model is inadequate for defining and identifying risks. As such, the ERM as a tool for Risk Management in the O&G Industry is irrefutably ideal. It has a positive effect on the performance, accountability and business continuity in the O&G industry.

Recommendations

This research provided insights that are unique in some material aspects while others serve as timely reminders that will help Guyana if applied, to make excellent decisions that will foster its environmental security and protect it from exploitation, knowingly, it is an emerging O&G production nation and also a third-world or developing economy.

1. ***Guyana needs to seek international professional assistance for the development of its systems safety and environmental policies and strategies.*** The research noted that one contributor to policies failure is, poorly designed policies. The O&G industry is complex, global and sophisticated. Upstream companies are mature and have the bottom-line as an ultimate goal. Thus, their experience allows them to identify loopholes in laws and policies, and they can capitalise on those shortcomings. Therefore, the Government of Guyana needs to take heed.
2. ***Strengthen the institutional and enforcement bodies capabilities.*** The research noted that another contributor to policies failure is institutional and enforcement incapability. It also provided insights into the outcome of the aforementioned incapability. Thus, Guyana needs to strengthen its institutions by providing training, development and sufficient compensation to foster a culture of compliance. Additionally, to employ professionals not political activists. Professionals who are qualified, knowledgeable, skilled and committed to the development of Guyana. This recommendation will provide long-term sustainability, economic growth and human capital development.
3. ***Monitor the corporate governance and leadership activities of the O&G companies operating in Guyana.*** Another contributor to policies failures is negligence by some O&G companies. The role of Directors and CEOs in the adoption of risk management policies and strategies are significant, major and critical. Thus, the Government of Guyana should not be naive but create an environment that propels these companies to be environmentally accountably by introducing key mechanisms for public accountability, including timely audits of agencies and state-owned companies, regular disclosure of information to the public, ensuring that there are systematic, independent and periodic systems review. Consequently, there will be the need for an independent Commission, free from political interference, who have direct responsibilities to monitor the activities of these upstream O&G companies operating in Guyana. In addition, petition the O&G companies to embrace ERM framework. It is a holistic risk management tool that helps companies to prepare themselves to face imminent risks.
4. ***The Government of Guyana has to face the facts that:***
    - *Guyana is vulnerable to environmental crisis;*
    - *it does not have the adequate legal frameworks;*
    - *there is no completed National Disaster Risk Management (DRM)*

system nor comprehensive programme, and

- *as upstream companies continue their activities, as a nation, it is not aware of their risk management frameworks and a contingency plan if an upstream disaster is to occur, God forbid.*

As a nation, let's take guidance from other nations bad experiences and make decisions that are informative. Guyana has the competitive advantage over other countries failures. The Government needs to capitalise on their experiences, hold the upstream operators accountable and seek to finalise its National DRM system and programme, develop its legal frameworks and put measures in place to monitor its environmental vulnerabilities.

5. *Governments should seek to create well-designed policies and develop and implement strategies that foster a positive relationship with the O&G companies, while, O&G companies fulfil their legal and social responsibility to all stakeholders, the custodians of the natural resources and the financial investors.*

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