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RESEARCH

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The mediating effect of enterprise risk management implementation on operational excellence in the Malaysian oil and gas sector: a conceptual framework

R. Tasmin¹, M. H. Muazu^{2*} , A. H. Nor Aziati¹ and N. L. Zohadi³

Abstract

Globally, the challenges of the oil and gas industry are unique due to the nature of its operations that is full of risks. Issues like volatile market prices, health and safety, environmental performance and high cost of production are affecting the operational performance of the sector. These problems if left unchecked could change the level of production and revenue generation to the Malaysian government and would as well influence the country's regional position in oil and gas production. As a result, many oil and gas firms including PETRONAS adopted operational excellence strategy, but some of the challenges kept re-occurring. It is against this circumstance that this research is aimed at determining the effect of enterprise risk management determinants on operational excellence in the Malaysian oil and gas industry. It is also aimed at exploring the mediating effect of enterprise risk management implementation on such a relationship. The article used a conceptual approach where journal articles, conference papers, professional reports, thesis and term papers were reviewed. Conceptual and theoretical frameworks were proposed in this paper, and literature was reviewed to lay a foundation for empirical research that would establish the relationship between the postulated variables in the study. Dimensions and measurement of the variables in the current study were drawn from earlier researches and recommendations. However, data were not collected, and a result of the analysis was not presented in the paper.

Keywords: Operational excellence, Enterprise risk management, Health and safety, Efficiency, Determinants

Introduction

The global oil and gas business environment is characterized by unpredictable incidents such as fall in price, the rise in the cost of production, new regulations and rising demands from diverse stakeholders. It, therefore, became imperative for firms to re-strategize their business towards excellence to meet up the needs of their stakeholders and the environmental pressures at all times. Vital among business excellence components is operational excellence which helps build crucial

operational performance metrics [40]. Operational excellence was necessitated in the Malaysian oil and gas industry to compete globally and the need to come out of the heat the country suffered from the continued drop in oil prices and increase in the cost of production [10].

International oil and gas companies had experienced and been affected by the drop in oil prices, the rise in the cost of exploration and refining, loss of oil in pipeline distribution, shipping and reservoir. Operational excellence was embraced by some of the major oil companies to lower the effects of the rising risk in the industry. Statistics ascribed to Ernst & Young [20] showed that 77% of the studied companies run an operational excellence (OE) program or had operational excellence program,

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and 53% of these corporations executed OE across the firm. The study further highlighted that 86% of the integrated oil companies (IOCs) have an OE or had one in the past, and as for the National oil companies (NOCs), 50% of them from the sampled corporations have never implemented OE program. It is, therefore, an indication of the need for OE in the NOCs, as they are the ones that are most affected by these emerging risk factors in recent time.

The oil, gas and energy sectors were among the bases of Malaysia's growth as it contributed approximately 20% of national Gross Domestic Product (GDP) in 2012 [1]. Its NOC, PETRONAS now an IOC, has been playing an essential role in the development of the oil sector in so many countries around the globe. It is now among the fortune 500 companies in the world. The company is saddled with the responsibility of providing support to the industry regarding resource planning, distribution and marketing. PETRONAS, in its strives for excellence and sustainability, developed a lot of initiatives, ranging from organizational restructuring to eliminating redundancy and reducing expenditure [36].

From the statistics shown, the big major oil firms have long-established OE programs that are entrenched across the companies. OE thus grow into a program that became an asset to the IOCs that led to a substantial reduction in the costs of drilling and completion, quantity of petroleum loss to spillage, growing refinery energy effectiveness and revenues [20]. Operational excellence is therefore proven by outcomes of productivity, the efficiency of assets and other resources. An organization that executed operational excellence program is recognized to have considerably lowered operational risk, reduced costs of operation and better grounds compared to competitors, which creates value for clients and stakeholders [46]. Accomplishing operational excellence in the oil and gas sector becomes more critical now than ever been before due to the increasing complexities of the emerging business environment.

As it is, higher efficiency is among the primary goals in oil and gas industry in Malaysia and other parts of the world. It is important to note that as more facilities are brought to bear, their complexities increases and the inherent risks, as well as regulatory demands [29]. Putting more facilities also raises pressure to achieve a high return on investment and the need to accomplish excellence [23]. Since oil and gas firms are among the significant contributors to global environmental issues, regulations guiding their operations continue to grow in complexity. Even enforcement of regulations is becoming more coordinated such that noncompliance faces stricter measures that could bring down companies [46]. Those oil and gas companies, PETRONAS to

be specific, therefore need a robust enterprise risk management (ERM) system for governance, compliance and opportunity exploration and management. The ERM is needed also to handle these regulatory risks, operational risks, financial risks and even strategic risks that will eventually assist in the implementation of operational excellence program in the firm.

Risk management is one prerequisite to achieve sustainable competitive advantage for continuity and longevity of global business operation [42]. Global risk incidents in the oil and gas industry and the Malaysian experience made a significant push to the continuous need for ERM in achieving operational excellence [41]. PETRONAS's emergency evacuation of staff from African operation and the rise in fatalities from operational incidents in 2016 are one of such incidents. The event of Deepwater Horizon drilling rig in the Gulf of Mexico in 2010, BP cherry point refinery fire 2012, Amuay fire and refinery shut down in Venezuela in 2012, and the Pemex pipeline explosion—these accidents serve as caution note to players in the industry about emergencies [20]. These emergencies led to the drop in output, staff morale, loss of assets, the rise in the cost of operation and lots more, which directly affect the firm performance of all sort. As a result, the oil firms experienced stricter regulations across the globe. Regulations on unconventional oil and gas resources—such as the technique for extracting gas from shale, which raises concern about the environment mainly, the water table, were enforced [7].

It is true that operational excellence is validated through cohesive performance across risk, revenue and cost [29]. Hence, the interconnectedness of these individual functions automatically sets a firm on a pathway to operational excellence. Summarily put, achieving operational excellence means having a sound ERM strategy that aligns with a firm's operational capabilities and the ability to execute this plan reliably and consistently [24, 33]

In recent time oil and gas companies, primarily upstream operators had witnessed a steady decline in the barrel of oil per day, per capital dollar production and asset reliability [20]. The issue of asset reliability was due to ageing, and the increase in finding and lifting costs is becoming unbearable for oil firms. Again, the continued escalating pressure on the oil companies [33], particularly those that supply oil-dependent nations with the majority of their revenues to perform, is on the increase. In striving to overcome the volatility of the oil and gas market, NOCs have been buying access to new markets and expanding the existing ones. Specifically, NOCs took a tone towards investing in operations outside their home countries for over a decade now [24]. This expansion further exposes the NOCs to more risks.

Results

As a result of the above challenges, some of the major IOCs adopted OE, which had significantly improved efficiency in their operations. However, even the most successful OE program needs improvement because new regulations are enacted, new risks are emerging, employees are demanding for a healthier and safer working environment, and new tools and technologies are discovered. Although studies have been conducted in the field of operational excellence, most of the studies were in manufacturing and service industries. Researchers like [11, 23, 37, 39, 40] conducted studies on OE, but none of them considered risk management determinants as variables affecting OE, also no traced study conducted in the oil and gas sector in Malaysia. Regarding the above-mentioned issues, this study is aimed at developing a conceptual framework that will depict the determining effect of ERM determinants on OE as well as show the mediating effect of ERM implementation between the determinants and OE in the Malaysian oil and gas industry.

Conceptual framework

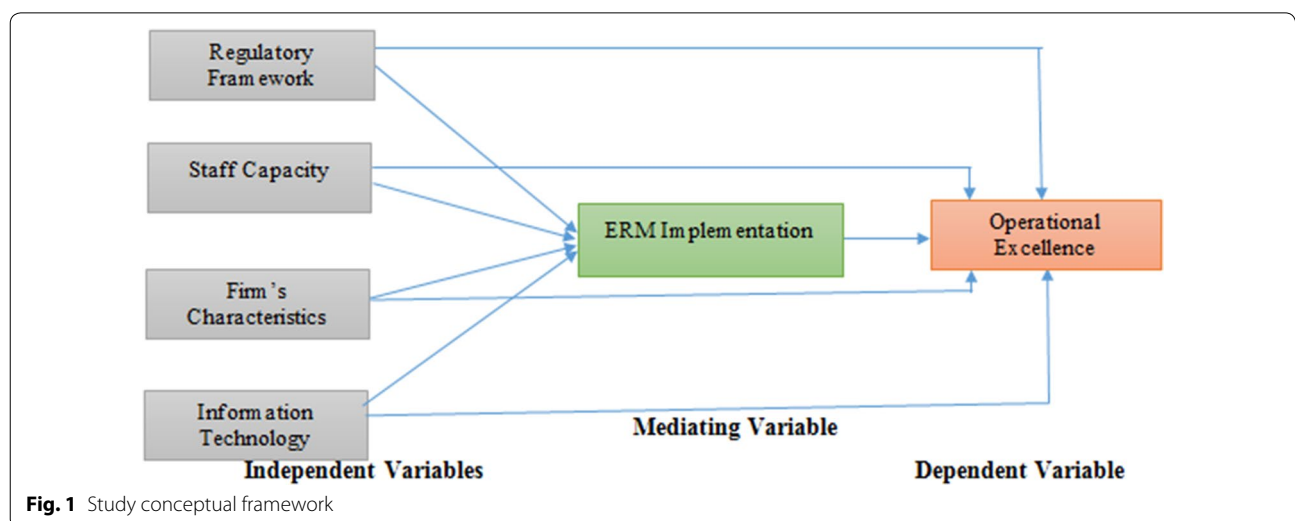
The conceptual framework is a schematic depiction of the interactions between variables of interest in a study [4]. It helps in explaining the linkage and flow of the relationship among variables of a study. In the current article, it displayed how regulatory framework connects with operational excellence directly and through ERM implementation, which applies all through the other variables, as shown in Fig. 1.

Dimensions of the study variables

This section describes the various dimensions adopted to explain and measure each of the variables in this

study. The dependent variable OE’s dimensions include health and safety, reliability, efficiency and the environment [5, 12, 16–21, 24, 29]. Here, many of the indices are grouped to reduce the number of items to a considerate and reasonable figure. Health and safety are further broken into elements which include security, injuries and health assurance. Reliability, on the other hand, includes asset design and maintenance, downtime and product availability. Efficiency has to do with improved productivity, cost reduction, quality improvement and waste reduction. The environment deals with issues like the volume of waste, the safety of host communities and the social interactions.

The independent variables like regulatory framework are measured by the number of regulatory bodies, regulations and the enforcement of the laws as supported by Abu Bakar et al. [2], Bolu [8], Viscusi [43]. Firm characteristics have three dimensions adopted from earlier studies [3, 26–28, 30] that include firm size, ownership and business complexity. Also staff capacity’s constructs include training methods, content of the training and evaluation as posit and used by Cole [14], Danziger and Dunkle [15], Kumsuprom et al. [31], Chileshe et al. [13]. The last but not the least among the variables, information technology would be operationalized by the process needs of IT, IT infrastructure and control process as suggested by Pagach and Warr [34], Wilson et al. [45]. The mediating variable ERM implementation would be measured using three constructs such as governance, structure and process of risk management implementation as used by Lai and Samad [32], Ping and Muthuveloo [35], Shad and Lai [38].



Theoretical backing of the research

Theory of constraint and resource base view approach was adopted for the study. Goldratt [25] postulated that constraints theory is a methodology for identifying the primary limiting factor (i.e. constraint) that blocks firms from achieving a set goal. Goldratt further maintained that an organization would have to systematically continue improving the identified constraint until it ceases to be a limiting factor. This is to say that anything that limits a firm from achieving higher performance against its goal is a constraint. Some of the recognized constraints could deter effectiveness of OE staff behaviour, availability of resource, compliance issues and other risk factors, especially in the oil and gas sector. The OE management system provides a company with the benefits of lowering costs of production, improving efficiencies (cost and process), reducing a number of health and safety incidents, maximizing returns on operating assets and improving competitive advantage [9]. Bucklers' position on constraints theory coincides with the view of [12, 20] on OE as regards oil and gas that it is about asset efficiency, reliability, personal and process safety, health and the environment. With these assertions, one could conclude that it may be the best theory to explain operational excellence in the oil and gas sector in Malaysia. It is so because theory of constraints offers a robust set of tools for helping to achieve OE in a firm because it emphasizes on the need to identify such constraints and find a way to manage them. Some of these needed tools include ERM implementation that would eventually reduce these risk elements as constraints to attaining OE.

On the other hand, resource-based view theory (RBV) was adopted to explain the independent variables of the study (regulatory framework, firm characteristics, staff capacity and information technology). The RBV is about utilizing internal resources to manage and improve organizational performance [22]. The RBV highlights the firm as a unique collection of resources [6]. According to Wernerfelt [44], RBV is the combination of valuable resources under the control of an organization, which is a central competitive gain for an organisation. By implication, the RBV would enable a firm to upgrade its operations so as to comply with regulatory requirements, the resources would enable organizations to invest in IT infrastructure and staff capacity building. Again, the RBV means that companies operations and complexity could be expanded by the resources under their control. Earlier studies on operational excellence adopted and used RBV, studies like that of Fok-Yew and Ahmad [23] and that of Shehadeh et al. [40]. The usage of the theory, though in other sectors not oil and gas, has been giving the current study the backing to adopt the same to explain operational excellence in the oil and gas sector in Malaysia.

Discussion

The study was necessitated due to the varying business conditions in the global oil industry and the continued emergence of new business risks, despite the clamour for ERM in organizations. Many of the major (international) oil companies have re-strategized their operations by employing operational excellence to achieve improved productivity, with productive capital and asset utilization, considering employees safety and the environment in creating value to all their stakeholders. From a study conducted by Ernst & Young [20], it shows that only 50% of the global NOCs owned by states adopted OE in their organizations. As a result, majority of them were the most affected by the dwindling oil prices, the rise in the cost of oil exploration, distribution, refining and storage.

Risks such as machinery breakdowns, employees' slips, and fatalities, reservoir and pipeline explosions, environmental degradation and uprising from the host communities—hostilities with concerns to royalties being paid to them and the condition of their environments, are substantially affecting the performance of NOCs in the global arena. At times, these problems lead to the temporary shutdown of operation home and abroad. PETRONAS experienced a number of fatalities and emergency evacuation from some of its foreign production site in 2016 [36]. This development further shows the need for risk management (RM) to achieve operational excellence in the oil and industry. Although most of IOCs had OE and some NOCs, there is still a need to improve it as new risks are emerging day by day due to new regulations, new technologies, stakeholders pressure and above all, changed parameters. It is important to note that ERM has gone beyond only protecting businesses from negative events to helping in cost reduction and developing new business strategies to accept, manage and capitalize on business opportunities [33]. This therefore means that the study would serve as an eye opener for the industry to explore new business opportunities through risk management.

So the study deemed fit to investigate the factors that influence or drive the implementation of enterprise risk management because all the mentioned challenges are related to risk. Specifically, the study seeks to establish whether those ERM determinants and its implementation can predict or influence the implementation of operational excellence program in the Malaysian NOC—PETRONAS. And once this relationship is established, it would go a long way in guiding PETRONAS towards improving and sustaining cost efficiency of its assets, human resources and machines in surpassing increased stakeholders expectations with concerns to safety of its employees, health and the environment. That would also mean an increase in productivity, expansion of operations

beyond the borders of Malaysia, the rise in government revenue, employment creation and poverty reduction, which would eventually reduce social vices in the society.

This study would cover PETRONAS as Malaysian NOC. It would include all its 148 operating subsidiaries. Engineers and managers would be chosen purposively from operations, engineering, human resources and risk management departments. In most cases, they are in one way or the other involved in risk management, and operational excellence objectives setting and implementation and therefore could provide reliable information on the subject matter. The study would cover four key ERM determinants (firms' characteristics, information technology, staff capacity and regulatory framework) that predict operational excellence through ERM implementation intensity as a mediating variable of the Malaysian Oil and gas company, PETRONAS.

Conclusion

In this paper, issues and challenges of the oil and gas sector were discussed in relation to the industry's best operational performance also known as operational excellence. The nature and percentage of adoption of OE among NOCs and IOCs were highlighted in the earlier part of the article. The need for improvement in operational excellence in the Malaysian NOC PETRONAS was buttressed, and theoretical and conceptual frameworks were developed that would guide the study. All the postulated variables and their measurement construct as supported by scholars and studies conducted in the field of OE were discussed. The major contribution of this paper is the new framework developed that incorporate ERM implementation as a mediating variable as well as using IT, regulatory framework, firm characteristics and staff capacity as the independent variables of the study. The paper was able to propose a framework that was scarcely exploited on operational excellence in the oil and gas sector, and there was rarely any studies found to have used the same framework. The article contribution to theory is in the conceptualization of relationship among the variables and the combination of variables used in earlier studies as dimensions in the current research. The article generally laid a foundation for future research in the area of OE.

Methods

The current article reviewed theoretical and empirical literature to arrive at the development of the proposed framework. Quite a number of journal articles, company reports, dissertations, seminar papers, term papers, and professional papers and views were considered in the process of developing the conceptual framework and variables dimensions used as the measurement indices in

terms of analysis. Consequently, the methodology used in this article is therefore a literature review and conceptualization of how ERM determinants and implementation could influence operational excellence in the Malaysian oil and gas sector. The underpinning theories were found in previous studies and were reviewed interpreted to explain the proposed relationships among the postulated variables.

Abbreviations

NOC: national oil company; IOC: integrated oil companies; OE: operational excellence; ERM: enterprise risk management; GDP: gross domestic product; IT: information technology; RBV: resource-based view.

Authors' contributions

All authors RT, MHM, NAAH and NLZ have (a) made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; (b) been involved in drafting the manuscript or revising it critically for important intellectual content; (c) given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content; (d) agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. (e) All authors have read and approved the manuscript.

Competing interests

The authors of this article—RT, MHM, NAAH and NLZ declared that there is no competing interest.

Availability of data and materials

Not applicable.

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