Sustainable Asset-Integrity Management under Intelligent Risk Based Decision Support System: A Case of KSA Oil and Gas Sector

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Abstract

This study entails sustainable physical assets integrity management under an intelligent risk-based decision support system concerning the Saudi Arabian oil and gas sector. Its focus was on Saudi Arabian enterprises, whether they are running effectively and sustainably over time and these organizations are using the risk-based decision support system or not. Based on the judgment random sampling method to select studies from various secondary sources about Saudi Arabia's oil and gas sector and with the help of thematic analysis, findings of this study showed that the organizations in oil and gas sector can use the intelligent risk-based decision support system to enhance their overall performance. This research has identified how large scale assets can be used efficiently in drilling, processing, and transporting oil and gas. The study has also identified a feasible and reliable framework to attain a greater level of asset dependability and maintainability using data and risk decision management.

Moreover, this research has found ways to enhance the reliability of risk identification methods and identified suitable indicators for risk thresholds measurement. Findings also show that Asset Integrity Management (AIM) is based on an asset's ability to execute operations successfully and to the intended level of performance concerning the sustainable output spread across the usable asset life and taking environmental, health, and safety performance into account. More crucially, the notion of Integrity Management is connected to the managerial implications of asset management, such as natural gas and oil rigs, refineries, and power plants that need to assured the efficacy and efficiency of the core operations.

Keywords: Asset Integrity Management (AIM), Sustainability, Key Risk Indicators, Oil and Gas industry, Risk Based Decision Support System

Introduction

Because of its complex nature, oil and gas sector is quite often regarded as a very intricate industry where the company's management is supposed to make crucial decisions on routine basis. Issue becomes more complex as it involves a large number of spending – expenditures on exploration of oil and gas discovery through the distribution to the ultimate consumers. Additionally, there exist certain regulations related to the usage of assets involved in a sustainable manner. Resultantly, the basic concept of sustainable Assets Integrity Management (AIM) was introduced which is to ensure and be able to demonstrate that the assets deliver required function and level of performance in terms of service or output (Samantra et al., 2017). AIM concerning the purchase, operation, maintenance, modification, and disposal of key assets and properties, is critical to the long-term success of most asset-intensive enterprises. When industrial activities grow, corporate success becomes closely linked to asset availability, maintenance, and deployment and sustainability gives it added advantage. Sustainability is described as fulfilling current demands without jeopardizing future generations' capacity to meet their own. It has become a buzzword in companies that rely on natural resources (Ratnayake, 2013). Resultantly, AIM has allowed the firms to reach their ultimate goals, both financial and non-financial (Ilora, 2018).

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With the metamorphosis of artificial intelligence in the last few years, artificial intelligence has had a big influence on the management and decision-making of enterprises in the oil and gas sector regarding the overall sustainability of the assets over time (Ratnayake, 2013). It has increased the need for researchers to conduct a detailed study on the sustainable asset integrity management under an intelligent risk-based decision support system and analyze how oil and gas companies are specifically utilizing the risk-based decision support system to ensure the overall practice of managing large scale oil production plants to operate efficiently and effectively. Whereas it is also vital to evaluate what modifications can be done to further improve the overall efficiency and effectiveness of asset performance and gradually raise the degree of sustainability by the concerned firms functioning in top oil producing countries e.g. KSA.

This study focused on the fundamental circumstances of Saudi Arabian enterprises working in the oil and gas sector and examined the sustainable asset integrity management through intelligent risk-based support mechanisms in their respective organizations. Despite of its importance, limited research has been carried out concerning the sustainable AIM, and in the past, there has been no comprehensive research conducted related to how the sustainability of AIM can be ensured through efficient utilization of intelligent risk-based decision support system by the companies of KSA operating in oil and gas sector.

Since asset-intensive businesses are under increasing demand from their stakeholders to attain the optimal level of asset utilization to ensure balanced and sustainable performance over their life cycle this study further intended to design a functional and practical framework to achieve a higher degree of assets reliability and maintainability. Major objectives of this study are to examine the risk identification methods, explore indicators for risk thresholds measurement in the oil and gas sector, evaluate the role of data quality for performance measurement of assets in the oil and gas sector of KSA and examine the role of data and risk management for sustainable assets integrity and address the role of Physical Asset Integrity Management in KSA's Oil & gas industry using a risk-based decision support system.

Literature Review

According to Chandima et al. (2012), AIM is to ensure that the assets specifically deliver the expected function performance in a sustainable way for the entire useful life and at the total optimum cost without compromising the safety, health, environmental performance, or the overall reputation of the organization. The basic concept of Asset Integrity Management has been specifically explained by Ratnayake et al. (2013) as they referred it to the complex work of managing the integrity of engineering assets such as industrial plants, buildings, and equipment owing to their interrelationships with financial, information, human, and intangible assets. Moreover, the researchers figured out new possible ways for better handling of the physical assets, specifically pressure containments in the Oil and Gas sector (Temizel et al., 2019). As AIM has increased importance in oil and gas sector and this importance keep on increasing as the life of asset and price of replacement increases.

According to Seneviratne and Ratnayake (2012), most of the infrastructure of the oil and gas sectors has either already completed or is about to complete its operational life expectancy. Moreover, considering the overall replacement cost of the asset and the resultant time for a turnaround are comparatively on the higher side for numerous reasons. Kelly (2021) has highlighted that within the Oil and Gas industry, there are numerous challenges such as vessel's internal inspection, which is referred to as a significant contributing factor to their production, corrosion, and downtime for oil and gas production facilities and the researchers added that taking steps for employing new solutions has become a necessity in numerous sites, particularly in offshore oil rigs and power plants (Kelly, 2021). If a certain critical asset, for example, a pressure vessel as mentioned earlier, is brought out of operation for internal or external

inspection purposes for insulated static assets, this poses a significant loss of production, which may extend beyond the expected downtime.

Saudi Arabia is the world's largest oil exporter and its oil income is increasing rapidly, owning mostly to higher global oil prices. Saudi Arabia, the United States, and the Russian Federation currently account for 40% of global oil output (International Energy Agency, (IEA) Oil Market Report (OMR), December 2018), all of which play an important role in balancing market trends and crude oil violability (Saudi Ministry of Finance, Quarterly Budget Performance Report). Saudi Arabia has one of the world's highest per capita energy consumption rates. As a result, the government has lowered gasoline and electricity subsidies by around half, and it has outlined a clear plan for reducing energy subsidies to zero (Fattouh & El-Katiri, 2015). These figures show the importance of AIM in KSA since the price of oil and gas is rapidly increasing and posing a serious importance to the asset integrity management in the relevant sector.

Concept of AIM in the sustainable operations of the industry

According to Ratnayake (2013), AIM is considered to be the exploitation, acquisition, modification, maintenance, and disposal of crucial properties and assets, which are considered to be vital to the overall sustainable efficiency of most assets-oriented businesses. Moreover, in the case when industrial operations of the company become more and more asset oriented then the corresponding performance of the business is more attached to the overall maintenance, availability, and eventually the deployment of the assets. Constantines and Davies (2020) further added that AIM not only assists in driving the sustainable performance of the company, but it also keeps the maintenance, inspection, and repair costs at a significantly lower level, by improving the operational safety and reliability of the plants. According to Ferriera et al. (2020), managing the overall integrity of assets can be considered a significantly challenging task mainly due to the interrelationship with the informational, financial, reputational, and human assets but is adds to the overall sustainability.

As Fernandes, Jimenez, Kraak and Tsagdis (2019) have drawn attention to the fact that politics may impact oil & gas production through regulation. Typically, an oil & gas business is subject to a slew of rules that govern where, when, and how extraction is carried out. Fernandes et al. (2019) stated that oil and gas firms favor nations with stable political systems and a track record of awarding and enforcing long-term leases. Some firms, on the other hand, just go where the oil and gas are, even if the country doesn't precisely match their desires. A variety of challenges may occur as a result of this, including unexpected nationalization and/or shifting political winds that alter the regulatory environment.

Fernandes et al. (2019) also point out towards the depletion of easy-to-get oil & gas reserves. Exploration has progressed to drilling in less-than-ideal conditions. As elaborated by Fernandes et al. (2020), the term "geological risk" refers to the difficulties of extraction as well as the chance that the accessible reserves in any deposit will be less than predicted. Oil and gas geologists work hard to reduce geological risk by testing often thus; estimates that signify "wrong" are uncommon. Supply and demand shocks pose a significant risk to oil and gas enterprises. As previously said, businesses need significant costs and time to establish, and they are difficult to shut down when prices fall or ramp up when prices rise. The unequal pattern of output contributes to the volatility of oil and gas prices (Kelly, 2021).

All of the above hazards contribute to the operating expenses. The more stringent the rule and the more complicated the drill, the more expensive the project and cost unpredictability due to globalization also arise some serious cost problems (Ratnayake, 2009). To ensure efficient and effective utilization and improved asset management, a firm is required to reach a balanced and efficient decision concerning the assessment of the performance. Tang et al., (2019) argued that the major issue for AIM is linked with the various elements of the human dimensions. Most importantly, the overall performance of the assets is discussed in the terms of societal,

financial, and environmental dimensions that specifically deliver the value of sustainability to the owner of the asset. It re-establishes the importance of sustainable asset management.

The indicators in measuring the proactive risk thresholds

According to Skorobogatova et al. (2021), key indicators of risk are critical predictor of the unfavorable events that adversely affect organizations. They specifically monitored the changes in the basic risk exposure, and contributed toward the early warning signs that assist the firms in reporting the risks, preventing the crisis, and mitigating them. Key Risk Indicators (KRIs) are considered to be informative, and they act as a catalyst in decision-making. Tadjiev et al. (2021) added that proactive risk management involves careful analysis of a situation to determine the potential risk associated with the assets of the company. Companies identify the drivers of risks to understand the root cause, assess its possibility of occurrence and the impact it caused to the risks, and develop contingency plan (Tang et al., 2018).

According to Temizel et al. (2019) it is necessary for companies engaged with complex assets to design and implement effective KRIs and should be an essential part of the risk framework. Moreover, Chen et al. (2019) mentioned that indicators in measuring the proactive risk thresholds are required for oil & gas industry, due to the level of risk involved in the industry. Green et al. (2021), Chandima et al. (2012) and Healy et al. (2016) suggested that the proactive risk thresholds for the companies can be the Financial KRIs, social KRIs and technological KRIs specifically based on the total number of failures of the specific plants being utilized by the oil & gas sector over the period of time and average time between the technological failure faced by the asset e.g. carbon emission.

Moreover, Ilora (2018) specifically highlights that there are two major drivers for the development of the upgraded framework, which include assuring a higher degree of intervention and early detection against the issues of integrity but it is based on quality data. Dia et al. (2021) indicated that the firms utilize different data regarding the assets, like the time it takes to develop a single unit of inventory or stock in the case of the Oil and Gas industry, the firm can utilize the quality data to analyze the overall efficiency of the oil extraction plant over the time period. Therefore, it can be determined that the performance measurement of the assets is one of the key elements for the business corporations in any industry, which requires quality data over the period for an asset to determine its performance from varied aspects within the life cycle of the assets and reducing risk (Dia et al., 2021).

This optimization can be aided by automated, integrated data analytics. Data analytics is critical for producing unconventional drilling outcomes that are both cost-effective and safe. Drilling businesses must build contemporary systems for capturing and organizing real-time data from operations, which will enable monitoring algorithms, predictive analysis, risk reporting, safety alarms, and other features. Raw data from surface, downhole, and tool sensors must be continually collected (Fattouh & El-Katiri, 2015).

Sustainable Asset-Integrity Management Using Risk-Based Decision Support System

Different authors and researchers, such as Chandima, (2010); Ilora, (2018); Dia et al. (2021), have specifically highlighted the integrity of sustainable asset management through a risk-based decision support mechanism. The overall development in the oil and gas sector has heightened issues of integrity considering the prevalent challenging and climatic operating conditions in different rigs of oil and gas globally (Kishawy et al., 2010). Moreover, it has been analyzed by Ilora (2018) that data and Risk-Based Decision management was specifically regarded as the two critical success factors for AIM which would result in the desired improvement concerning the specific large-scale assets like Plant and Machinery. In addition to that, Collins (2018) specifically utilizes the data visualization approach in a manner that aids in smart risk communication and decision over the period.

Andi et al. (2021) further highlighted that the AIM has specifically included three significant elements, which include design integrity, technical integrity, and the operational integrity of the asset, as these specific elements ensure that the opportunities are optimized through an efficient and effective decision-making. On the other hand, the sustainable assets integrity management can be conducted through an efficient risk-based decision support mechanism, and there are different aspects concerning the Risk Management, including Risk-Based Methods, Risk visualization, and Risk-Informed decision support; the aspects of data management include the digitization of data, data analytics and visualization of data (Dia et al., 2021).

The above discussion clarifies that companies that rely heavily on their assets face a significant amount of pressure from all of the stakeholders to achieve the optimal level of utilization of those assets in order to obtain a balanced and sustainable performance. Companies that work in the o&g industry look for nations that have stable political systems and a track record of enforcing long-term leases. On the other hand, some firms will just go where the oil and gas are, regardless of whether or not the country as a whole can accomplish its objectives. As a result of this, a variety of problems may emerge, such as unforeseen nationalization and/or shifting political winds that have an effect on the regulatory environment. In order to ensure effective and efficient utilization and improved asset management, the firm in question is required to arrive at a decision about the assessment of performance that is both balanced and effective.

Research Methodology

Research Design

Among other sources, gathering information from the internet, government documents or resources, libraries, and other previously done research, this study employed secondary data, which is then summarized and organized to improve the study's overall efficacy. Since secondary research is less expensive than primary research, secondary research employs existing data, but preliminary research requires the researcher to obtain the data themselves or a third party's assistance. Researchers use secondary research to supplement data gathered from primary research. Furthermore, research approaches are of two types: inductive and deductive (Woiceshyn & Daellenbach, 2018). The reasoned approach has been used in this research because an author goes from theory to data in the deductive method.

Sampling Technique, Sampling Size and Data Collection Mechanism

The quantitative approach is used in this research by going through the published organizational records, exploring the internet, reading the books, and reviewing the literature. To collect the data for secondary analysis, there are multiple resources were used such as company websites, planning and scheduling, trade publications, rankings of the firm, market research reports, lubrication program, Governmental statistics, asset critically ranking and industry association publications.

After some data or other information has been obtained, secondary sampling designs were used. Secondary structures can be based on a sample (point) or a model (geospatial model). The author used different types of papers and articles to collect the data (Taherdoost, 2016).

Since this study focused on the Saudi Arabian Oil and Gas sector for that purpose researchers selected additional research from different sources mentioned above. At the same time, the sample size for the study is around ten various articles on AIM from the oil and gas companies along with the risk-based decision-making mechanism.

Data Analysis Method

This study has adopted thematic analysis technique, which specifically allows the researcher to reach a detailed conclusion related to the themes of the research and the research questions (Castleberry & Nolen, 2018). Initially, the overall findings of the research have been divided into different pieces. To uncover recurring themes, subjects, ideas, and patterns of meaning, data were studied carefully. Later on overall analysis was conducted for the data gathered to reach a detailed conclusion.

Research Findings and Analysis

For the purpose of analysis, researcher evaluated key publications and studies on sustainable AIM utilizing data and risk management to recommend approaches for managing the integrity of sustainable assets. Key publications included on the keywords of asset integrity management and sustainability in action and following themes from these sources were generated.

Theme 1 - AIM in the oil and Gas Sector

The goal behind AIM is to ensure technical, operational, and design integrity management through AIM. The fundamental emphasis of integrity management is to keep or enhance the long-term value of assets in order to overcome difficulties related to effective performance and growing stakeholder pressure.

Based on the secondary data, the study infers that asset integrity management is better achieved by producing or obtaining qualitative and quantitative data from the organization. Firms have an economic, legal, and moral obligation to improve their integrity since breaches of integrity harm the corporate brand and money. It also considers precise procedures and processes throughout the industrial plant's life cycle, beginning with design and decommissioning.

After evaluating data, it was found that asset management is connected to improving equipment and facilities such as refineries, production power plants, and gas and oil rigs to strengthen the organization's capacity to perform operational efficiency.

Theme 2 - AIM's role in the oil and gas sustainability

The organization's management identifies distinct risk drivers that influence the purpose of risk priority and contingency planning. Furthermore, it is difficult to maintain production facilities' asset integrity, requiring efficient and effective usage and enhancing asset management. An organization must make a streamlined and effective decision related to the performance assessment.

Theme 3 - Measuring the Proactive Risk Thresholds

It can be inferred from the reviewed literature that risk exposure denotes a crisis and remedies to remove those dangers over time. The concept of key risk indicators is regarded to be information adequacy since it aids in decision-making. It also provides a thorough perspective of the risks that influence its overall objectives.

Theme 4 - Data Quality for Performance Measurement of the Asset

It was also found that data with all the major qualities lead to the most appropriate and relevant alternative for the company's management, allowing the organization to fulfill its goals. According to Lukens et al. (2019), the basic data quality tools include data completeness, data accuracy, data relevance, data reliability, and data timeliness. These specific qualities of the data are deemed critical for sustaining the overall quality of the data. According to the findings of the research conducted by Martins et al. (2014), if the collected data is considered to be gathered from an incongruous source at different times, then it may not specifically be

considered to be an appropriate indicator concerning decision making and planning purposes for the organization.

Oil and gas companies can use data quality to analyze asset performance in terms of several asset performance characteristics over time. For example, suppose the firm possesses accurate, complete, and trustworthy data on the asset's environmental effects. In that case, the firm will be able to draw an accurate conclusion about the asset's performance in terms of its sustainability towards the climate and society as a whole (Dia et al., 2021

Theme 5 - Risk-based Decision Support System

Aiming to improve large-scale assets like Plant and Machinery, AIM relied heavily on data and risk decision management to achieve the desired results. The entire development in the oil and gas business has heightened integrity challenges, given the prevalent demanding and climatic operating conditions in many oil and gas rigs across the world. Furthermore, according to Ilora (2018), data and risk decision management were especially regarded as the two important success criteria for Asset Integrity Management that would result in the desired improvement concerning certain large-scale assets such as Plant and Machinery.

Significance of AIM in the sustainable operations of the industry

Keeping in view the objectives of this study, along with other data, 10 pieces of research were analyzed. Sinevirantne and Ratnayake (2012) highlighted that AIM application in an organization has a significant impact on ensuring that it maintains sufficient amounts of resources throughout the period and ensuring the health and safety of the employees and allows in protecting the overall environment in which the plant of the firm operates. Ilora (2016) also has a similar opinion; AIM is the key element in effective business operations in the oil and gas sector as they assist in achieving sustainability in the organization's operations with respect to the society, the health of the employees and safety of public.

On the other hand, Sahid (2019) suggested that the companies in the oil and gas sector have been utilizing AIM, particularly for their offshore assets so that the performance of the asset is monitored, operational, design and technical integrity are required to be managed efficiently to reduce the overall cost. Moreover, this particular model of AIM became famous, particularly in the oil and gas Industry which utilizes heavy-duty plants in the production of varied commodities.

Indicators in Measuring the Proactive Risk Thresholds

The second set of questions investigated in this study was about the proactive risk thresholds and indicators being utilized in determining the risk thresholds. Andi et al. (2021) indicated that the oil exploration and refining companies keep their eyes on different indicators with respect to the performance of assets and different thresholds e.g. international oil prices, as the oil prices reduces the management of the company reduces the overall production of the oil and in case if the prices of oil in the international market increases, the firm increases its production.

In addition, Ahmad et al. (2016), presented different indicators related to measuring the proactive risk thresholds as the findings suggest that in numerous organizations, it has been observed that management of the entities has specifically maintained different risk thresholds with respect to the environmental hazardous the oil and gas company may cause to the society, different organizations selected in the study has maintained the Paris Agreement Accord which restricts the emission of greenhouse gases to 450 parts per million of CO2 Equivalent GHG emission and once the share of emission reaches to its limits the firm ensures that the assessment must be conducted to reduce the production and overall emissions.

Utilizing Data Quality for Performance Measurement of the Asset

Further studies (Lukens, 2019) highlighted that the quality of the data is a critical element for the decision making of the firms with respect to the AIM and other decision-making mechanisms as well as is the key element for measuring the overall performance of the asset over the course of time (Ratnayake, 2012). Moreover, Lukens (2019) explained that the utilization of quality data in measuring the performance of the asset is the key element in implementing AIM; a similar notion was presented by Martins et al. (2014). Furthermore, Lukens et al. (2019) pointed out that selected entity utilizes the quality data for measuring the performance of the oil production plant to analyze its daily emission of greenhouse gas which particularly prevents the organization in reaching the upper limit of carbon emission set by the organization from a specific plant.

Sustainable Asset Integrity Management Using Risk-Based Decision Support System in the Saudi Arabian Oil and Gas Companies

The final objective of the research that has specifically been analyzed is about the sustainable assets integrity management of the oil and gas sector based on the decision support system in Saudi Arabia. Sharif et al. (2017) suggested that the oil and gas sector companies of KSA have recently adopted Risk-Based Decision Support Mechanism in their organizations, and it was found quite efficient and effective in maintaining a high level of performance. On the other hand, Healy and Serafeim (2018) have provided different notions related to the sustainable AIM by the oil and gas sector organizations in Saudi Arabia as it has also been analyzed that the oil and gas sector companies in Saudi Arabia are still struggling to utilize the Risk-Based decision support system, and still utilizing the traditional decision-making mechanism.

Healy and Serafeim (2018) also suggested that the Saudi Arabian oil and gas companies' performance related to the efficiency of the assets is on the lower side, mainly because these companies do not meet with the international standards related to the carbon emission and safety standards. On the other hand, Basile et al. (2021) shared that the sustainable AIM has become a necessity for every single oil and gas organization considering the fact that the impact of the assets being utilized in the industry is quite huge and they have a wider impact upon the company and the overall environment, and the risk-based decision support system is the most advanced mechanism to deal with.

Therefore, it can be concluded that the Saudi Arabian oil and gas sector has analyzed the overall importance of sustainable AIM, and they have taken numerous steps to ensure the compliance related to the sustainability and performance of assets, but the firms are unable to completely adopt the Risk-Based Decision Support System in their respective companies over the time and their asset's performance in the last few years have been below par in comparison to the other large oil and gas sector companies globally.

Discussion

The overall findings of this research highlighted that AIM in sustainable operations of the company is considered to be an essential part of the research. Findings also suggested that AIM application in their respective firms has a significant impact upon ensuring that the firms maintain sufficient amount of resources throughout the period and ensuring the health and safety of the employees and protecting the overall environment where the plant operates. Moreover, the findings also show that the companies in the oil and gas sector have been utilizing AIM, particularly for their offshore assets throughout their lifecycle to monitor the performance of the assets. Therefore, these findings are directly in line with the overall findings of the research conducted by Constantines and Davies (2020), which showed that the sustainable AIM not only assists in driving the sustainable performance of the company, but also keeps the maintenance, inspection and repair cost very low as well as improving the

operational safety of the major tangible assets of the company can be ensured through efficient utilization of AIM over time.

In addition to that, the findings highlighted that the oil and gas sector companies usually utilize the proactive risk threshold and manage the overall risk associated with the business operations of the company as it helps in the overall analysis of the situation and determines the potential risks linked with the company's operations. The findings suggest that the companies utilize the different indicators related to the assessment of risk linked with the business operations and that significantly affects the entity over time. These findings are in line with Chen et al. (2019) where they suggested that the proactive risk thresholds for the companies can be the Financial KRIs and other relevant indicators regarding the environment, which assist the efirm in measuring the performance of the assets on regular basis.

Based on the findings, the companies belonging to the oil and gas sector have opted for a valuable mechanism of Risk-Based Decision Support Mechanism, which is an efficient support system for ensuring sustainable AIM within KSA. However, it is important to note that Saudi Arabian Oil and Gas companies have to make continuous efforts in designing and implementing risk-based decision support system. Every O&G firm is should incorporate emerging risk-based decision support to ensure sustainable management of the asset, design integrity, technical integrity, and the operational integrity of the asset. By way of an effective and efficient risk-based decision support mechanism, the organization could undertake informed decision making, visualization and methodologies, and the management of data could be undertaken safely and effectively through data visualization, data analytics and data digitization.

Conclusion

An asset's ability to perform specific functions up to the desired performance level about the provision of sustainable output over the useful asset life and consideration for environmental, health and safety performance is central to asset AIM. Management implications for asset management, such as managing natural gas and oil rigs, refineries, and power plants, are central to the Integrity Management idea. These operations must be effective and efficient to protect an asset's performance capability. Risk detection and mitigation can be made more effective by using this data to guide future improvements, which help to achieve this study's first objective.

For the second objective, particular indicators are designed to monitor proactive risk levels. The researcher has specifically determined the importance of AIM in the O&G's sustainable operations that revealed core information. For example, the research conducted by Constantines and Davies (2020) confirmed that the application of AIM is implemented in the organization, allowing for better safety and health management of workers and environmental protection. Additionally, a separate study found that AIM had a major impact on oil and gas firms. However, Tang (2019) argued that the implementation of AIM was fundamentally tied to the integrity of the technical, design, and operational aspects of AIM implementation.

The implementation of various methods was put into use to comprehend how the quality of data quantified the asset performance and what impacted the measurement of proactive risk threshold. However, the global oil prices also impacted the ability of oil corporations to refine and manufacture the end useable products. With regards to that, the companies maintained their integrity with the Paris Agreement, which allowed the better assessment of low emission of harmful substances into the environment. It is also evident that the use of well-structured data helped in achieving sustainable AIM. Finally, the findings suggested that the desirable results, which allowed the efficient calculations of the company's daily log of carbon emissions, can only be achieved when accurate data is present.

The overall findings of this research suggested that to improve the risk and mitigation strategies, a proactive approach is required that would help in AIM to run sustainable functions of the company. In addition to that, maintaining sufficient resources, both physical and non-physical, held organizations accountable with regard to AIM. The regular monitoring of asset performance helped in lowering the production costs when the technical and operational integrity was sufficiently dealt with.

Future Research Direction

Future research could be conducted in enhancing the ability to comprehend the quality of data and the possibility of utilizing it as a performance indicator and updating techniques for identifying risk and mitigation about AIM. In this regard, a solid and organized framework should exist to collect, process, and visualize the overall data likely to supplement the communication and exposure of risk smartly. The implementation of strategies related to management must be well-researched in terms of applying to the O&G industry. The development of technical and relevant elements regarding the varied tenets is essential to measure the risk's impact on the management that is supported by way of data quality.

Research Limitation

This study utilized the secondary data for the analysis purpose, but due to the rapid changes in global paradigms e.g. Covid 19, rapidly increasing oil and gas prices requires primary data collection for a better understanding of the phenomenon in this current volatile situation. This is also because data attributed to oil and gas assets must be well documented and structured to offer a comprehensive view of the physical state of the asset. Primary data collection and data integration is considered cumbersome to achieve operational excellence; however, dynamics of the technical and operational efficiency in today's 21st-century offer that efficiency of the risk-based decisions which would notably depends on the asset intelligence, which is impacted by the quality of data.

Recommendation

The framework for AIM is required to align with a progressive viewpoint on managing data and risk. Also, it must be updated to attain a powerful risk based technique for maintenance, operations and design. There is a strong need for a collaborative approach by oil and gas operators to co-host or manage data hubs for better interaction and interconnection of data networks. The oil and gas entities must conform to the regulatory standards that involve the utilization of risk quantification and incorporation of corporate policies as opposed to the conventional approach of risk analysis to secure aspects of risk by way of design, operations, and maintenance.

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