Digital Transformation In The Offshore Oil And Gas

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Abstract. The offshore oil and gas exploration and production industry is currently facing serious challenges that threaten its profitability and future. Sustainability is needed to meet tougher regulations and address climate change, while global demand for energy and other consumer goods is growing at a rate that alternative energy sources alone cannot meet. However, competing energy sources present an economic challenge for the industry, which must reinvent itself in order to remain competitive and become more sustainable. Meanwhile, higher competition for exploration areas and the complexity of their operation leads to higher capital and operating costs and lower oil prices, which usually leads to lower profits. Modern solutions have been put forward to solve these problems. However, the oil industry does not yet have the necessary drilling equipment for its exploration and development. This scientific work is devoted to the search and consideration of various solutions to energy problems facing man today. Using the latest generation information technology.

1 Introduction

The offshore oil and gas industry consists of activities carried out on the high seas to evaluate, explore and exploit fossil fuel resources that are used throughout the world. As a source of fuel, energy and other components used in the production of everyday commodities. This industry is made up of three main groups: upstream , midstream and downstream . The first includes exploration and production operations, which are carried out to discover and extract oil and gas resources from offshore reservoirs and to operate the platforms created for these activities. Midstream includes activities (such as transportation,

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processing, and storage) to process these resources and produce other products from them. Finally, downstream is associated with the wholesale and distribution of products from previous groups to consumers and others. Offshore exploration and production is the focus of this study.

The offshore exploration and production industry is highly competitive, with many operators competing to find new appraisal sites and new operating licenses. This competition is forcing operators to look for new routes on the high seas, moving from exploration in shallow waters to deeper waters and remote areas where remoteness and weather create additional challenges for operations, such as increased risk to humans and the environment, and challenges to effectively execute operations. Global competition and agreements also affect the world's oil reserves, which directly affects oil prices (Cassagne, 2020). Low price spikes have become more frequent over the past 15 years, and the global COVID-19 pandemic that hit the industry in 2020 has again demonstrated the impact of very low prices on profitability. Because lower oil prices usually mean lower profits, the need to cut costs wherever possible has been an important driver of industry innovation and transformation. Sustainability has also been an important factor in this regard. Managing possible environmental risks is a top priority for regulators, which usually translates into ever stricter regulations and is forcing the industry to reinvent itself in order to remain competitive. NCS operators and other stakeholders are among the most technically advanced, innovative and highly engineered companies in the industry. Nevertheless, activities related to offshore exploration and production are carried out by many stakeholders with complex relationships that make up a complex and highly interdependent system (Alvik et al., 2020). Traditionally, these activities have been managed manually across disparate repositories through monolithic legacy software with low data and system interoperability, and traditional business models that have hardly changed. However, advanced technologies are available for implementation in supply chain management systems in the oil and gas industry. Such a transformative update depends on understanding the inefficiencies of operations and preparing an accurate picture of how these operations should be performed (International Energy Agency, 2020).

Over the past decade, the discussion of digital transformation in the oil and gas industry, especially in NCS , has focused on the development and implementation of digital tools and software. The future of this highly regulated industry is at risk due to several factors (as explained earlier) that also threaten its efficiency, profitability and sustainability. However, maintaining competitiveness, reducing costs and emissions, and expanding operations are seen as the most important reasons for this emphasis, as well as the main benefits of digitalization, digital collaboration and data access in general. As with activities and operations, the industry is prioritizing the development of technologies, tools, software and methods to access more oil, further offshore and in more challenging environments. At the same time, the support provided by the supply chains and logistics operations of these activities has not been the focus of the transformation. Even when they are brought to the attention of global consultants and academia , the supply chain is perceived through a unified view of one of its parts, usually logistics. However, improving one or more parts of the supply chain in isolation from the whole—and the stakeholders involved in operations—is likely to fail in the transformation challenge. Therefore, successful digital transformation depends on understanding and adopting a holistic view and approach to operations. This study aims to address this gap by looking at offshore exploration and production activities and supporting their supply chain, both holistically and systematically, to identify the best alternatives to bridge the two areas, and to help change business models and formulate plans. by solving the problem. the above problems and help ensure the success of digital transformation (Alvik et al., 2020).

The present study addresses these issues by examining the digital transformation initiated in support of offshore E&P supply chain operations by a well-known Russian operator. The study also aims to contribute to the success of this transformation by analyzing how operations can be made more efficient, presenting potential alternatives based on real-world observations, and providing a strategic roadmap to guide their implementation. The discussion in this study, the proposed alternatives, and the roadmap focus on the supply chain and logistical support of drilling operations and drilling activities related to development and construction of wells, which narrows the focus of research due to the huge size of the industry. More importantly, the industry is a highly interdependent system; therefore, the success of a transformation for a single operator depends on the success of most, if not all, of the stakeholders involved in the industry. Thus, such stakeholders are key drivers and can potentially create barriers to improvement and transformation (United Nations Development Program, 2017).

2 Research methodology

General systems theory refers to the study of systems and was first introduced by Ludwig von Bertalanffy in the 1940s as an alternative way to study complex systems. The goal of a general system theory is to model the dynamics, conditions, and limitations of a system and explain its principles (i.e., its purpose, methods, and tools) in order to define and explain its interactions and relationships between parts of the system and beyond in relation to others. . systems. Generally, general system theory is concerned with the development of broadly applicable principles and concepts rather than being strictly limited to one field of knowledge, integrating knowledge from physics, biology, and the social sciences. Thus, general system theory is concerned with creating many different ways of seeing the world and situations in it, and how they interact with each other and/or with the world. It is based on the principle that a system goes beyond the fusion of its parts and is best understood when its parts are studied in the context of their relationship with each other and the system as a whole, rather than in isolation. In general system theory, systems are combinations of components or subsystems, each limited by its own physical, logical, and functional characteristics, that interact to achieve the same end goal or task. These components and characteristics are not limited to the "hard parts" (such as software, physical components, elements, and parts), but also include the "soft parts" of a system, such as the human and social aspects associated with that system. This approach to viewing and studying systems lends general systems theory an interdisciplinary nature that makes it valuable and flexible enough to be used in many different areas of study, ranging from areas focused on heavy engineering to others such as health care, education, and social issues. . Ultimately, general system theory is the framework that supports many different approaches to the study of systems, and many tools are available for analysis and research, such as Forrester 's system dynamics, Beer 's viable system model , Checkland 's soft systems (Bech et al., 2020).

interdisciplinary, multidisciplinary and transdisciplinary approach to the study of systems is called SE and focuses on the design, integration, use, management and decommissioning of complex systems throughout their life cycle as part of a cohesive effort that ensures their success, defined SE as "interdisciplinary and integrative an approach that allows you to successfully implement, use and decommission engineering systems using system principles and concepts, as well as scientific, technological and managerial methods. According to INCOSE, the SE point of view is based on the principles of systems thinking, which provide a unified point of view for understanding reality. Systems practitioners now understand and accept systems as conceptual constructs that can be used to interact with and enhance complex real world situations. This approach to systems is known as systems thinking. This approach is widely used in SSM. Systems thinking is a concept that allows you to perceive and understand relationships, cause and effect, connections, interdependencies and feedback that can help solve complex problems and describe systems behavior defined systems thinking as “a conceptual framework, a body of knowledge and tools that have been developed over the last seventy years to clarify the full patterns and help us understand how to change them effectively. From a systems thinking perspective, a system is an "adaptive whole" that changes and adapts to survive in its environment. For this to be true, each of the functional parts of the system must be properly connected to the others, supporting the flow of relevant information and allowing the system to adapt to maintain performance. Thanks to the introduction of systems thinking, one can begin to understand the multi-layered nature of the world through systemic comprehension and the ability to think critically in difficult situations (Zwicky et al., 1969).

However, not all approaches to systems allow for the “soft parts” to be taken into account. Formal systems approaches usually focus on goals, "best practices" and performance indicators and are set to work towards achieving them. As a result, the system is more likely to focus on measurable outcomes and may ignore relationships and relationships. An analysis of system behavior and potential flaws is more likely to point to one point of view or one person, rather than an examination of the context and other factors that need to be considered when setting up and operating the system, which could lead to potential errors. limitations. Therefore, a soft perspective may be required to understand and contextualize the complexities in systems, which will allow the system to be transformed into an improved and extended version of itself. SSM was created by Checkland in the 1970s as an extension of his critique of formal systems methods; that is, the inability to focus on the social and "soft" aspects of the system. SSM methods are suitable for investigating complex and complex problems and help to find the most appropriate actions to be taken through an iterative analytical approach to scenarios that contain many actors and systems with little or no direct clear link between them.

The many methods and approaches available in the software engineering toolbox can be applied in a variety of contexts and disciplines. In Oil, Gas and Exploration and Production, research has explored SE and systems thinking to capture business requirements, vendor-led build-to-order solution development, early-stage system design and validation, DT systems maintenance documentation, system design at the conceptual stage, as well as several other applications in the oil and gas sector, demonstrating the benefits and potential of implementing SE in the industry. Many other studies are available when the search expands to maritime and maritime areas, especially in relation to the supply chain and maritime transport, such as maritime transport management and management of maritime transport systems or systems, organization of acquisition criteria and solutions in technologies related to the reduction of marine emissions, policy frameworks for port infrastructure systems, maritime transport system resiliency, engineer-to-order supply chain in shipbuilding, and many other examples Adoption of SE (Gassmann et al., 2013).

Thus, the framework provided by GST, SE and soft SE, as well as systems thinking methods, is ideal for systematically examining the supply chain in order to simultaneously understand its parts and how it works as a whole. This has the potential to support the success of the DT held at the company's event. This systems approach helps in the study and understanding of the processes and functions that exist in complex organizations, providing a methodological framework that allows you to analyze and break down the organization as a collection of numerous subsystems and systematically reconstruct it, taking into account the relationships that exist in organizations. organizations. This study uses this approach because it is ideal for demonstrating that deviating from traditional mindsets and business models can provide opportunities for organizational transformation through innovation, technology, and digital solutions to those aspects of the supply chain that need improvement. , unlike traditional models, methods and ways of thinking may not be perceived. Finally, the combination of these approaches is ideal for providing an action plan that can lead to successful DT by considering the network as a context for organizational transformation (Bouncken et al., 2019).

3 Results and Discussions

The information that led to the article's findings was classified using three codes, each indicating the area to which the findings relate. These codes are: (I) organization and culture, (II) operations management, and (III) technology related.

The AS-IS study showed that current supply chain operations are inefficient and fragmented within and across the organization. Operations management is based on monolithic software with little or no interoperability in the IT support platform, which may be due to current redesigned processes and monolithic software in the operational setup. Consequently, the communication between those who manage supply chains and logistics operations and the activities to be carried out abroad is poor, leading to the exchange of important information about the supply chain based on manual information gathering, email and phone calls.

Finally, upstream and maintenance business units are not linked to supply chain operations, making them increasingly difficult to manage. As a result, reliance on manual supply chain operations incurs overhead costs that are a costly burden on an organization's profitability. This inefficient condition creates problems and constraints that reduce the efficiency of the supply chain and must be addressed in order to improve the efficiency and effectiveness of the operator. The results show that the operator understands the scope of the limitations of their supply chain operations and is willing to change them and realize their vision. Technology is at the center of this vision and the operator has implemented many initiatives. However, most of these initiatives were focused on drilling productivity and efficiency, and decision making was based not on a system approach, but on single interventions in certain areas of the organization. In addition, some of the stakeholders involved in this change may not have the appropriate level of knowledge or the right skills to define the tasks required to achieve the desired results. Thus, initiatives are hampered by the difficulty of conducting a full organizational DT and possibly by a lack of knowledge and skills among the organization's stakeholders.

4 Conclusions

The main objective of this study was to examine the DT of supporting offshore exploration and production supply chain operations with a focus on well construction related drilling activities. The second goal was to contribute to the success of this DT by presenting potential alternatives based on the information gathered through the interviews and workshops and the strategic roadmap as a guide to their implementation. To achieve this goal, a thorough study of the operator's operational structure, its goals and potential alternatives to achieve these goals was carried out, guided by three research questions. The remainder of this subsection provides a general discussion of this study in light of its research questions and research objectives.

The methods and approaches of SE and soft SE provided the basis on which this study was designed and carried out. Identifying the needs identified by stakeholders during the workshops and integrating the data collected from these and multiple sources relied on systematic methods such as system charts and other tools to understand the major issues in this organization and build consensus among different viewpoints.

The results of this study show that an operator's current operations in the supply chain are dispersed within and across the organization. The daily operations of the supply chain are inefficient and the communication between those who manage the supply chain and logistics is unsatisfactory, as the exchange of important information about the supply chain depends on manual work to overcome the lack of interoperability in the IT support platform. This may be due to the current overly complex processes and monolithic software in the operational setup. All interactions that occur in AS IS operations are based on manual intervention, and the same applies to software - in the context of the supply chain, all information is entered into any software manually, as is the exchange of information with other software. Any ongoing data that is generated in any software (such as transactional data) is also dependent on manual interaction to be available for the next step in the supply chain, and is only provided upon request or through established agreements and processes. Thus, the quality of the available data is compromised due to several manual dependencies and interventions that occur during the execution of supply chain processes. At the same time, data is not always pulled from the source where it was created, requiring a complex process of reconciling the information across the many applications that use it. Finally, there is a constant risk of serious data breaches, whether intentional or erroneous, just as there are serious operational vulnerabilities due to people 's reliance on keeping data up to date and correct.

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