Gulf Journal of Advance Business Research
ISSN 3078-5294 (Online), ISSN 3078-5286 (Print)
FE Gulf Publishers
https://fegulf.com

Transforming vessel and fleet operations in oil and gas: A framework for integrated operations planning and efficiency optimization

David Chinalu Anaba[1], Mercy Odochi Agho[2], Ekene Cynthia Onukwulu[3], & Peter Ifechukwude Egbumokei[4]

[1]Independent Researcher, Port Harcourt, Nigeria
[2]Independent Researcher, Port Harcourt, Nigeria
[3]Independent Researcher, Nigeria
[4]Shell Nigeria Gas (SEN/ SNG), Nigeria

Corresponding Author: David Chinalu Anaba
Corresponding Author Email: davidc.anaba@gmail.com

Article Info

Volume No: 3	**Issue No:** 1	**Page No:** 262-281
Received: 10-10-24	**Accepted:** 21-12-24	**Published:** 21-01-25

DOI: 10.51594/gjabr.v3i1.78
DOI URL: https://doi.org/10.51594/gjabr.v3i1.78

Abstract
Efficient vessel and fleet management is critical for optimizing operations in the oil and gas sector, where the complexity of logistics, scheduling, and sustainability requirements presents significant challenges. This paper introduces a comprehensive framework for integrated operations planning and efficiency optimization, addressing key operational inefficiencies and sustainability concerns in vessel and fleet management. The proposed framework leverages advanced tools such as Primavera™ for project scheduling, NAVIGARE™ for fleet tracking and management, and predictive analytics to enable proactive decision-making. By integrating these technologies, the framework enhances operational efficiency by minimizing delays, optimizing fuel consumption, and aligning schedules with project milestones. Predictive analytics, powered by machine learning, forecasts potential disruptions and recommends optimal routes and schedules, thereby reducing downtime and associated costs. NAVIGARE™ offers real-time tracking and monitoring of vessel performance, ensuring compliance with safety and environmental standards. Primavera™ streamlines project and logistics planning, allowing seamless coordination of fleet schedules with onshore and offshore operations. A central feature of this framework is its focus on sustainability. By prioritizing fuel efficiency and reducing carbon emissions through data-driven planning, the framework aligns with industry goals for sustainable operations. Case studies demonstrate

how companies adopting this approach achieve significant cost savings and environmental benefits, underscoring its value in achieving operational excellence. The framework also emphasizes collaboration between stakeholders, ensuring that vessel and fleet management is adaptive to dynamic project requirements and external factors such as weather and regulatory constraints. This problem-solving model establishes a foundation for scalable solutions that can be tailored to diverse operational contexts in the oil and gas industry.

Keywords: Vessel and Fleet Management, Oil and Gas Operations, Primavera, Navigare Predictive Analytics, Sustainability, Integrated Operations Planning, Fuel Efficiency, Carbon Emissions Reduction, Real-Time Monitoring.

INTRODUCTION

Efficient vessel and fleet operations are critical to the success of logistics in the oil and gas industry, where the movement of resources, equipment, and personnel often determines project timelines and overall operational costs. Vessels serve as the backbone of offshore and intercontinental activities, connecting production sites, storage facilities, and distribution networks. However, managing these operations comes with significant challenges, including the complexity of scheduling, high fuel consumption, and the need to meet sustainability goals in a highly competitive and environmentally sensitive sector (Aakhus & Bzdak, 2015, Hermeto, et al., 2014, Tsvetkova & Gammelgaard, 2024). Inefficiencies in these areas not only escalate costs but also hinder adherence to environmental standards and project timelines.

To address these challenges, this paper proposes a comprehensive problem-solving framework that integrates advanced tools and methodologies to optimize vessel and fleet management. By leveraging Primavera™ for robust scheduling, NAVIGARE™ for real-time fleet tracking, and predictive analytics for data-driven decision-making, the framework aims to enhance operational efficiency while addressing critical concerns like fuel efficiency and carbon emission reductions (Ajith, 2023, Hsu, 2015, Petukhov, 2020, Wanasinghe, et al., 2020). This integrated approach ensures that vessel operations align seamlessly with broader project objectives and sustainability targets, offering a pragmatic solution to longstanding operational inefficiencies.

The framework's scope extends beyond efficiency optimization to address the evolving needs of the oil and gas sector. It aligns with industry efforts to achieve greater environmental sustainability and operational resilience. By providing actionable insights and demonstrating measurable improvements, the proposed framework holds significant potential for adoption across diverse operational contexts in the oil and gas industry. Its relevance is further underscored by its adaptability to emerging regulatory and market demands, making it a valuable tool for stakeholders seeking to stay competitive while meeting global sustainability goals (Alamanos, Rolston & Papaioannou, 2021, Werbińska-Wojciechowska, Giel & Winiarska, 2024).

Through this framework, the study aims to bridge the gap between traditional operational practices and modern technological solutions, paving the way for transformative improvements in vessel and fleet operations in the oil and gas sector.

LITERATURE REVIEW

Efficient vessel and fleet management plays a vital role in the oil and gas industry, as the seamless transportation of materials, equipment, and personnel underpins the success of offshore and onshore operations. Traditional practices in vessel and fleet operations relied heavily on manual scheduling, static planning techniques, and limited tracking capabilities. These methods were often characterized by fragmented communication between departments, insufficient data integration, and reactive management approaches that focused on mitigating issues after they arose (Alex, 2023, Iris & Lam, 2019, Redutskiy & Balycheva, 2024). Such

methods, while effective in simpler logistical environments, are inadequate for addressing the complex, high-stakes demands of modern oil and gas operations.
One of the primary limitations of traditional practices lies in their inability to handle dynamic and real-time changes in operational requirements. Unforeseen factors, such as adverse weather conditions, supply chain disruptions, or vessel breakdowns, can severely disrupt schedules and increase operational costs. Furthermore, traditional fleet management systems often fail to account for fuel consumption optimization, leading to inefficiencies that are both economically and environmentally costly (Al-Haidous & Al-Ansari, 2019, Rogage, et al., 2024). These systems also struggle to comply with increasing regulatory pressures for sustainable operations, as they lack the tools to monitor and manage carbon emissions effectively. This gap has driven the need for more advanced and integrated solutions to optimize vessel and fleet operations, ensuring alignment with industry objectives for cost-efficiency, reliability, and sustainability. Czachorowski, Haskins & Mansouri, 2023, presented Overview of oil and gas industry's value chain as shown in figure 1.

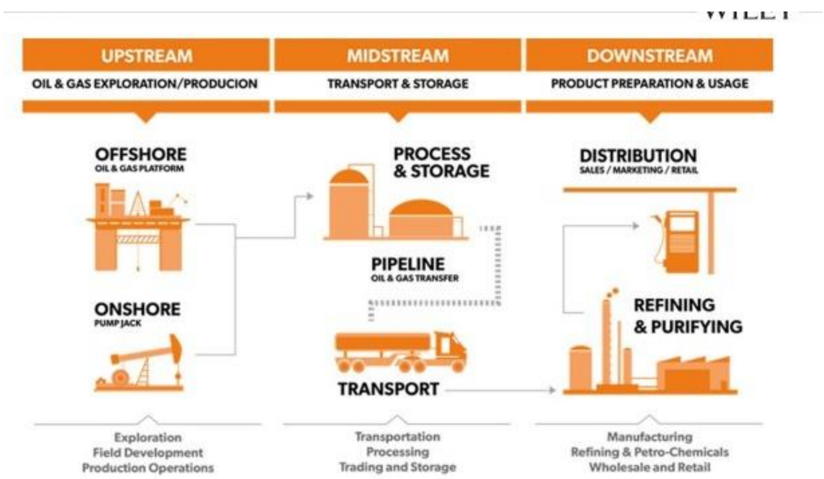

Figure 1: Overview of Oil and Gas Industry's Value Chain
(Czachorowski, Haskins & Mansouri, 2023).

The integration of advanced tools and technologies has emerged as a transformative approach to addressing these limitations. Primavera™ has become a pivotal tool for scheduling and project management, offering robust capabilities to plan, monitor, and execute complex projects involving fleet operations. By incorporating features like resource allocation, task dependencies, and progress tracking, Primavera™ enables project managers to synchronize fleet schedules with overarching operational timelines (Ahlawat, et al., 2023, Raj, et al., 2015). Its ability to integrate with other enterprise systems enhances data sharing and communication, reducing delays caused by misaligned schedules or resource shortages. Studies have demonstrated that organizations employing Primavera™ experience significant improvements in operational efficiency and project predictability.
NAVIGARE™, a specialized fleet tracking and performance monitoring platform, adds another layer of optimization to vessel and fleet management. Unlike traditional tracking systems, NAVIGARE™ provides real-time insights into vessel locations, performance metrics, and fuel consumption. These capabilities enable operators to respond proactively to changes in operational conditions, minimizing downtime and optimizing resource use. NAVIGARE™ also supports compliance with environmental regulations by monitoring emissions and recommending fuel-efficient practices (Alinam, 2022, Isibor, 2021, Rögnvaldsson, et al., 2018). Its user-friendly interface and integration capabilities make it a valuable tool for enhancing situational awareness and decision-making across fleet operations.

Predictive analytics has further revolutionized vessel and fleet management by enabling data-driven decision-making. Using machine learning algorithms, predictive analytics can analyze historical and real-time data to forecast potential disruptions, identify optimal routes, and recommend proactive maintenance schedules. This approach minimizes risks and ensures that operations remain aligned with project objectives. For instance, predictive analytics can identify patterns of vessel wear and tear, allowing operators to schedule maintenance before failures occur (Al-Atroshi & Zeebaree, 2024, Stodder, 2015). Similarly, by analyzing weather forecasts and traffic conditions, predictive analytics can recommend the most efficient and safe routes for vessels, reducing fuel consumption and travel time.

The integration of these tools into a unified framework has proven to be particularly effective in overcoming the challenges of traditional fleet management. Studies in logistics and transportation have highlighted how such frameworks can bridge the gap between operational efficiency and sustainability. Primavera™ and NAVIGARE™ work in tandem to align scheduling and tracking, while predictive analytics provides the foresight needed to anticipate and mitigate potential disruptions (Bani-Hani, Tona & Carlsson, 2020). This synergy ensures that vessel and fleet operations are not only efficient but also adaptive to the dynamic nature of oil and gas projects. Armstrong & Banks, 2015, presented Integration of systems as shown in figure 2.

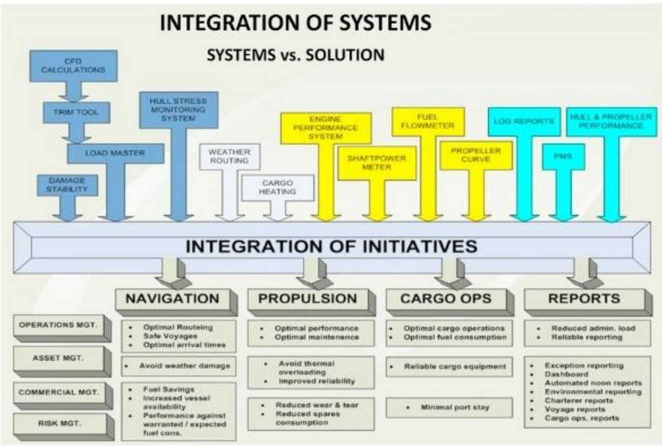

Figure 2: Integration of Systems (Armstrong & Banks, 2015).

Moreover, the literature underscores the importance of sustainability in modern fleet management. The oil and gas industry faces growing scrutiny over its environmental impact, with stakeholders demanding tangible actions to reduce carbon emissions and promote energy efficiency. Advanced tools like NAVIGARE™ and predictive analytics have become indispensable in meeting these demands, offering capabilities to monitor emissions, optimize fuel use, and plan sustainable operations (Alpen, 2024, Joshva, et al., 2024, Sardar, 2024). For instance, NAVIGARE™ can calculate fuel efficiency metrics for each vessel, while predictive analytics can recommend operational adjustments to further reduce emissions. Together, these tools enable companies to demonstrate compliance with environmental regulations and align with broader sustainability goals.

Despite their advantages, the adoption of advanced tools and technologies in vessel and fleet management is not without challenges. One significant barrier is the integration of these tools into existing systems and workflows. Many organizations in the oil and gas sector operate legacy systems that may not be compatible with modern platforms like Primavera™ and NAVIGARE™. This incompatibility can lead to data silos and inefficiencies, limiting the potential benefits of advanced tools (Awad & Salam, 2023, Kaiser, 2010, Sales Neverdal, 2019). Additionally, the implementation of predictive analytics requires access to high-quality data, which may be fragmented or incomplete in traditional systems. Addressing these challenges requires a concerted effort to modernize infrastructure and train personnel in the use of advanced technologies.

In conclusion, the literature on vessel and fleet operations in the oil and gas industry highlights a clear evolution from traditional practices to integrated, technology-driven approaches. While traditional methods struggled to meet the demands of modern logistics and sustainability, tools like Primavera™, NAVIGARE™, and predictive analytics have emerged as powerful solutions to optimize operations. These tools not only enhance scheduling, tracking, and decision-making but also align operations with environmental and regulatory standards. However, their successful implementation requires addressing challenges related to system integration, data quality, and personnel training (Chen & Zhang, 2014, Nookala, 2022). By overcoming these barriers, the oil and gas industry can fully realize the benefits of advanced vessel and fleet management, achieving operational excellence and sustainability in a highly competitive landscape.

Conceptual Framework

The conceptual framework for transforming vessel and fleet operations in the oil and gas industry emphasizes an integrated approach that combines operational planning, efficiency optimization, and sustainability focus. This framework addresses the industry's evolving needs, balancing the critical aspects of operational efficiency, cost management, and environmental responsibility. By leveraging advanced tools and methodologies, it offers a structured pathway to overcome traditional inefficiencies and align with contemporary challenges.

Integrated operations planning serves as the cornerstone of this framework, focusing on the seamless coordination of scheduling, resource allocation, and project milestones. Vessel and fleet operations are inherently complex, involving multiple stakeholders, dynamic project requirements, and logistical constraints. Effective coordination ensures that resources are utilized optimally, minimizing downtime and delays (Aziza, Uzougbo & Ugwu, 2023, Roy & Dunbar, 2022). This involves creating a unified scheduling system that integrates real-time data and predictive analytics to anticipate potential disruptions and adjust plans proactively. By aligning vessel schedules with project timelines, the framework enhances operational predictability and reduces bottlenecks.

The allocation of vessels, personnel, and equipment must be dynamic, allowing for adjustments based on changing project needs. Advanced tools like Primavera™ play a significant role in this process, enabling operators to visualize dependencies, allocate resources effectively, and monitor progress in real-time. This capability not only ensures the timely delivery of resources but also reduces instances of over- or under-utilization, leading to cost savings and improved efficiency (Theodorou, 2017, Vemulapalli, 2023). Efficiency optimization builds on the foundation of integrated operations planning by addressing critical performance metrics, such as fuel efficiency and operational costs. In the oil and gas industry, fuel consumption constitutes a significant portion of operational expenses, and inefficiencies in this area can escalate costs substantially. The framework incorporates tools like NAVIGARE™ and predictive analytics to monitor and optimize fuel usage. Real-time tracking of vessel performance enables operators to identify areas of inefficiency, such as excessive idling or suboptimal routes (Bakare, et al., 2024, Kaiser, 2015, Silvius & Schipper, 2019). Predictive analytics further enhances this process by recommending actionable changes to improve fuel efficiency, such as adjusting speeds, optimizing routes, and scheduling maintenance before breakdowns occur. Seimetz Chagas, et al., 2023, presented comparison between Non Periodic Planning and Periodical Planning as shown in figure 3.

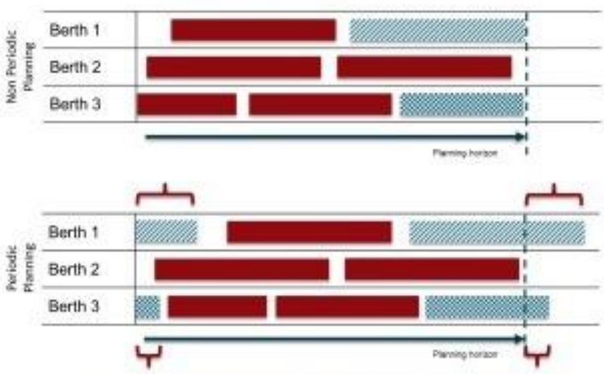

Figure 3: Non Periodic Planning vs. Periodical Planning (Seimetz Chagas, et al., 2023).

Reducing operational costs is another key objective of efficiency optimization. By integrating data from various sources, the framework provides a holistic view of operations, identifying cost-saving opportunities without compromising performance. For instance, predictive analytics can analyze historical maintenance data to forecast equipment failures, enabling proactive repairs that reduce costly downtime. Similarly, optimizing vessel scheduling through Primavera™ reduces the need for emergency charters or expedited shipments, which often incur higher costs. Together, these measures contribute to significant cost reductions while maintaining high levels of operational reliability.

A sustainability focus is integral to the framework, aligning vessel and fleet operations with environmental and regulatory standards. The oil and gas industry faces growing scrutiny over its environmental impact, particularly in terms of carbon emissions. The framework incorporates strategies to monitor, manage, and reduce emissions, ensuring compliance with global sustainability goals (Ballesteros-Pérez, 2017, Raut, Narkhede & Gardas, 2017). Tools like NAVIGARE™ are essential in this regard, providing detailed insights into fuel consumption and emissions for each vessel. Operators can use this data to implement fuel-efficient practices, such as optimizing engine performance or reducing unnecessary trips.

The integration of predictive analytics further enhances the framework's sustainability focus by enabling long-term planning for environmental compliance. For example, predictive models can assess the impact of various operational strategies on carbon emissions, allowing operators to make informed decisions that balance efficiency and sustainability. Additionally, the framework encourages the adoption of alternative fuels and energy-efficient technologies, which are increasingly available as the industry moves toward greener practices.

Carbon emission reduction is a central element of the sustainability focus, and the framework provides actionable strategies to achieve this goal. By leveraging real-time data and predictive insights, operators can identify and implement measures that reduce emissions without compromising operational performance. For instance, predictive analytics can recommend speed adjustments based on weather and traffic conditions, which not only reduce fuel consumption but also minimize emissions (Bayable, 2020, Kaiser, 2019, Saif, et al., 2024). Similarly, the integration of advanced fleet tracking systems ensures that vessels operate within optimal parameters, reducing their environmental footprint. Figure 4 shows supply chain operations in the context of offshore drilling activities as presented by Czachorowski, Haskins & Mansouri, 2023.

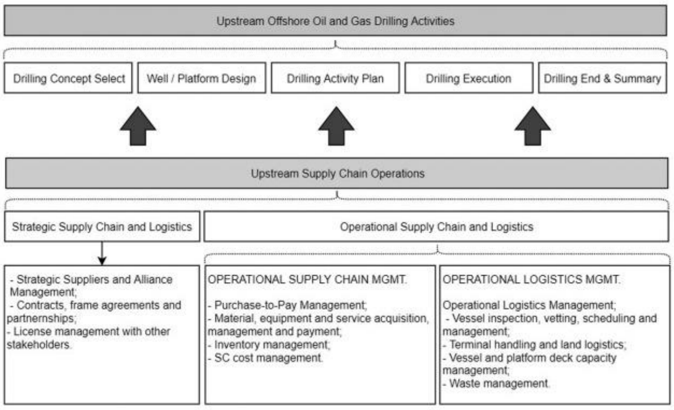

Figure 4: Supply Chain Operations in the Context of Offshore Drilling Activities (Czachorowski, Haskins & Mansouri, 2023).

Environmental compliance is another critical aspect of the sustainability focus. Regulatory requirements for emissions and environmental protection are becoming increasingly stringent, and non-compliance can result in significant financial and reputational penalties. The framework incorporates tools and processes to ensure that vessel and fleet operations meet these requirements consistently. For example, NAVIGARE™ can generate detailed reports on emissions and fuel usage, providing the documentation needed to demonstrate compliance during audits (Hani, 2020, Michalczyk, et al., 2020). Additionally, the framework supports continuous monitoring and improvement, allowing operators to adapt to evolving regulations and industry standards.

The integration of these components—operations planning, efficiency optimization, and sustainability—forms a cohesive framework for transforming vessel and fleet management in the oil and gas industry. By addressing the interdependencies between these elements, the framework ensures that improvements in one area do not come at the expense of another. For instance, optimizing fuel efficiency also contributes to cost savings and emission reductions, creating a win-win scenario for operators and stakeholders (Bayesteh, 2024, Kovacevich, Hinrichs & Hasan, 2001). Similarly, integrating sustainability strategies into operations planning ensures that environmental goals are achieved without compromising project timelines or resource utilization.

In conclusion, this conceptual framework offers a comprehensive approach to addressing the challenges of vessel and fleet operations in the oil and gas sector. By emphasizing integrated operations planning, it ensures seamless coordination and resource allocation. Through efficiency optimization, it enhances fuel efficiency and reduces operational costs, providing tangible benefits for operators. Finally, its sustainability focus aligns operations with environmental goals, ensuring compliance with regulations and contributing to the industry's broader efforts toward sustainable development. By adopting this framework, the oil and gas industry can achieve transformative improvements in vessel and fleet management, paving the way for a more efficient, cost-effective, and environmentally responsible future.

METHODOLOGY

The methodology for transforming vessel and fleet operations in oil and gas involves a multi-step approach, incorporating the careful selection and integration of advanced tools, comprehensive data collection and analysis, framework development, and validation through case studies. The goal is to create a robust framework that enhances operational efficiency, reduces costs, and optimizes sustainability outcomes. This process ensures that the integration of scheduling, resource allocation, fleet performance tracking, and predictive analytics can be achieved effectively to meet the dynamic demands of the oil and gas industry.

The first stage in the methodology involves selecting the appropriate tools for transforming vessel and fleet operations. The tools—Primavera™, NAVIGARE™, and predictive analytics platforms—are chosen based on several criteria, including their ability to integrate seamlessly into existing operational workflows, their scalability to handle large datasets, and their capacity to address specific challenges in scheduling, fuel efficiency, and sustainability. Primavera™ is selected for its advanced scheduling and project management capabilities, making it an ideal tool for coordinating complex timelines and resources (Belachew, 2022 Kujala, et al., 2022, Shitu, 2021). NAVIGARE™ is chosen for its superior fleet tracking and performance monitoring features, which allow operators to obtain real-time data on vessel locations, fuel consumption, and operational status. Predictive analytics platforms are incorporated for their ability to process large volumes of data and generate actionable insights to inform decision-making, optimizing fleet efficiency and resource allocation. These tools are integrated into a unified system to ensure streamlined operations, real-time data accessibility, and data-driven decision-making.

Once the tools are selected and integrated, the next step is data collection and analysis. This phase involves gathering data from multiple sources, including vessel performance records, fuel consumption logs, and scheduling patterns. Data collection encompasses various aspects of fleet operations, such as travel routes, weather conditions, engine performance, and operational downtime. By collecting this data over an extended period, it is possible to identify trends, inefficiencies, and areas for improvement. Machine learning models play a key role in predictive analytics, enabling the system to analyze historical data and predict future performance (Caputo, Evangelista & Russo, 2018, Shou, et al., 2021). These models can forecast fuel consumption, assess the impact of different scheduling scenarios, and predict potential maintenance needs. Machine learning algorithms are used to identify patterns in the data that may not be immediately apparent, providing deeper insights into operational inefficiencies and helping operators to make informed decisions that optimize vessel and fleet performance.

The next phase of the methodology involves the development of the framework itself. This step focuses on designing a workflow that integrates the capabilities of Primavera™, NAVIGARE™, and predictive analytics into a cohesive system. The workflow is structured to ensure that scheduling, resource allocation, fleet tracking, and predictive insights work in synergy. A key component of the framework is the integration of real-time data into the scheduling process. Primavera™ serves as the central platform for scheduling, where operational milestones, timelines, and resource requirements are mapped out. NAVIGARE™ feeds data into the system in real time, allowing operators to adjust schedules based on current fleet performance and conditions (Cascetta, Henke & Di Bartolomeo, 2021, Thom, 2024). Predictive analytics models are continuously updated with real-time data, providing operators with forecasts and recommendations on fuel efficiency, vessel performance, and potential delays. The workflow ensures that the system is dynamic, enabling real-time adjustments to optimize efficiency without compromising safety or operational timelines.

The final step of the methodology involves validating the framework through case studies and measuring key performance indicators (KPIs). To validate the framework, it is implemented in sample oil and gas operations, allowing for real-world testing of its effectiveness. These case studies are designed to test the framework’s ability to optimize scheduling, improve fuel efficiency, and reduce operational costs in various scenarios. The case studies involve deploying the framework in different operational settings, such as offshore platforms or pipeline construction projects, where the logistics of vessel and fleet management are crucial. By applying the framework in diverse contexts, it is possible to assess its adaptability and effectiveness across a range of operational challenges (Cheng, et al., 2023, Lehtinen & Aaltonen, 2020).

Key performance indicators are established to measure the success of the framework in achieving its goals. These KPIs include metrics such as fuel consumption reduction, cost savings, schedule adherence, and carbon emissions reduction. Additionally, operational efficiency metrics such as vessel idle time, maintenance costs, and downtime are tracked to evaluate the overall impact of the framework on fleet performance. Data collected from the case studies is analyzed to determine whether the framework delivers the expected outcomes in terms of improved efficiency, sustainability, and cost-effectiveness.

The implementation of the framework is also measured against baseline performance data collected before its introduction. By comparing pre- and post-implementation performance, it is possible to assess the degree of improvement in various operational metrics. This comparison helps determine the effectiveness of the integrated system and provides valuable insights into potential areas for further optimization. If the results from the case studies demonstrate significant improvements in fleet management, scheduling efficiency, fuel usage, and sustainability, the framework can be scaled for broader application across the industry.

Moreover, the validation process allows for continuous refinement of the framework. Any identified shortcomings or challenges that arise during the case studies can be addressed through iterative updates to the workflow, tool integration, or data analysis processes. This iterative approach ensures that the framework remains adaptable to evolving industry needs and technological advancements (Cristofari, 2023, Leyba, et al., 2024).

In conclusion, the methodology for transforming vessel and fleet operations in the oil and gas industry focuses on a systematic approach that incorporates the selection of advanced tools, data collection, framework development, and case study validation. By selecting tools like Primavera™, NAVIGARE™, and predictive analytics platforms, and integrating them into a unified operational system, the framework aims to enhance scheduling efficiency, fuel optimization, and overall fleet performance. Data collection and analysis through machine learning further support decision-making by providing actionable insights based on historical and real-time data (Alhouli, 2011, Onyshchenko, et al., 2024). Through case studies and the measurement of KPIs, the framework is validated and refined to ensure its effectiveness in real-world oil and gas operations. Ultimately, this methodology offers a comprehensive solution for optimizing vessel and fleet operations, improving efficiency, reducing costs, and promoting sustainability in the oil and gas sector.

RESULTS AND DISCUSSION

The results and discussion of the framework for transforming vessel and fleet operations in oil and gas reveal significant benefits in operational efficiency, sustainability metrics, and the optimization of scheduling, fuel consumption, and overall fleet management. The integration of advanced tools like Primavera™, NAVIGARE™, and predictive analytics provides a comprehensive solution to address the complexities inherent in modern fleet operations. While the framework shows substantial improvements, challenges such as data integration and the adoption of new technologies also arise, which require careful consideration (Aamodt, 2013, Jing, 2014).

One of the primary benefits of the framework is enhanced operational efficiency. By integrating scheduling, fleet performance tracking, and predictive analytics into a cohesive system, the framework streamlines vessel operations, reducing idle time and optimizing resource allocation. With real-time data from NAVIGARE™, fleet managers gain better visibility into vessel performance, including fuel consumption, engine health, and operational status (Czachorowski, 2021, Lievens & Blažević, 2021). This increased visibility allows for more accurate scheduling, minimizing downtime and delays due to unforeseen circumstances. The real-time monitoring capabilities enable fleet managers to adjust schedules dynamically based on weather conditions, vessel performance, or external delays, ensuring that operations run smoothly and on time.

The use of Primavera™ as a scheduling and project management tool enhances coordination across various operational phases, facilitating better resource allocation and meeting project milestones efficiently. The ability to optimize scheduling through real-time data feeds from NAVIGARE™ allows fleet managers to adjust schedules on the fly, ensuring that vessels are deployed effectively and that operations stay on track. This has a significant impact on reducing operational delays and improving project timelines, which ultimately leads to cost savings and better use of resources.

Another notable benefit of the framework is its contribution to improving sustainability metrics, particularly in reducing fuel consumption and carbon emissions. Predictive analytics plays a critical role in optimizing fuel efficiency by providing forecasts of fuel usage under various operating conditions (Czachorowski, 2022, Ligade, Bhogade & Birajdar, 2019). By analyzing historical and real-time data, machine learning models can predict the most fuel-efficient routes, speed settings, and maintenance schedules, allowing operators to make data-driven decisions that minimize fuel consumption. This not only reduces operational costs but also helps meet sustainability goals by lowering the environmental impact of fleet operations.

Through predictive analytics, the framework also allows for the identification of potential inefficiencies in the fleet, enabling preemptive maintenance and adjustments before performance degradation occurs. This predictive maintenance approach reduces the risk of vessel breakdowns, ensuring that operations remain uninterrupted and fuel consumption is kept at optimal levels (Czachorowski, 2022, Kaiser, 2010). Furthermore, by optimizing vessel performance and reducing the frequency of repairs and replacements, the framework extends the lifespan of assets, contributing to the long-term sustainability of fleet operations.

However, despite the many benefits, the implementation of the framework also presents challenges and limitations. One of the most significant challenges encountered during the deployment of the integrated system is the complexity of data integration. The oil and gas industry often operates with a range of legacy systems and diverse data sources, making it difficult to integrate real-time data into a unified platform (Eley, Moran & Kaub, 2023, Loureiro, Romero & Bilro, 2020). The synchronization of data from various systems, including scheduling software, fleet tracking tools, and predictive analytics platforms, is a complex task that requires careful planning and robust infrastructure.

The integration of tools like Primavera™, NAVIGARE™, and predictive analytics into existing operational frameworks can be particularly challenging due to differences in data formats, software compatibility, and varying levels of data quality. For instance, the data generated by NAVIGARE™ may not always align seamlessly with the scheduling data from Primavera™, requiring additional processing or manual intervention. This complexity necessitates a well-designed data integration strategy that includes standardized data formats, API connections, and reliable data cleaning processes (Farahpoor, Esparza & Soriano, 2023, Lu,et al., 2019). Without an effective integration system, the potential for errors and discrepancies increases, which could undermine the reliability and accuracy of the framework.

Additionally, training requirements for tool adoption represent another significant challenge. While the advanced tools integrated into the framework provide immense benefits, they require skilled personnel who can effectively use these tools and interpret the data. The oil and gas industry is traditionally conservative in adopting new technologies, and many fleet managers and operators may not be familiar with the specific features and functionalities of tools like Primavera™ or NAVIGARE™. This knowledge gap necessitates extensive training programs to ensure that operators are proficient in using the tools and fully understand their capabilities.

Training is particularly important for the effective utilization of predictive analytics. While machine learning models can provide actionable insights, they require users to interpret the data correctly and make informed decisions. Without proper training, operators may struggle to understand the implications of predictive analytics and may not take full advantage of the system's capabilities (Fernandes, 2016, MacDonald, Clarke & Huang, 2022). Furthermore, some employees may resist the adoption of new technologies due to familiarity with traditional methods or concerns about the reliability of the new tools. Overcoming this resistance requires strong change management strategies, including comprehensive training, clear communication about the benefits of the new system, and hands-on support during the implementation phase.

Another limitation involves the ongoing maintenance of the system. As with any technology-driven solution, the framework requires continuous updates and adjustments to ensure its optimal performance. New data sources, changing regulations, and evolving industry standards may necessitate modifications to the system's underlying algorithms, data integration protocols, or user interfaces. The need for ongoing maintenance and system upgrades can strain resources and may pose challenges in terms of ensuring that the system remains adaptable and up to date (Onyshchenko, et al., 2024).

Despite these challenges, the framework has shown promise in addressing key issues in vessel and fleet management, particularly in the oil and gas industry. The integration of advanced tools like Primavera™, NAVIGARE™, and predictive analytics creates a comprehensive solution that enhances scheduling, improves fuel efficiency, and promotes sustainability. As the industry continues to face pressures to reduce operational costs and meet stricter environmental regulations, the adoption of such integrated systems will become increasingly important (Gado, 2024, Mansouri, Lee & Aluko, 2015, Wagstaff, 2023). By reducing fuel consumption, improving scheduling, and optimizing fleet performance, the framework helps companies achieve their efficiency and sustainability goals.

In conclusion, the results of implementing the framework for transforming vessel and fleet operations in oil and gas demonstrate its potential to significantly improve operational efficiency, reduce costs, and enhance sustainability metrics. While challenges such as data integration and training requirements exist, these can be addressed through strategic planning, ongoing support, and clear communication (Seimetz Chagas, et al., 2023, Siddiqui, Verma & Verter, 2018). The framework's success depends on its ability to integrate various tools into a cohesive system, enabling real-time data-driven decision-making that optimizes fleet operations and minimizes environmental impact. With continued development and refinement, the framework has the potential to become a standard for fleet management in the oil and gas industry, driving long-term operational success and contributing to global sustainability efforts.

Recommendations

The recommendations for transforming vessel and fleet operations in oil and gas through an integrated operations planning and efficiency optimization framework highlight key strategies that can ensure the success of the system. By focusing on adoption strategies and scaling the framework to suit different operational contexts, the framework can be more effectively integrated, used, and scaled across a wide variety of operations in the industry (Czachorowski, Haskins & Mansouri, 2023, Narang, et al., 2024).

A crucial element in the successful adoption of this framework is stakeholder collaboration. The oil and gas industry involves numerous stakeholders, including fleet operators, logistics providers, project managers, and maintenance teams, all of whom must be aligned for the framework to function effectively. One of the primary recommendations is to ensure strong collaboration among stakeholders from the early stages of the project. Stakeholder engagement should be an ongoing process, involving them in decision-making, problem-solving, and sharing insights (Gao & You, 2017, Mitchell, et al., 2022). This collaborative approach ensures that all parties understand the goals, benefits, and processes of the framework, thus fostering buy-in and commitment to the system.

Moreover, collaboration should extend to cross-functional teams within the organization. For example, a coordinated effort between the IT, fleet management, and sustainability departments can ensure that the technical infrastructure is in place to support the system, while also making sure that the operational team understands how to leverage the system to meet sustainability goals (Helbig, et al., 2015, Parmiggiani, 2015, Suboyin, et al., 2024). A multi-disciplinary team approach can facilitate the design and implementation of the framework in a way that addresses the needs of all departments involved, which is critical to overcoming siloed thinking that often hampers technological transformation.

Effective change management is another key strategy for ensuring the successful adoption of the framework. Change management involves preparing employees and stakeholders for the transformation, addressing potential resistance, and fostering a culture that embraces innovation. One of the most effective ways to ensure smooth adoption is to conduct extensive training sessions for employees at all levels (Glimfjord & Shariza, 2024, Nampalli, 2022). This training should cover the use of new tools such as Primavera™ and NAVIGARE™, as well as the importance of predictive analytics in optimizing fleet operations. As employees become proficient with the tools, they will be more confident in using them and will be more likely to contribute valuable feedback for improving the system.

To further ease the transition, organizations should implement a phased rollout of the framework, starting with a pilot program in one region or fleet. This allows for testing the framework in real-world conditions, identifying any challenges that arise, and addressing them before a full-scale implementation. A phased approach also helps in gradually building organizational confidence and familiarity with the system, preventing overwhelm from immediate widespread implementation (Glotzbach, 2020, Nampalli, 2022, Reddy & Bhuvan, 2024). Additionally, during the pilot phase, feedback from users can be used to fine-tune the system, addressing potential issues related to tool integration, scheduling, or data accuracy. This iterative approach makes it possible to adapt the framework to the specific needs and challenges of the operation.

Another important aspect of the framework's adoption is the creation of a support structure for troubleshooting, maintenance, and continuous improvement. This support should include dedicated personnel who are well-versed in the framework's components and are available to assist users in resolving any issues. Additionally, regular check-ins and system evaluations can ensure that the framework evolves alongside changing industry needs and technological advancements. As the fleet grows and new data streams are integrated, the system must be continuously updated to remain effective (Harris, 2024, Panayides, Borch & Henk, 2018).

When scaling the framework to different operational contexts, customization is crucial. The oil and gas industry is diverse, with varying operational environments ranging from offshore drilling rigs to onshore refineries, each requiring unique fleet management practices. Tailoring the framework to the specific requirements of these contexts ensures that the tools and processes can address the distinct challenges that each environment presents. For instance, an offshore fleet might require more specialized tracking and maintenance protocols due to the harsh environmental conditions, while an onshore fleet may have more complex logistical coordination needs due to the density of operational sites (Melnyk, et al., 2024, Trevathan, 2020).

To tailor the framework to different operational contexts, it is important to understand the nuances of each environment. The system must be adaptable, capable of incorporating local operational requirements, regulatory constraints, and sustainability targets. For example, in offshore operations, fleet performance tracking systems like NAVIGARE™ might be more focused on weather conditions, fuel consumption under specific sea states, and compliance with maritime regulations (Glotzbach, 2020, Nascimento, et al., 2020). On the other hand, for onshore operations, the focus could shift to managing the transportation of equipment, optimizing fuel consumption for long-distance hauls, and ensuring safety compliance in areas with heavy traffic or diverse terrain.

One effective way to scale the framework across different contexts is to leverage modularity in its design. This modular approach enables the customization of specific tools, such as scheduling software, predictive maintenance systems, or fleet tracking solutions, based on the operational needs of each setting. By offering flexibility, the framework can be adapted to a wide range of contexts without compromising its effectiveness. Additionally, organizations can scale the system incrementally, deploying the framework in one region or division and expanding it as they learn from the process (Goldsby & Martichenko, 2005, Nurwinahyu, 2016). This step-by-step approach ensures that the organization can assess the framework's performance in different contexts and make necessary adjustments before full-scale adoption.

Another key consideration when scaling the framework is the integration with existing systems. Many oil and gas operations already have established systems for fleet management, scheduling, and maintenance. To avoid disruption, the new framework should be designed to work alongside these legacy systems, allowing for seamless data transfer and integration. One approach to achieving this is by utilizing open architectures or application programming interfaces (APIs) that facilitate interoperability with other platforms (Hareide, 2019, Ogbu, Ozowe & Ikevuje, 2024). Ensuring smooth integration minimizes the risk of system incompatibilities and allows the organization to continue using legacy systems that might still serve essential functions while gradually transitioning to the new framework.

Furthermore, scalability also requires careful consideration of the technical infrastructure needed to support the framework as it grows. As the volume of data generated by fleet operations increases, so does the need for robust data storage, processing, and analysis capabilities. Cloud-based platforms and advanced data analytics tools, including machine learning algorithms, can support the increased data load and provide real-time insights into fleet performance, fuel consumption, and scheduling (Gupta & Shah, 2022, Odimarha, Ayodeji & Abaku, 2024). Scaling the system involves ensuring that the underlying infrastructure can handle growing data volumes and user demands without compromising system performance or data integrity.

In conclusion, transforming vessel and fleet operations in oil and gas requires a carefully structured approach that includes robust stakeholder collaboration, comprehensive change management, and scalable customization to suit different operational contexts. By adopting these strategies, oil and gas companies can effectively implement the integrated operations planning and efficiency optimization framework. The result is a more efficient, sustainable, and cost-effective fleet management system that can help companies meet both operational goals and environmental targets (Armstrong & Banks, 2015, Odimarha, Ayodeji & Abaku, 2024). Through careful planning, adaptation, and continuous improvement, this framework can drive long-term success and contribute to the future of the oil and gas industry.

CONCLUSION

In conclusion, transforming vessel and fleet operations in the oil and gas industry through an integrated operations planning and efficiency optimization framework provides a comprehensive solution to the challenges faced by modern oil and gas logistics. The proposed framework, which integrates advanced tools such as Primavera™, NAVIGARE™, and predictive analytics, presents a holistic approach that addresses key concerns including scheduling inefficiencies, fuel consumption optimization, and sustainability goals. By utilizing data-driven insights and advanced technologies, this framework has the potential to revolutionize fleet management, making operations more efficient, cost-effective, and environmentally responsible.

The framework's key contributions lie in its ability to improve operational efficiency by streamlining scheduling, enhancing fuel efficiency, and optimizing resource allocation across the fleet. Predictive analytics enables real-time decision-making, allowing operators to anticipate maintenance needs, optimize fuel consumption, and reduce downtime, all of which contribute to cost savings and improved operational performance. Additionally, the emphasis on sustainability and reducing carbon emissions aligns with industry-wide efforts to meet environmental targets and regulatory requirements. By integrating sustainability metrics into the operational planning process, the framework offers a way to not only optimize fleet performance but also reduce the environmental impact of vessel operations in a critical industry.

The implications of this framework for the oil and gas industry are far-reaching. As the industry continues to face increasing pressure to adopt sustainable practices and improve operational efficiency, frameworks like the one proposed in this study can serve as a blueprint for other organizations looking to optimize their vessel and fleet operations. The integration of predictive analytics and advanced scheduling tools opens up new possibilities for enhancing decision-making and operational flexibility, ensuring that the oil and gas industry remains competitive in an increasingly complex and environmentally-conscious market.

Future directions for research and implementation of this framework lie in expanding its capabilities through further technological advancements and adapting it to the evolving needs of the industry. As more data becomes available through the Internet of Things (IoT) and other digital platforms, the predictive capabilities of the framework can be enhanced, providing even more granular insights into fleet performance and maintenance needs. Additionally, as sustainability goals become more stringent, there is an opportunity to refine the framework to support the transition to fully decarbonized fleets through the integration of renewable energy sources and cleaner technologies.

In sum, the framework provides a strong foundation for optimizing vessel and fleet operations in oil and gas. By fostering collaboration among stakeholders, embracing technological innovations, and focusing on sustainability, it offers a practical and scalable approach that can drive significant improvements in operational efficiency and environmental performance. The oil and gas industry stands to benefit greatly from the continued development and implementation of such frameworks, ensuring that the sector remains agile, efficient, and sustainable in the face of evolving challenges.

References

Aakhus, M., & Bzdak, M. (2015). Stakeholder engagement as communication design practice. *Journal of Public Affairs*, *15*(2), 188-200.

Aamodt, R. (2013). *A maritime perspective on integrated operations in the Norwegian petroleum industry* (Master's thesis, University of Stavanger, Norway).

Ahlawat, P., Borgman, J., Eden, S., Huels, S., Iandiorio, J., Kumar, A., & Zakahi, P. (2023). A new architecture to manage data costs and complexity. *Boston Consulting Group (BCG)*, 1-12.

Ajith, P. J. (2023). *Measuring energy efficiency of offshore support vessels in UAE for developing an operational framework and performance index* (Doctoral dissertation, College of Management and Economic Studies, UPES, Dehradun).

Alamanos, A., Rolston, A., & Papaioannou, G. (2021). Development of a decision support system for sustainable environmental management and stakeholder engagement. *Hydrology*, *8*(1), 40.

Al-Atroshi, C., & Zeebaree, S. R. (2024). Distributed Architectures for Big Data Analytics in Cloud Computing: A Review of Data-Intensive Computing Paradigm. *Indonesian Journal of Computer Science*, *13*(2).

Alex, B. (2023). *Transitioning to a New Horizon: Exploring the drivers, barriers, and success factors for Norwegian Offshore service vessel firms' transition from Oil and Gas to the Offshore Wind Industry* (Master's thesis, University of South-Eastern Norway).

Al-Haidous, S., & Al-Ansari, T. (2019). Sustainable liquefied natural gas supply chain management: a review of quantitative models. *Sustainability*, *12*(1), 243.

Alhouli, Y. (2011). *Development of ship maintenance performance measurement framework to assess the decision making process to optimise in ship maintenance planning*. The University of Manchester (United Kingdom).

Alinam, M. (2022). Interactive Experience Design: Integrated and Tangible Storytelling with Maritime Museum Artefacts.

Alpen, I. (2024). *Critical success factors of the Norwegian offshore support vessel industry* (Master's thesis, University of South-Eastern Norway).

Armstrong, V. N., & Banks, C. (2015). Integrated approach to vessel energy efficiency. *Ocean Engineering*, *110*, 39-48.

Awad, S., & Salam, M. A. (2023, October). Offshore Shipping Logistics Excellence–Digitalization and Control Room/Integrated Planning Center Concept. In *Abu Dhabi International Petroleum Exhibition and Conference* (p. D031S101R001). SPE.

Aziza, O. R., Uzougbo, N. S., & Ugwu, M. C. (2023). Legal frameworks and the development of host communities in oil and gas regions: Balancing economic benefits and social equity. *World Journal of Advanced Research and Reviews*, *19*(3), 1582-1594.

Bakare, O. A., Aziza, O. R., Uzougbo, N. S., & Oduro, P. (2024). A governance and risk management framework for project management in the oil and gas industry. *Open Access Research Journal of Science and Technology*, *12*(01), 121-130.

Ballesteros-Pérez, P. (2017). M-PERT: Manual project-duration estimation technique for teaching scheduling basics. *Journal of construction engineering and management*, *143*(9), 04017063.

Bani-Hani, I., Tona, O., & Carlsson, S. (2020). Patterns of resource integration in the self-service approach to business analytics.

Bayable, M. M. (2020). *The Influence of Fleet Management Practices on Construction Performance: The Case of Awwce* (Doctoral dissertation).

Bayesteh, A. (2024). Agile-Based Optimized Planning and Scheduling Methodology for Multiple Scattered Projects.

Belachew, S. (2022). *Analysis Of Fleet Management Practices And Its Effect On Operational Performance Of Hagbes Plc* (Doctoral dissertation, St. Mary's university).

Caputo, F., Evangelista, F., & Russo, G. (2018). The role of information sharing and communication strategies for improving stakeholder engagement. In *Business models for strategic innovation* (pp. 25-43). Routledge.

Cascetta, E., Henke, I., & Di Bartolomeo, M. I. (2021). La settima rivoluzione dei trasporti. Le innovazioni in corso ei possibili scenari futuri. *Ingegneria Ferroviaria*, *76*(6).

Chen, C. P., & Zhang, C. Y. (2014). Data-intensive applications, challenges, techniques and technologies: A survey on Big Data. *Information Sciences*, *275*, 314-347.

Cheng, Z., Wan, H., Niu, H., Qu, X., Ding, X., Peng, H., & Zheng, Y. (2023, October). China offshore intelligent oilfield production monitoring system: Design and technical path forward for implementation. In *Abu Dhabi International Petroleum Exhibition and Conference* (p. D021S048R005). SPE.

Cristofari, G. (2023). Platformization in the European Union. Politico-Legal Challenges of Platforms as Infrastructures.

Czachorowski, K. V. (2021). Cleaning up our act: systems engineering to promote business model innovation for the offshore exploration and production supply chain operations. *Sustainability*, *13*(4), 2113.

Czachorowski, K. V. (2022). Digital Transformation in the Offshore Oil and Gas Exploration and Production supply chain operations.

Czachorowski, K. V., Haskins, C., & Mansouri, M. (2023). Minding the gap between the front and back offices: A systemic analysis of the offshore oil and gas upstream supply chain for framing digital transformation. *Systems Engineering*, *26*(3), 241-256.

Eley, G., Moran, J., & Kaub, S. (2023, October). Walk to Work and the Automation of the Offshore Oil and Gas Market. In *Abu Dhabi International Petroleum Exhibition and Conference* (p. D031S112R007). SPE.

Farahpoor, M., Esparza, O., & Soriano, M. (2023). Comprehensive IoT-driven fleet management system for industrial vehicles. *IEEE access*.

Fernandes, L. M. A. (2016). *Wearable devices for blind orientation and navigation* (Master's thesis, Universidade de Tras-os-Montes e Alto Douro (Portugal)).

Gado, N. G. (2024). AI Revolutionizes Construction Management "Building Smarter, Safer, and Efficiently Addressing Industry Challenges". *Engineering Research Journal*, *183*(3), 330-344.

Gao, J., & You, F. (2017). Design and optimization of shale gas energy systems: Overview, research challenges, and future directions. *Computers & Chemical Engineering*, *106*, 699-718.

Glimfjord, J., & Shariza, K. M. (2024). A qualitative study on MNCs in the shipping industry, and their adaptation to environmental sustainability.

Glotzbach, T. (2020). *Navigation of autonomous marine robots: novel approaches using cooperating teams*. Springer Nature.

Glotzbach, T. (2020). Navigation of Autonomous Marine Robots.

Goldsby, T. J., & Martichenko, R. (2005). *Lean six sigma logistics: Strategic development to operational success*. J. Ross Publishing.

Gupta, D., & Shah, M. (2022). A comprehensive study on artificial intelligence in oil and gas sector. *Environmental Science & Pollution Research*, *29*(34).

Hani, I. B. (2020). Self-Service Business Analytics and the Path to Insights: Integrating Resources for Generating Insights.

Hareide, O. S. (2019). The use of eye tracking technology in maritime high-speed craft navigation. *Doktoravhandlinger ved NTNU*.

Harris, L. (2024). Telematics and Big Data: Revolutionizing Fleet Management in the Automotive Industry.

Helbig, N., Dawes, S., Dzhusupova, Z., Klievink, B., & Mkude, C. G. (2015). Stakeholder engagement in policy development: observations and lessons from international experience. In *Policy practice and digital science: Integrating complex systems, social simulation and public administration in policy research* (pp. 177-204). Cham: Springer International Publishing.

Hermeto, N. D. S. S., Ferreira Filho, V. J. M., & Bahiense, L. (2014). Logistics network planning for offshore air transport of oil rig crews. *Computers & Industrial Engineering*, *75*, 41-54.

Hsu, N. (2015). *Data quality of fleet management systems in open pit mining: issues and impacts on key performance indicators for haul truck fleets* (Doctoral dissertation, Queen's University).

Iris, Ç., & Lam, J. S. L. (2019). A review of energy efficiency in ports: Operational strategies, technologies and energy management systems. *Renewable and Sustainable Energy Reviews*, *112*, 170-182.

Isibor, C. I. (2021). *Optimal Floating Production Storage Offloading (FPSO) revamp project management: the execution phase model development*. University of Salford (United Kingdom).

Jing, L. (2014). *An integrated simulation-based process control and operation planning system for marine oily wastewater management* (Doctoral dissertation, Memorial University of Newfoundland).

Joshva, J., Diaz, S., Kumar, S., Suboyin, A., AlHammadi, N., Baobaid, O., ... & Saputelli, L. (2024, November). Navigating the Future of Maritime Operations: The AI Compass for Ship Management. In *Abu Dhabi International Petroleum Exhibition and Conference* (p. D021S070R005). SPE.

Kaiser, M. J. (2010). An integrated systems framework for service vessel forecasting in the Gulf of Mexico. *Energy*, *35*(7), 2777-2795.

Kaiser, M. J. (2015). *Offshore service industry and logistics modeling in the Gulf of Mexico*. Springer International Publishing.

Kaiser, M. J. (2019). The role of factor and activity-based models in offshore operating cost estimation. *Journal of Petroleum Science and Engineering*, *174*, 1062-1092.

Kovacevich, S. T., Hinrichs, L. J., & Hasan, U. (2001, April). Managing Change in a Changing Environment: Creating an Improved Logistics Organization for Offshore East Kalimantan. In *SPE Asia Pacific Oil and Gas Conference and Exhibition* (pp. SPE-68678). SPE.

Kujala, J., Sachs, S., Leinonen, H., Heikkinen, A., & Laude, D. (2022). Stakeholder engagement: Past, present, and future. *Business & Society*, *61*(5), 1136-1196.

Lehtinen, J., & Aaltonen, K. (2020). Organizing external stakeholder engagement in inter-organizational projects: Opening the black box. *International Journal of Project Management*, *38*(2), 85-98.

Leyba, A. C. G., Rana, M. Q., Salazar, A. M., Saini, M., Oladinrin, O., & Lee, A. (2024). Deploying the hybrid project management methodology framework in major transportation projects in the United Kingdom. *Journal of Architectural Engineering Technology*, *13*(2).

Lievens, A., & Blažević, V. (2021). A service design perspective on the stakeholder engagement journey during B2B innovation: Challenges and future research agenda. *Industrial Marketing Management*, *95*, 128-141.

Ligade, A., Bhogade, V., & Birajdar, S. (2019). Use of optimization techniques for construction projects: study & application. *International Journal of Innovations in Engineering Research and Technology*, 1-5.

Loureiro, S. M. C., Romero, J., & Bilro, R. G. (2020). Stakeholder engagement in co-creation processes for innovation: A systematic literature review and case study. *Journal of Business Research*, *119*, 388-409.

Lu, H., Guo, L., Azimi, M., & Huang, K. (2019). Oil and Gas 4.0 era: A systematic review and outlook. *Computers in Industry*, *111*, 68-90.

MacDonald, A., Clarke, A., & Huang, L. (2022). Multi-stakeholder partnerships for sustainability: Designing decision-making processes for partnership capacity. In *Business and the ethical implications of technology* (pp. 103-120). Cham: Springer Nature Switzerland.

Mansouri, S. A., Lee, H., & Aluko, O. (2015). Multi-objective decision support to enhance environmental sustainability in maritime shipping: A review and future directions. *Transportation Research Part E: Logistics and Transportation Review*, *78*, 3-18.

Melnyk, O., Onyshchenko, S., Rudenko, S., Pavlova, N., & Muradian, A. (2024). Embracing integrated optimization strategies for cost-effective port operations in marine logistics. In *Systems, Decision and Control in Energy VI: Volume I: Energy Informatics and Transport* (pp. 491-508). Cham: Springer Nature Switzerland.

Michalczyk, S., Nadj, M., Azarfar, D., Maedche, A., & Gröger, C. (2020). A state-of-the-art overview and future research avenues of self-service business intelligence and analytics.

Mitchell, D., Blanche, J., Harper, S., Lim, T., Gupta, R., Zaki, O., ... & Flynn, D. (2022). A review: Challenges and opportunities for artificial intelligence and robotics in the offshore wind sector. *Energy and AI*, *8*, 100146.

Nampalli, R. C. R. (2022). Data-Driven Strategies for Improving School Bus Fleet Maintenance: A Predictive Approach to Safety and Performance. *Journal of Scientific and Engineering Research*, *9*(12), 192-203.

Nampalli, R. C. R. (2022). Machine Learning Applications in Fleet Electrification: Optimizing Vehicle Maintenance and Energy Consumption. *Educational Administration: Theory and Practice*, *28*(4), 01-12.

Narang, R., Khan, A. M., Devgun, V., & Pathak, A. (2024, November). Path Planning Optimizer for Workover Rigs and Stimulation Vessels: Efficiency and Emissions Management. In *Abu Dhabi International Petroleum Exhibition and Conference* (p. D041S133R004). SPE.

Nascimento, D. L. D. M., Goncalvez Quelhas, O. L., Gusmão Caiado, R. G., Tortorella, G. L., Garza-Reyes, J. A., & Rocha-Lona, L. (2020). A lean six sigma framework for continuous and incremental improvement in the oil and gas sector. *International Journal of Lean Six Sigma*, *11*(3), 577-595.

Nookala, G. (2022). Metadata-Driven Data Models for Self-Service BI Platforms. *Journal of Big Data and Smart Systems*, *3*(1).

Nurwinahyu, P. H. (2016). *Development of Integrated Operations Strategy to Accelerate Offshore Operations Capability* (Master's thesis, University of Stavanger, Norway).

Odimarha, A. C., Ayodeji, S. A., & Abaku, E. A. (2024). Machine learning's influence on supply chain and logistics optimization in the oil and gas sector: a comprehensive analysis. *Computer Science & IT Research Journal*, *5*(3), 725-740.

Odimarha, A. C., Ayodeji, S. A., & Abaku, E. A. (2024). Machine learning's influence on supply chain and logistics optimization in the oil and gas sector: a comprehensive analysis. *Computer Science & IT Research Journal*, *5*(3), 725-740.

Ogbu, A. D., Ozowe, W., & Ikevuje, A. H. (2024). Remote work in the oil and gas sector: An organizational culture perspective. *GSC Advanced Research and Reviews*, *20*(1), 188-207.

Onyshchenko, S., Kravchenko, O., Melnyk, O., Steba, A., & Nykytyuk, P. (2024). Enhancing the optimal fleet management and offshore marine operations in subsea resource. *Geomining*, *224*, 269.

Panayides, P., Borch, O. J., & Henk, A. (2018). Measurement challenges of supply chain performance in complex shipping environments. *Maritime Business Review*, *3*(4), 431-448.

Parmiggiani, E. (2015). Integration by infrastructuring: The case of subsea environmental monitoring in oil and gas offshore operations.

Petukhov, B. (2020). *Operational scheduling with business modelling and genetic algorithms* (Doctoral dissertation, Victoria University).

Raj, P., Raman, A., Nagaraj, D., & Duggirala, S. (2015). High-performance big-data analytics. *Computing Systems and Approaches (Springer, 2015)*, *1*.

Raut, R. D., Narkhede, B., & Gardas, B. B. (2017). To identify the critical success factors of sustainable supply chain management practices in the context of oil and gas industries: ISM approach. *Renewable and Sustainable Energy Reviews*, *68*, 33-47.

Reddy, M. H., & Bhuvan, M. B. (2024). Real-Time vehicle tracking and fleet monitoring. *International Journal of Information Technology and Computer Engineering*, *12*(4), 94-101.

Redutskiy, Y., & Balycheva, M. (2024). Energy efficiency in petroleum supply chain optimization: push segment coordination. *Energies*, *17*(2), 388.

Rogage, K., Mahamedi, E., Brilakis, I., & Kassem, M. (2022). Beyond digital shadows: A Digital Twin for monitoring earthwork operation in large infrastructure projects. *AI in Civil Engineering*, *1*(1), 7.

Rögnvaldsson, T., Nowaczyk, S., Byttner, S., Prytz, R., & Svensson, M. (2018). Self-monitoring for maintenance of vehicle fleets. *Data Mining and Knowledge Discovery*, *32*, 344-384.

Roy, S., & Dunbar, S. (2022). *Improving Supply Chains in the Oil and Gas Industry: 12 Modules to Improve Chronic Challenges for Maintenance, Repair and Operations* (Vol. 16). Springer Nature.

Saif, W., Rogage, K., Martinez, P., & Kassem, M. (2024). Decarbonising Construction Equipment: Management Practices and Strategies for Net Zero in UK Infrastructure Projects. *Building and Environment*, 112503.

Sales Neverdal, M. (2019). *Increasing the efficiency of drilling operations using contract management strategies: A study from the Norwegian O&G industry* (Master's thesis, University of Stavanger, Norway).

Sardar, A. (2024). *Improving safety and efficiency in the maritime industry: a multi-disciplinary approach* (Doctoral dissertation, University of Tasmania).

Seimetz Chagas, R. D., Soares, J. B. C. D. O., Longhi, R. P., Vieira, B. F., de Arruda, E. F., Leite, L. S. B. D. S., & Ferreira Filho, V. J. M. (2023). A solution framework for the integrated periodic supply vessel planning and port scheduling in oil and gas supply logistics. *Optimization and Engineering*, *24*(2), 1115-1155.

Shitu, I. A. M. (2021). *Port performance and crude oil export logistics system distribution in Nigeria* (Doctoral dissertation, University of Plymouth).

Shou, W., Wang, J., Wu, P., & Wang, X. (2021). Lean management framework for improving maintenance operation: Development and application in the oil and gas industry. *Production Planning & Control*, *32*(7), 585-602.

Siddiqui, A., Verma, M., & Verter, V. (2018). An integrated framework for inventory management and transportation of refined petroleum products: Pipeline or marine?. *Applied Mathematical Modelling*, *55*, 224-247.

Silvius, G., & Schipper, R. (2019). Planning project stakeholder engagement from a sustainable development perspective. *Administrative Sciences*, *9*(2), 46.

Stodder, D. (2015). Visual analytics for making smarter decisions faster. *Best Practices Report, TDWI Research*.

Suboyin, A., Diaz, S., Mannan, S., Kumar, S., Baobaid, O., & Villasuso, F. (2024, November). The Game-Changing Role of Scope 3 Emissions in Logistics and Maritime Sustainability. In *Abu Dhabi International Petroleum Exhibition and Conference* (p. D041S137R001). SPE.

Theodorou, V. (2017). Automating user-centered design of data-intensive processes.

Thom, A. L. (2024). *Revolutionizing Oil And Gas Maintenance: A Project Management Plan For Unleashing Smart Business Intelligence (Bi) For Enhanced Work Prioritization And Risk-Tracking* (Doctoral Dissertation, Universidad Para La Cooperacion Internacional).

Trevathan, M. M. T. (2020). *The evolution, not revolution, of digital integration in oil and gas* (Doctoral dissertation, Massachusetts Institute of Technology).

Tsvetkova, A., & Gammelgaard, B. (2024). Social-ecological resilience in extreme natural environments: a multiple case study of Arctic offshore supply ecosystems. *International Journal of Operations & Production Management*.

Vemulapalli, G. (2023). Optimizing Analytics: Integrating Data Warehouses and Lakes for Accelerated Workflows. *International Scientific Journal for Research*, *5*(5), 1-27.

Wagstaff, B. (2023). *Data-Driven Models for Robust Egomotion Estimation* (Doctoral dissertation, University of Toronto (Canada)).

Wanasinghe, T. R., Gosine, R. G., James, L. A., Mann, G. K., De Silva, O., & Warrian, P. J. (2020). The internet of things in the oil and gas industry: a systematic review. *IEEE Internet of Things Journal*, *7*(9), 8654-8673.

Werbińska-Wojciechowska, S., Giel, R., & Winiarska, K. (2024). Digital twin approach for operation and maintenance of transportation system—systematic review. *Sensors*, *24*(18), 6069.