

MINI REVIEW



Effective supply chain strategies in the volatile oil and gas sector: managing uncertainty with best practices

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ABSTRACT

In the dynamic and uncertain landscape of today's oil and gas industry, characterized by unpredictable shifts in supply and demand, geopolitical tensions, the looming threat of natural disasters, and unforeseen global events like the COVID-19 pandemic, oil and gas enterprises are confronted with a compelling need to embrace best-in-class supply chain strategies. Central to these challenges lies the critical requirement for effective risk mitigation, encompassing comprehensive contingency planning and supplier diversification. Technological advancements and the application of data analytics in demand forecasting are pivotal elements in optimizing supply chain management. Cultivating strong supplier relationships promotes adaptability, while the integration of sustainable practices enhances competitiveness. These strategic approaches empower companies not only to navigate market volatility and the erratic fluctuations in crude oil prices but also to prosper in this ever-changing environment.

KEY WORDS

Oil and gas industry; Supply chain management; Best practices; Crude oil prices; Collaboration

ARTICLE HISTORY

Received 13 September 2023;
Revised 7 August 2025;
Accepted 26 August 2025

Introduction

In the current volatile and dynamic business landscape, the oil and gas industry face intricate challenges within its supply chain strategies. The convergence of global economic factors, geopolitical uncertainties, and complex regulatory landscapes heightens price volatility, posing a persistent threat to operational stability. Compounded by the industry's reliance on remote and underdeveloped locations, addressing these challenges requires intricate logistical solutions and significant infrastructure development. The integration of evolving technologies, managing demand uncertainties, and meeting sustainability expectations further amplifies the complexity of supply chain management. Optimizing the supply chain is not merely a strategic choice; it is imperative for mastering processes that are fundamental to competitiveness and resilience [1].

Additionally, various research endeavors, as illustrated by the work of Hussain et al. have delved into the pivotal role played by cost-effective supply chain practices in ensuring an uninterrupted supply of crude oil [2]. His study underscores the significance of minimizing lead times and distribution costs, recognizing that despite inherent challenges in the oil industry's supply chain, opportunities for enhancement and cost savings have been identified.

The intricacies and rigidity of the supply chain in the oil and gas industry contribute to uncertainties that exert a direct influence on economies and even political landscapes in various countries [3]. Effectively handling uncertainty stands out as a primary objective in supply chain management. The design of the supply chain entails critical strategic decisions, often involving substantial investments, long-term implications, and challenges in reversibility. Consequently, there is a crucial need to structure the supply chain in a manner that facilitates seamless adaptation to uncertainties in the future [3,4].

In a complementary perspective, Chima, in his article, explores the pivotal role of supply-chain management in the oil industry [5]. He studies strategies for enhancing supply chains

within the sector and elucidates how optimizing supply-chain logistics contributes to overall efficiency. His research emphasizes the global nature of the oil industry's supply chain, spanning domestic and international transportation, ordering processes, inventory visibility and control, materials handling, and information technology. Thus, the oil industry emerges as a classic model for the implementation of supply-chain management techniques.

Through an in-depth exploration of these interconnected themes, this article aims to enrich the ongoing discussion surrounding potent supply chain management strategies within the oil and gas sector, nurturing resilience, efficiency, and enduring success. The central aim of this study is to scrutinize and evaluate the incorporation of state-of-the-art supply chain solutions in the Oil and Gas sector, with a concentrated focus on pivotal components. Furthermore, the study seeks to explore domains essential for operational efficiency, cost control, and holistic competitiveness.

Supply Chain Perspective in Oil and Gas

The supply chain in the oil and gas industry is an intricately woven, globally interconnected network, consisting of several crucial stages, each serving a pivotal role in the industry's overall operations. To investigate the effective strategies and best practices, it is imperative to first comprehend the comprehensive supply chain cycle within the oil and gas sector. As per Chima, it initiates with meticulous geological surveys and sophisticated seismic analysis to pinpoint potential reserves, subsequently progressing into the drilling and production phases, which demand a continuous influx of specialized equipment and materials to support these operations [5]. The transportation facet of this supply chain is multifaceted, involving extensive pipeline infrastructure for the efficient conveyance of crude oil and natural gas, as well as maritime shipping methods for the transport of these valuable resources. Refineries, crucial elements within this chain, undertake the intricate task of refining crude oil into an array of valuable products, ranging from gasoline to petrochemicals.

The marketing and distribution channels within the supply chain then come into play, facilitating the widespread dissemination of these refined products to both end consumers and various industries. Figure 1 offers a visual representation of the comprehensive journey through the supply chain in the oil and gas sector, illustrating the intricate and interconnected nature of its various stages.

Supply Chain Management

The concept of supply chain management (SCM) is deeply rooted in integrated business planning, a philosophy championed by experts in logistics, strategy, and operations research since the 1950s [6]. In the present era, numerous researchers are actively involved in the integration of diverse planning tools into advanced planning systems [7,6].

SCM in the oil and gas industry is a strategic and complex process that encompasses the planning, procurement, production, transportation, storage, and distribution of materials, equipment, and resources needed for the exploration, production, refining, and distribution of oil and gas products. Effective management of the supply base is pivotal to achieving success. It involves a meticulous selection of relevant suppliers and a strong focus on aligning with organizational objectives, both of which are vital components of successful supplier relationship management. Furthermore, the importance of sustainability considerations is on the rise. Cultivating robust and collaborative supplier relationships contributes to more resilient supply chains, enabling organizations to swiftly adapt to market fluctuations and unforeseen challenges, ultimately enhancing their competitiveness and long-term sustainability.

Supply Chain Solutions

Within the competitive landscape of today's Oil and Gas sector, the incorporation of advanced supply chain solutions transcends being merely optional; it is now an indispensable necessity. This study endeavors to meticulously identify and explore these imperative solutions, which are delineated in detail in Fig. 2. The objective is to dissect and understand the strategic interventions that can enhance supply chain efficiency and competitiveness in this dynamic industry.

Demand forecasting

Demand forecasting holds paramount importance in the oil and gas industry, serving as a critical element for streamlining procurement and production operations. The precision in forecasting is instrumental in anticipating and meeting the fluctuating demands of the market. The integration of data analytics and AI tools proves invaluable in this context, offering sophisticated insights that go beyond traditional forecasting methods. This technological leverage not only minimizes waste but also optimizes the allocation of resources, ensuring that materials and production capacities are aligned with the actual demand. The enhanced accuracy in demand forecasting, as highlighted by Ghaithan et al. contributes significantly to cost control strategies within the oil and gas sector, promoting operational efficiency and financial sustainability [8].

Inventory management

Inventory management plays a pivotal role in the seamless operations of oil and gas organizations, ensuring optimal levels of materials and products precisely when needed. This strategic function involves meticulous planning and control to strike the right balance between supply and demand. The effective management of inventory is crucial for mitigating the risks associated with both excess and insufficient stock. By

keeping inventory levels in check, organizations can reduce carrying costs, which is instrumental in optimizing overall operational expenses. Moreover, the strategic control of inventory helps in averting shortages, a critical factor that could disrupt the continuity of operations. In the dynamic and demanding oil and gas sector, maintaining an agile and responsive inventory management system is essential for ensuring smooth operations and meeting market demands efficiently.

Contractor management

Managing contractors efficiently is of paramount importance as it serves as a critical strategy for mitigating risks associated with third-party relationships. This process involves a comprehensive approach to ensure that external resources are seamlessly aligned with the organizational objectives. By guaranteeing this alignment, organizations in the oil and gas sector enhance their operational resilience and minimize potential disruptions. The efficient management of contractors encompasses thorough vetting, transparent communication, and a mutual understanding of goals and expectations. This alignment not only fosters a collaborative working environment but also safeguards against risks that may arise from divergent interests or practices. Ultimately, efficient contractor management is integral to establishing a robust and symbiotic relationship between oil and gas organizations and their external partners, contributing to the overall success and stability of operations.

Master data management (MDM)

Master Data Management stands as a critical component within the Oil and Gas industry. The utilization of MDM tools is indispensable for enabling real-time monitoring of diverse supply chain activities. These tools play a pivotal role in ensuring the consistency and accuracy of data across various platforms and processes within the industry. The enhancement of supply chain visibility is a direct outcome of effective MDM implementation, providing stakeholders with a holistic view of operations. Furthermore, MDM supports predictive analytics by offering a reliable foundation of consistent and accurate data. This enables organizations to forecast trends, identify potential issues, and make informed decisions based on reliable insights. Additionally, the facilitation of rapid exception handling is a key benefit of MDM, allowing organizations to address deviations or anomalies swiftly and effectively.

In essence, the integration of MDM tools into the supply chain operations of the Oil and Gas industry is not just a technological necessity; it is a strategic imperative that enhances data integrity, supports analytical capabilities, and ensures a responsive and resilient supply chain ecosystem. MDM tools are indispensable for real-time monitoring of supply chain activities in the Oil and Gas industry. Ensuring data consistency and accuracy, enhancing supply chain visibility, supporting predictive analytics, and facilitating rapid exception handling.

E-Procurement

E-Procurement emerges as a transformative force within the oil and gas industry, revolutionizing supply chains through the incorporation of electronic processes. This paradigm shift aims at streamlining various procurement activities and minimizing reliance on manual tasks, as highlighted by Jahani et al. (2021). The transformation brought about by E-Procurement extends beyond mere process optimization. Enhancing transparency is a key aspect, providing stakeholders with increased visibility into procurement activities. This transparency fosters

accountability and trust throughout the supply chain, ensuring that all relevant parties have access to real-time information. Simultaneously, E-Procurement facilitates cost control by leveraging data-driven insights. Through the analysis of procurement data, organizations can identify cost-saving opportunities, negotiate favorable terms, and optimize expenditure. Moreover, the adoption of E-Procurement contributes to a holistic improvement in overall procurement efficiency. By automating and digitizing procurement processes, organizations can achieve faster turnaround times, reduce errors, and enhance the overall responsiveness of the procurement function. In essence, E-Procurement stands as a cornerstone in modernizing and optimizing oil and gas supply chains, driving efficiency, transparency, and cost-effectiveness throughout the procurement lifecycle.

Effective Deployment of Supply Chain Best Practices

The effective deployment of supply chain best practices in the Oil and Gas sector is an intricate and ongoing process, critical within the dynamic and ever-evolving landscape of the industry. Success in this endeavor demands unwavering dedication, flexibility, and a commitment to continuous enhancement. The integration of best practices is not a one-time implementation but a persistent effort to adapt to the unique challenges posed by the sector's volatility.

Dedication is a fundamental requirement, emphasizing the persistent and focused application of proven supply chain methodologies. Flexibility becomes paramount, acknowledging the need to adjust strategies in response to changing market dynamics, technological advancements, and unforeseen external factors. An unwavering commitment to continuous enhancement underscores the proactive approach necessary for staying ahead of industry trends and maintaining a competitive edge.

Aligning the supply chain strategy with broader business objectives becomes a cornerstone of success. This involves a strategic synchronization between supply chain practices and overarching organizational goals. Vigilant monitoring is essential, necessitating a constant awareness of industry shifts, emerging technologies, and regulatory changes. Adaptability to evolving circumstances is key, ensuring that supply chain practices remain agile and responsive to the ever-changing dynamics of the Oil and Gas sector. Ultimately, this comprehensive approach to supply chain best practices not only secures a decisive competitive advantage but also establishes the foundation for sustained success in the dynamic and demanding realm of the Oil and Gas industry.

By addressing these detailed components, the study aims to offer comprehensive insights that can guide organizations in the Oil and Gas industry toward enhanced efficiency, safety, and competitiveness.

Conclusions

In summary, the dynamic and unpredictable nature of the oil and gas industry underscores the need for advanced supply chain strategies to ensure resilience and enduring success. This study has emphasized the crucial role of effective risk mitigation, supplier diversification, and

technological advancements, particularly in leveraging data analytics for demand forecasting. The outlined key supply chain solutions, including demand forecasting, inventory management, contractor management, Master Data Management (MDM), E-Procurement, and best practices deployment, collectively form a comprehensive framework aimed at enhancing operational efficiency, cost control, and industry competitiveness. Embracing these strategies and maintaining a steadfast commitment to continuous improvement empower organizations in the Oil and Gas sector to navigate uncertainties, capitalize on opportunities, and secure a decisive competitive advantage in the ever-evolving industry landscape. The adoption and effective implementation of these best practices not only enable organizations to address challenges related to fluctuating crude oil prices and market uncertainties but also lays the groundwork for long-term success. Collaboration is another pivotal, requiring organization to collectively pursue excellence by integrating these practices into their operations and wholeheartedly embracing available tools. This collaborative effort results in the establishment of resilient supply chains crucial for achieving sustained success within the ever-changing oil and gas sector.

Disclosure Statement

No potential conflict of interest was reported by the author.

References

1. Lisitsa S, Levina A, Lepekhn A. Supply-chain management in the oil industry. InE3S Web of Conferences 2019. 02061p. <https://doi.org/10.1051/e3sconf/201911002061>
2. Hussain RA, Assavapokee TI, Khumawala B. Supply chain management in the petroleum industry: challenges and opportunities. Int J Glob Logist & Supply Chain Manag. 2006;1(2):90-97.
3. Sinha AK, Aditya HK, Tiwari MK, Chan FT. Agent oriented petroleum supply chain coordination: Co-evolutionary Particle Swarm Optimization based approach. Expert Syst Appl. 2011;38(5):6132-6145. <https://doi.org/10.1016/j.eswa.2010.11.004>
4. Vachon S, Hajmohammad S. Supply chain uncertainty and environmental management. Asian J Sustain Soc Responsib. 2016;1(1):77-89. <https://doi.org/10.1186/s41180-016-0005-0>
5. Chima CM. Supply-chain management issues in the oil and gas industry. J Bus Econ. 2007;5(6).
6. Shapiro JF. Challenges of strategic supply chain planning and modeling. Comput. Chem. Eng. 2004;28(6-7):855-861. <https://doi.org/10.1016/j.compchemeng.2003.09.013>
7. Lasschuit W, Thijssen N. Supporting supply chain planning and scheduling decisions in the oil and chemical industry. Comput. Chem. Eng. 2004;28(6-7):863-870. <https://doi.org/10.1016/j.compchemeng.2003.09.026>
8. Ghaithan AM, Attia AM, Duffuaa SO. A multi-objective model for an integrated oil and natural gas supply chain under uncertainty. RAIRO Oper Res. 2021;55(6):3427-3446. <https://doi.org/10.1051/ro/2021158>