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Abstract

Purpose: The aim of the study was to assess the impact of lean management practices on supply chain flexibility in Congo.

Methodology: This study adopted a desk methodology. A desk study research design is commonly known as secondary data collection. This is basically collecting data from existing resources preferably because of its low cost advantage as compared to a field research. Our current study looked into already published studies and reports as the data was easily accessed through online journals and libraries.

Findings: The study found that lean management practices significantly enhance supply chain flexibility by emphasizing waste reduction, continuous improvement, and efficient resource utilization. These practices foster a more responsive and adaptable supply chain, capable of swiftly adjusting to changes in demand and market conditions. By streamlining processes and eliminating non-value-added activities, lean management enables quicker production cycles and reduces lead times. Additionally, lean practices such as Just-In-Time (JIT)

inventory management and cross-functional team collaboration improve coordination and communication across the supply chain. This enhanced collaboration leads to better decision-making and faster response to disruptions. Overall, the implementation of lean management practices results in a more agile and resilient supply chain, better equipped to handle variability and uncertainty.

Implications to Theory, Practice and Policy: Resource-based view theory, contingency theory and dynamic capabilities theory may be used to anchor future studies on assessing the impact of lean management practices on supply chain flexibility in Congo. In practice, organizations are encouraged to adopt a holistic approach to lean management that encompasses various lean practices tailored to their specific industry and operational context. At the policy level, it is important to advocate for initiatives that support the adoption of lean practices in supply chain management.

Keywords: *Lean Management, Supply Chain, Flexibility*

INTRODUCTION

Lean management practices, rooted in the principles of minimizing waste and optimizing processes, have increasingly gained prominence in enhancing supply chain efficiency. Supply chains in developed economies, particularly exemplified by the USA, have showcased remarkable levels of flexibility and adaptability in recent years, leveraging advancements in technology and strategic management approaches. A notable instance of this adaptability is seen in the widespread adoption of just-in-time (JIT) inventory management systems. According to Christopher and Peck (2018), JIT systems have fundamentally transformed inventory management practices, enabling companies to reduce holding costs by as much as 40% while simultaneously maintaining or even improving service levels. This transition has not only led to cost savings but has also positioned companies to respond swiftly to fluctuating market demands, minimize the occurrence of stockouts, and optimize production processes, thereby contributing significantly to the overall resilience of supply chains.

Furthermore, the integration of cutting-edge technologies such as artificial intelligence (AI) and the Internet of Things (IoT) has further enhanced the agility of supply chains in developed economies. Li and Zhang (2019) highlight the impact of AI-driven predictive analytics in significantly improving demand forecasting accuracy, by over 30% in some cases. This improved accuracy has directly translated into better inventory optimization and reduced lead times, allowing companies to make more informed decisions and adapt rapidly to changing market conditions. Additionally, the implementation of IoT-enabled supply chain visibility solutions has enhanced real-time tracking capabilities, risk management strategies, and overall decision-making processes, enabling businesses to navigate disruptions with greater resilience and efficiency. These technological advancements underscore the dynamic nature of supply chains in developed economies, positioning them to thrive amidst evolving market dynamics and customer expectations.

Moreover, the utilization of sustainable supply chain practices has gained traction in Middle Eastern economies such as the United Arab Emirates (UAE). A study by Al-Ghamdi and Al-Ahmadi (2020) showcases how the adoption of green supply chain strategies, including renewable energy adoption and waste reduction measures, has not only enhanced environmental sustainability but also improved operational efficiency and resilience. These sustainable practices have enabled companies in the UAE to reduce costs, enhance brand reputation, and adapt to evolving regulatory requirements, contributing to long-term supply chain flexibility and competitiveness.

In Latin American economies like Brazil, supply chains have leveraged innovative strategies such as collaborative planning, forecasting, and replenishment (CPFR) to enhance flexibility and responsiveness. Study by Santos and Oliveira (2019) highlights how CPFR initiatives have facilitated information sharing, improved demand forecasting accuracy, and reduced lead times, enabling companies to adapt swiftly to market fluctuations and customer demands. This collaborative approach has strengthened relationships among supply chain partners and improved overall supply chain performance in developing economies.

Additionally, the adoption of lean manufacturing principles has been instrumental in enhancing supply chain flexibility in countries like Mexico. Study by Garcia and Cruz (2021) showcase how lean practices, such as waste reduction and continuous improvement, have optimized production

processes, reduced costs, and improved responsiveness to customer needs. These lean strategies have enabled companies in developing economies to achieve greater operational efficiency and adaptability, positioning them for sustained growth and competitiveness in dynamic market environments.

In developing economies such as India, supply chains have also demonstrated notable levels of flexibility and adaptability, albeit within the context of unique challenges and opportunities. One prominent area showcasing this adaptability is the increasing adoption of cloud-based supply chain management systems. Study by Dasgupta (2021) indicates that a significant proportion of medium-sized enterprises in India have embraced cloud platforms, leading to improved scalability, collaboration, and cost-effectiveness within their supply chain operations. This shift towards cloud-based solutions has not only enhanced operational efficiencies but has also empowered businesses to respond swiftly to evolving market dynamics, thereby enhancing overall supply chain agility.

In developing economies across Southeast Asia, such as Vietnam, supply chains have demonstrated notable flexibility and adaptability, leveraging technological advancements and innovative strategies. A significant area of focus has been the adoption of blockchain technology in supply chain management. According to a study by Nguyen and Phan (2020), blockchain-based supply chain platforms have streamlined processes, improved transparency, and enhanced trust among stakeholders, leading to more agile and resilient supply chains. This technology has enabled companies in developing economies to better trace products, mitigate risks, and respond effectively to market disruptions.

Furthermore, the integration of data analytics and machine learning algorithms has played a crucial role in enhancing supply chain flexibility. Research by Tan and Chan (2018) emphasizes the impact of data-driven insights on demand forecasting accuracy and inventory optimization in Malaysian supply chains. These technologies have empowered businesses to make data-driven decisions, anticipate market trends, and adjust supply chain strategies swiftly, contributing to overall operational resilience and competitiveness. Moreover, agile manufacturing practices have gained prominence in developing economies, contributing significantly to supply chain flexibility and responsiveness. Mishra and Rao (2018) highlight the impact of agile principles, such as modular production and cross-functional teams, in reducing lead times by up to 25% in Indian manufacturing firms. These agile strategies enable companies to customize products, respond promptly to changing customer demands, and effectively mitigate supply chain risks, thereby enhancing overall operational resilience. The combination of technological innovation and agile strategies underscores the adaptability of supply chains in developing economies, positioning them to navigate complexities and capitalize on growth opportunities in dynamic market environments.

In Sub Saharan African economies like South Africa, supply chains have embraced innovative solutions such as digital twinning to enhance flexibility and resilience. Study by Mahlaba and Mbohwa (2022) highlights how digital twinning technology, which involves creating virtual replicas of physical assets and processes, has improved supply chain visibility, simulation capabilities, and decision-making. This approach has enabled companies in South Africa to optimize operations, mitigate risks, and respond effectively to disruptions, thereby enhancing overall supply chain agility.

Supply chains in Sub-Saharan economies have shown notable progress in enhancing flexibility and adaptability through various innovative approaches. One significant development is the adoption of mobile technology for supply chain management. Research by Abdi, Atia, and Nassr (2020) emphasizes how mobile-based supply chain solutions have improved operational efficiency by 20% in countries like Kenya and Nigeria. These solutions facilitate real-time tracking, inventory management, and communication across the supply chain network, enabling companies to respond swiftly to market changes and disruptions.

Additionally, initiatives promoting sustainable supply chain practices have gained traction in Sub-Saharan Africa. Study by Nyongesa and Njoroge (2019) highlights the impact of green supply chain strategies, such as renewable energy adoption and waste reduction measures, on improving supply chain resilience and performance. These initiatives not only contribute to environmental sustainability but also enhance operational efficiency and cost-effectiveness, ultimately leading to greater supply chain adaptability and competitiveness in Sub-Saharan economies.

Lean principles are a set of management practices focused on maximizing value while minimizing waste within an organization. In the context of supply chains, several key applications of lean principles can significantly enhance flexibility and adaptability. One such application is lean inventory management, where companies strive to reduce excess inventory levels and optimize inventory turnover rates. This lean practice leads to improved flexibility by enabling companies to respond swiftly to changes in customer demand and market conditions. Study by Smith (2019) emphasizes how lean inventory management contributes to supply chain flexibility by reducing lead times and increasing responsiveness.

Another application of lean principles is lean production, which emphasizes continuous improvement and waste reduction in manufacturing processes. By implementing lean production techniques such as value stream mapping and kaizen, companies can enhance production flexibility and adaptability. This is evident in studies by Johnson (2020), where the application of lean production practices has led to increased production efficiency, reduced cycle times, and improved product quality. These improvements directly contribute to the overall agility of supply chains, allowing companies to adjust production levels quickly in response to demand fluctuations and market shifts.

Problem Statement

Despite the growing adoption of lean management practices in various industries, there remains a gap in understanding the precise impact of these practices on supply chain flexibility. While some studies have shown positive correlations between lean principles and enhanced flexibility, others suggest potential challenges and limitations. For instance, research by Smith (2019) highlights the benefits of lean inventory management in reducing lead times and increasing responsiveness, yet questions arise regarding the scalability of lean practices and their adaptability to dynamic market conditions. Similarly, studies by Johnson (2020) emphasize the role of lean production techniques in improving production efficiency and quality, but concerns linger regarding the trade-offs between lean efficiency and supply chain resilience. These conflicting perspectives necessitate a comprehensive analysis of the impact of lean management practices on supply chain flexibility to inform strategic decision-making and optimize supply chain performance.

Theoretical Framework

Resource-Based View (RBV) Theory

Originated by Jay Barney, the resource-based view theory posits that sustainable competitive advantage stems from a firm's unique resources and capabilities rather than external factors. This theory is relevant to the impact of lean management practices on supply chain flexibility as it emphasizes the importance of internal resources, such as lean practices, in enhancing organizational performance. Study by Williams (2021) highlights how firms can leverage lean management practices as valuable resources to improve supply chain flexibility, streamline processes, and gain a competitive edge.

Contingency Theory

Developed by Tom Burns and Stalker, contingency theory suggests that organizational effectiveness is contingent upon the alignment between internal and external factors. In the context of the impact of lean management practices on supply chain flexibility, this theory underscores the need to consider contextual variables such as market dynamics, technological advancements, and organizational culture. Study by Chen (2019) demonstrate how the effectiveness of lean practices in enhancing supply chain flexibility may vary based on contingency factors, highlighting the importance of a contextualized approach in understanding their impact.

Dynamic Capabilities Theory

Originated by David Teece, the dynamic capabilities theory focuses on a firm's ability to adapt and innovate in response to changing environments. This theory is pertinent to the impact of lean management practices on supply chain flexibility as it emphasizes the role of continuous improvement and learning in achieving organizational agility. Study by Lee (2020) explores how firms can develop dynamic capabilities through the implementation of lean practices, enabling them to enhance supply chain flexibility, responsiveness, and resilience in dynamic market conditions.

Empirical Review

Smith (2018) assessed the relationship between lean inventory management practices and supply chain flexibility in the automotive industry. Using survey data from multiple firms, the study found a significant positive correlation between the adoption of lean inventory practices and enhanced supply chain flexibility. Specifically, lean techniques such as Just-in-Time (JIT) inventory systems and Kanban methodologies were associated with reduced lead times, improved inventory turnover rates, and increased responsiveness to customer demands. The findings underscored the importance of lean inventory management as a strategic approach for improving supply chain flexibility in dynamic market environments. As a recommendation, the study suggested that companies in the automotive industry should focus on implementing lean inventory practices to optimize supply chain performance and achieve greater flexibility in meeting customer needs.

Johnson (2019) explored the impact of lean production techniques on supply chain flexibility in manufacturing firms. Through interviews with supply chain managers and quantitative analysis of production data, the study revealed that lean production practices positively influence supply chain flexibility by reducing lead times and enhancing responsiveness. Key lean practices such as value stream mapping, continuous improvement initiatives, and employee involvement in problem-solving were identified as drivers of improved flexibility and adaptability. The study's findings

highlighted the importance of aligning lean principles with supply chain strategies to achieve competitive advantage and operational excellence. As a recommendation, the study suggested that manufacturing firms should prioritize the adoption of lean production techniques and foster a culture of continuous improvement to enhance supply chain flexibility and responsiveness.

Brown (2020) investigated the effectiveness of lean supply chain management practices in improving flexibility and responsiveness in the healthcare sector. The study focused on a hospital setting and examined the implementation of lean principles such as standardized work processes, visual management systems, and waste reduction initiatives. The findings indicated that lean practices significantly enhanced supply chain flexibility by streamlining workflows, reducing lead times for patient care services, and improving resource utilization. As a recommendation, the study emphasized the need for healthcare organizations to integrate lean principles into their supply chain management strategies to achieve operational efficiencies and better meet patient needs.

Garcia (2021) examined the impact of lean Six Sigma practices on supply chain flexibility in the aerospace industry. The study spanned several years and assessed the implementation of lean Six Sigma tools and methodologies such as DMAIC (Define, Measure, Analyze, Improve, Control) process improvement cycles and statistical process control techniques. The findings demonstrated that lean Six Sigma initiatives contributed to enhanced supply chain flexibility by reducing defects, improving process efficiency, and fostering a culture of continuous improvement. The study highlighted the role of lean Six Sigma as a strategic approach for enhancing supply chain resilience and adaptability in complex manufacturing environments. As a recommendation, the study suggested that aerospace companies should invest in lean Six Sigma training and implementation to achieve sustainable improvements in supply chain flexibility and overall performance.

Lee (2018) evaluated the impact of lean management practices on supply chain flexibility across different industries. The study employed case studies and quantitative analysis to identify industry-specific nuances in the relationship between lean practices and supply chain flexibility. While lean techniques such as value stream mapping and waste reduction were found to improve flexibility in manufacturing sectors, service industries showed varied responses based on factors such as service complexity and customer demand variability. The findings underscored the importance of tailored lean implementation approaches based on industry characteristics to achieve optimal flexibility outcomes. As a recommendation, the study suggested that companies should conduct industry-specific assessments and customize lean strategies to maximize supply chain flexibility gains.

Wang (2019) conducted a meta-analysis synthesizing findings from multiple studies to assess the overall impact of lean management practices on supply chain flexibility. The meta-analysis included studies from various industries and regions, examining the effects of lean practices such as JIT production, Total Quality Management (TQM), and continuous improvement initiatives. The findings revealed a consistently positive association between lean practices and supply chain flexibility across different contexts. Specifically, lean techniques were found to improve responsiveness, reduce lead times, enhance process efficiency, and facilitate quick adaptation to changing market conditions. As a recommendation, the meta-analysis suggested that organizations should prioritize the adoption of lean principles and invest in continuous improvement efforts to achieve greater supply chain flexibility and competitiveness.

Kim (2022) examined the long-term impact of lean management practices on supply chain flexibility in the retail sector. The study tracked supply chain performance metrics over several years following the implementation of lean practices such as inventory optimization, demand forecasting improvements, and lean distribution strategies. The findings indicated sustained improvements in supply chain flexibility over time, including reduced stockouts, improved order fulfillment rates, and enhanced customer responsiveness. The study highlighted the enduring benefits of lean implementation and recommended continuous monitoring, evaluation, and adaptation of lean strategies to maintain and enhance supply chain flexibility amidst evolving market dynamics.

METHODOLOGY

This study adopted a desk methodology. A desk study research design is commonly known as secondary data collection. This is basically collecting data from existing resources preferably because of its low cost advantage as compared to a field research. Our current study looked into already published studies and reports as the data was easily accessed through online journals and libraries.

RESULTS

Conceptual Gap: While the studies by Smith (2018) and Johnson (2019) have focused on specific lean practices such as lean inventory management and lean production techniques, there is a conceptual gap in understanding the comprehensive impact of integrated lean management systems on supply chain flexibility. A study that synthesizes various lean practices, including inventory management, production techniques, and quality management (such as lean Six Sigma), would provide a more holistic view of how different aspects of lean management collectively influence supply chain flexibility.

Contextual Gap: The studies by Brown (2020) and Garcia (2021) have explored the impact of lean practices in specific sectors (healthcare and aerospace, respectively). However, there is a contextual gap in understanding how lean management practices translate across different industries and organizational contexts. A comparative study that examines the applicability and effectiveness of lean principles in diverse sectors, such as manufacturing, services, healthcare, and aerospace, would help identify sector-specific challenges and opportunities for enhancing supply chain flexibility.

Geographical Gap: While the studies by Lee (2018) and Wang (2019) have provided insights into the impact of lean practices on supply chain flexibility across different industries and regions, there is a geographical gap in understanding the specific challenges and strategies related to lean implementation in emerging economies or specific geographical regions. A study focusing on the adoption and adaptation of lean management practices in emerging markets or geographically distinct areas would offer valuable insights into the unique factors influencing supply chain flexibility in these contexts.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The impact of lean management practices on supply chain flexibility is significant and multifaceted, as evidenced by empirical studies across various industries and contexts. Studies such as those by Smith, Johnson, Brown, Garcia, Lee, Wang, and Kim collectively highlight the

positive influence of lean principles on enhancing supply chain flexibility. Lean inventory management practices, lean production techniques, lean supply chain management strategies, and lean Six Sigma initiatives have consistently demonstrated improvements in reducing lead times, improving responsiveness, streamlining workflows, and enhancing process efficiency within supply chains.

These findings underscore the strategic importance of adopting and implementing lean management practices to achieve greater supply chain flexibility, resilience, and competitiveness. The recommendations from these studies emphasize the need for organizations to align lean principles with supply chain strategies, foster a culture of continuous improvement, and tailor lean implementation approaches based on industry characteristics and contextual factors. Continuous monitoring, evaluation, and adaptation of lean strategies are also recommended to sustain and enhance supply chain flexibility amidst dynamic market conditions.

In conclusion, the collective evidence from empirical studies supports the assertion that lean management practices play a pivotal role in driving improvements in supply chain flexibility, ultimately contributing to operational excellence, customer satisfaction, and organizational performance across diverse industries and geographical regions.

Recommendations

The following are the recommendations based on theory, practice and policy:

Theory

To advance the theoretical understanding of the impact of lean management practices on supply chain flexibility, it is recommended to conduct further research that integrates multiple lean practices. This research should aim to develop a comprehensive theoretical framework that elucidates the synergistic effects of lean inventory management, lean production techniques, and lean Six Sigma initiatives on supply chain flexibility. Additionally, exploring the interaction effects of lean practices with other organizational factors such as technology adoption, organizational culture, and market dynamics will contribute to a deeper theoretical understanding. Longitudinal studies that investigate the sustained effects of lean implementation on supply chain flexibility over time can also enrich the theoretical perspective, providing insights into the dynamic nature of lean management's impact.

Practice

In practice, organizations are encouraged to adopt a holistic approach to lean management that encompasses various lean practices tailored to their specific industry and operational context. This involves integrating lean principles into supply chain strategies and operations, with a focus on continuous improvement, employee involvement, and cross-functional collaboration. Organizations should provide training and support for supply chain professionals to develop expertise in lean management practices and implementation techniques, fostering a culture of continuous improvement and innovation. By embedding lean principles into day-to-day operations and strategic decision-making, organizations can enhance supply chain flexibility, responsiveness, and overall performance.

Policy

At the policy level, it is important to advocate for initiatives that support the adoption of lean practices in supply chain management. This includes providing incentives for companies to invest

in lean training programs, implementation projects, and technology upgrades. Collaborating with industry associations, government agencies, and academia can help develop guidelines and best practices for lean implementation in different sectors, promoting knowledge sharing and standardization of lean principles. Policymakers should also encourage partnerships between stakeholders to facilitate the exchange of ideas, experiences, and resources, ultimately fostering a supportive ecosystem for lean management adoption. By aligning policy initiatives with industry needs and best practices, policymakers can contribute to building more agile, resilient, and competitive supply chains.

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