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The importance of production engineering in supply chain management with a focus on multidisciplinarity

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ABSTRACT

Production engineering, as a multidisciplinary field, can contribute to efficient supply chain management (LIZOT et al., 2019). This discipline covers a wide range of knowledge, from technology to finance and sustainability, providing a solid foundation to address contemporary industry challenges. The integration of knowledge from different areas allows the creation of innovative solutions, which not only aim to improve efficiency and reduce costs, but also promote sustainable practices in global supply chains.

Keywords: Production engineering, Supply chain, Sustainability.

INTRODUCTION

Production engineering, as a multidisciplinary field, can contribute to efficient supply chain management (LIZOT et al., 2019). This discipline covers a wide range of knowledge, from technology to finance and sustainability, providing a solid foundation to address contemporary industry challenges. The integration of knowledge from different areas allows the creation of innovative solutions, which not only aim to improve efficiency and reduce costs, but also promote sustainable practices in global supply chains (SANDERS; WAGNER, 2011).

In this way, multidisciplinary research plays a relevant role in understanding the complexities involved in the supply chain. For example, the integration of financial components can lead to the development of strategies that overcome traditional barriers, providing sustainable innovations (GUPTA; KUSI-SARPONG; REZAEI, 2020). This approach adds perspectives that are indispensable to solving current and future problems faced by supply chains (KNOPPEN; CHRISTIAANSE, 2007).

In addition, technological evolution, including the adoption of the Internet of Things (IoT) and Artificial Intelligence (AI), is redefining supply chain operations (GAIKWAD et al., 2024). The ability to collect and analyze data in real-time through these advanced technologies offers significant potential for enhancing operational efficiency and responsiveness to market demands. Such technological advancement, guided by production engineering, is essential to maintain competitiveness and relevance in an increasingly dynamic and globalized market environment (VILLA, 2002).

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Sustainability has also become a central pillar in supply chain management, at the forefront of promoting practices that balance economic efficiency with environmental responsibility. This approach not only benefits the environment, but also offers advantages to companies that adopt sustainable practices, reflecting positively on the relationship with *stakeholders* (NATARAJARATHINAM; QIU; LU, 2022).

Thus, it is understood that the importance of production engineering in supply chain management is amplified by its multidisciplinary nature, which allows it to address the complexity and demands of a globalized market in an effective way. Through the integration of diverse disciplines, this area continues to develop innovative and sustainable solutions, preparing supply chains to meet current and future challenges.

OBJECTIVE

This article seeks to present in a narrative way the role of the multidisciplinary approach to production engineering in supply chain management, with an emphasis on the integration of advanced technologies, sustainable practices and disruptive innovations.

METHODOLOGY

To develop this article, a literature review methodology was adopted, focusing on the collection and analysis of relevant literature related to multidisciplinarity in production engineering applied to supply chain management. Initially, a search was conducted in the Scopus and Web of Science databases to identify publications that discuss the intersection between production engineering, advanced technologies and sustainability within the context of supply chain management. The search equation was based on the following keywords: "Production Engineering" AND "Supply Chain Management" AND Multidisciplinarity AND "Advanced Technologies" AND Sustainability AND "Supply Chain Innovation" AND "Sustainable Practices" AND "Operational Efficiency" AND "Lean Manufacturing" AND "Corporate Social Responsibility". Data collection took place in January 2024 and there was no limitation regarding the year of publication of the articles.

DEVELOPMENT

Production engineering has emerged as a discipline that contributes to supply chain management, standing out for its multidisciplinary nature. This approach, which encompasses knowledge of technology, finance, global management and sustainability, allows you to address supply chain challenges. The intersection of these knowledge areas provides innovative solutions that improve efficiency, reduce costs, and promote sustainable practices in global supply chains (BALDWIN; FREEMAN, 2022).

In this way, multidisciplinary research is fundamental in today's competitive environment, where decision-makers in supply chains must manage complex issues. Sanders and Wagner (2011) stressed the importance of considering multidisciplinary approaches to provide greater understanding of current and future challenges and opportunities. Such approaches broaden the understanding of the problems, allowing the creation of complementarities that enrich the analysis and foster innovations in the supply chain.

According to Dolgui and Proth (2010), production engineering integrates advanced production and operations techniques to respond to the demands of the globalized market. The implementation of strict inventory controls, radio frequency identification (RFID) technologies, and flexible, reconfigurable manufacturing systems are all examples of how manufacturing engineering works to dramatically reduce production costs while maintaining system flexibility.

Knoppen and Christiaanse (2007), in turn, highlighted the importance of temporal and multidisciplinary collaboration in supply chain partnerships to adapt to the different phases of development, dealing with issues of ownership, coordination and adaptation. This multidisciplinary approach increases sensitivity and provides more robust explanations for complex phenomena in supply chains.

In the meantime, technological evolution, particularly with the advent of IoT and Artificial Intelligence, is redefining operations in supply chains, bringing new challenges and opportunities. Villa (2002) notes that the ability to collect and analyze data in real-time offers significant potential to improve efficiency and responsiveness in supply chain operations. These technologies require a multidisciplinary approach for their effective integration and application.

Thus, it is perceived that production engineering is increasingly aligned with sustainability practices, seeking solutions that balance economic efficiency with environmental responsibility. In this line of thinking, Natarajarathinam, Qiu, and Lu (2022) described an innovative project that combines service learning and supply chain management to improve the operational efficiency of food banks, demonstrating how production engineering can have a positive social impact.

Given the above scenario, it is understood that the multidisciplinary approach in production engineering in supply chain management is indispensable to address the growing complexity and demands of a globalized market. Through the integration of knowledge from various areas, production engineering develops innovative and sustainable solutions that meet current and future needs, keeping companies at the forefront of competitiveness and social responsibility.

FINAL CONSIDERATIONS

At the conclusion of this study, it became evident that multidisciplinarity in production engineering facilitates the implementation of lean and agile production systems, which are essential for effective

supply chain management. Interdisciplinary collaboration in production engineering also paves the way for disruptive innovations in the supply chain, such as the implementation of advanced planning and scheduling systems. The integration of information and communication technologies, such as ERP (*Enterprise Resource Planning*) systems and cloud-based solutions, allows for an integrated, real-time view of the entire supply chain. This enhanced visibility facilitates data-driven decision-making and fosters collaboration among all *stakeholders*, from suppliers to end customers.

The increasing emphasis on corporate social responsibility (CSR) and business ethics in supply chain management is yet another aspect where the multidisciplinarity of production engineering proves valuable. Integrating ethical and sustainability considerations into manufacturing engineering practices contributes to more accountable and transparent supply chains. Not only does this meet the expectations of modern consumers, who are increasingly aware of the environmental and social impact of their purchases, but it also helps businesses mitigate risk and build a positive reputation in the market.

The multidisciplinary nature of production engineering allows for an integrated approach to supply chain risk management. The ability to analyze and mitigate risks is enhanced by collaboration between experts from different fields. This ensures that supply chain management strategies are able to adapt to emerging uncertainties and challenges, ensuring business continuity and customer satisfaction.

These aspects highlight the importance of multidisciplinarity in production engineering to address contemporary and future challenges in supply chain management, promoting innovation, sustainability, and resilience in an increasingly complex and interconnected business environment.

REFERENCES

Dolgui, A., & Proth, J. M. (2010). Supply chain engineering: Useful methods and techniques. Springer.

Gaikwad, L. M., et al. (2024). Application of Internet of Things (IoT) in logistics and supply chain management. In Advanced IoT technologies and applications in the Industry 4.0 digital economy (p. 202).

Gupta, H., Kusi-Sarpong, S., & Rezaei, J. (2020). Barriers and overcoming strategies to supply chain sustainability innovation. Resources, Conservation and Recycling, 161, 104819. https://doi.org/10.1016/j.resconrec.2020.104819

Knoppen, D., & Christiaanse, E. (2007). Supply chain partnering: A temporal multidisciplinary approach. Supply Chain Management: An International Journal, 12(2), 164-171. https://doi.org/10.1108/13598540710745780

Lizot, M., et al. (2019). Analysis of evaluation methods of sustainable supply chain management in production engineering journals with high impact. Sustainability, 12(1), 270. https://doi.org/10.3390/su120100270

Natarajarathinam, M., Qiu, S., & Lu, W. (2023). Designing and assessing a multidisciplinary service-learning course in supply chain management. INFORMS Transactions on Education, 23(3), 196-209. https://doi.org/10.1287/ited.2023.0267

Sanders, N. R., & Wagner, S. M. (2011). Multidisciplinary and multimethod research for addressing contemporary supply chain challenges. Journal of Business Logistics, 32(4), 317-323. https://doi.org/10.1111/j.2158-1592.2011.01029.x

Villa, A. (2002). Emerging trends in large-scale supply chain management. International Journal of Production Research, 40(15), 3487-3498. https://doi.org/10.1080/00207540210143125