



Research Paper

Examining the barriers to adopting Industry 5.0 in supply chains

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Abstract

The purpose of the present study is to investigate the barriers to the adoption of Industry 5.0 in supply chains. The research is applied in terms of purpose and survey method. The type of research is qualitative-quantitative. Given that the purpose of this study is to investigate the barriers to the adoption of Industry 5.0 in supply chains; therefore, the research method is exploratory-applied in terms of purpose; cross-sectional in terms of data collection time; in terms of philosophical inductive-deductive; and in terms of data collection method or nature and research method, survey. In order to conduct the research, the review content analysis method and DEMATEL were used. The statistical population is manufacturing industry managers. 10 people were selected as a snowball. The research tool in this study is a researcher-made paired comparison questionnaire. The analysis tool is the DEMATEL technique, which has led to the creation of cause-and-effect relationships. The results of the study indicate that the components of lack of management support, lack of capabilities and organizational commitment, security concerns, risk in data ownership and data security, and lack of government support are, in order of absolute priority, influential. This study recommends launching small and pilot projects with direct management and support from managers to prove the role of technology and innovation in improving processes. After a positive conclusion, these examples can act as a model and motivational factor for other departments and managers.

Keywords:

Industry 5.0,
 supply chain, security,
 lack of management

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Extended Abstract

Introduction

Industry 5.0 is considered to be a step beyond Industry 4.0. While Industry 4.0 emphasizes digitalization and the use of big data, the Internet of Things (IoT), and automation, Industry 5.0 focuses more on human-machine collaboration. In Industry 5.0, the way humans interact with robots and intelligent systems is of particular importance. The goal of this interaction is to improve human productivity and quality of life (Buchholz ET AL, 2021). This new paradigm aims to create more efficient, flexible, and sustainable production systems by combining the strengths of humans and machines. In the context of sustainable supply chain practices, 5.0 holds significant promise. This approach offers opportunities to optimize processes, reduce waste, improve resource utilization, enhance product quality, and enable real-time monitoring and decision-making. The aim of this literature review is to explore and analyze the key barriers that organizations face in adopting I5.0 and achieving sustainable supply chain practices. By understanding these barriers, organizations can develop effective strategies to overcome them and pave the way for successful implementation. Industry 5.0, as a transformation in industrial processes, pursues goals such as improving the quality of life, increasing human-machine collaboration and interaction, and environmental sustainability (Kaur et al, 2020). With the advancement of new technologies, this industry can become an effective and efficient model in the world of manufacturing. Different types of challenges that organizations face are related to interoperability, information technology (IT) infrastructure, connectivity, and cybersecurity. Organizational barriers include resistance to change, lack of awareness, skills gaps, and organizational culture. Regulatory barriers include inadequate frameworks, legal ambiguities, compliance challenges, and ethical considerations. Economic and financial barriers also include issues such as high costs, uncertain return on investment, and financial constraints (Palacios et al, 2021). By examining the existing literature on these barriers, this review provides insight into the challenges organizations face when adopting I5.0 in sustainable supply chain practices. The review emphasizes the importance of addressing these barriers to unlock the full potential of I5.0 and create sustainable, resilient, and efficient supply chains.

Background

Sustainable supply chain management seeks to balance economic, environmental, and social aspects in the management of supply chain activities. The economic aspect of sustainability in supply chains is achieved by ensuring that supply chain activities are efficient and cost-effective. The environmental aspect of sustainability involves reducing waste and pollutants, sourcing materials and energy from sustainable sources, and ensuring that supply chain activities do not have negative environmental impacts. Finally, the social aspect of sustainability in supply chains involves ensuring fair labor practices, safe working conditions, and social participation. The integration of I5.0 technologies in supply chain management offers significant opportunities to achieve sustainability goals. Sustainable supply chains involve balancing economic, environmental, and social considerations, and I5.0 can contribute to all three aspects (Wu et al, 2024). In addition to reducing waste and energy consumption, I5.0 can also help promote circularity in supply chains. Circular supply chains involve the reuse, remanufacture, or recycling of products and materials, which reduces the need for new resources and minimizes waste. Integrating I5.0 technologies such as predictive maintenance and digital twins can make product lifecycle management more efficient and effective, allowing organizations to extend the lifespan of products and materials and promote circularity. In addition, I5.0 can create greater transparency and traceability in supply chains, which is critical for ensuring responsible sourcing, reducing environmental risks, and promoting ethical practices. The use of blockchain technology and



smart contracts can increase transparency and traceability, enabling supply chain stakeholders to track and trace products from raw materials to the end consumer. This can help organizations identify and address environmental and social issues such as deforestation, child labor, and human rights abuses (Nazarian et al, 2024).

Method

Given that the purpose of this study is the barriers to the adoption of Industry 5.0 in supply chains; therefore, the research method is exploratory-applied in terms of purpose; cross-sectional in terms of data collection time; inductive-deductive in terms of philosophy; and survey in terms of data collection method or nature and research method. In order to conduct the research, the review content analysis method and DEMATEL were used. The statistical population is manufacturing industry managers. 10 people were selected in a snowball method. The research tool in this study is a researcher-made paired comparison questionnaire. The analysis tool is the DEMATEL technique, which has led to the creation of cause-and-effect relationships.

Results

This research was conducted using a content analysis review method, which identified 10 barriers to the adoption of Industry 5.0 in supply chains. These 10 barriers include implementation costs, lack of government support, insufficient knowledge of disruptive technologies, lack of reliable information and technologies management support, lack of internal talent and skilled workers, risk in data ownership and data security, lack of capabilities and organizational commitment, market uncertainty, and security concerns. The following components are in order of absolute influential priority. 1. Lack of management support 2. Lack of capabilities and organizational commitment 3. Security concerns 4. Risk in data ownership and data security 5. Lack of government support The following components are in order of absolute influential priority. 1. Implementation costs 2. Market uncertainty 3. Lack of reliable information and technologies 4. Insufficient knowledge of disruptive technologies 5. Lack of internal talent and skilled workers

Discussion

Based on the research results, the following are recommended: 1. Managerial training and development program: Conduct specialized training courses on Industry 5.0 technologies, their benefits, and their positive impacts on the supply chain. This program should familiarize managers with the concepts of technology and innovative solutions, and highlight the importance of management support in the success of projects. 2. Create model teams and pilot projects: Launch small, pilot projects with the management and direct support of managers to prove the role of technology and innovation in improving processes. After a positive conclusion, these models can serve as a model and motivational factor for other departments and managers. 3. Develop an organizational culture based on innovation and change: Encourage managers and employees to participate in innovation processes, hold regular workshops and meetings to discuss the benefits of Industry 5.0, and encourage the adoption of new technologies. This approach will change attitudes and increase management support.