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AI BENEFITS AND CHALLENGES IN SUPPLY CHAIN MANAGEMENT

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Abstract

The recent advancements in AI technology present significant potential for improving operations, functions, and systems within supply chain management. However, the impact of AI on supply chain management and the associated benefits and challenges remains largely unexplored within the domain. The significance of this thesis lies in the limited research on supply chain sectors from the perspective of AI. Despite the potential advantages of AI, challenges may also arise such as security vulnerabilities, privacy concerns, and ethical issues. This thesis aims to explore the benefits and challenges of utilizing AI in supply chain management within manufacturing companies, who have implemented or plan to implement AI.

Purpose Statement and Research Question

Guided by the objective of the thesis, which is to explore the benefits and challenges of AI adoption in supply chain sectors and to investigate which aspects are addressed and achieved through adopting these AI technologies, this thesis adds to some of the gaps identified in previous research. It does this by exploring the potential effects of incorporating AI in supply chain management within manufacturing entities. An initial literature review presented some information systems typically used within supply chain sectors, existing technologies, the attempts of using AI in supply chain, as well as the challenges and opportunities experienced. A survey with managerial and supply chain decision-makers and professionals was conducted to support research findings and offer insights into the impacts of AI. The thesis aimed to identify the benefits and challenges that influence decision- makers, with the goal of answering the research question RQ: “What are the benefits and challenges of adopting AI in supply chain management within manufacturing companies?”

Selection criteria for literature

The search method included Scopus and Google Scholar to identify relevant studies on AI in supply chain management, for the literature review. Criteria included keyword relevant publication in reputable journals, and high citation count. Irrelevant results were removed through automated filters and manual screening. The final selection comprised approximately 44 studies that met the criteria.

Empirical study

An empirical study was conducted using a mixed-methods approach, which incorporated

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a survey to gather responses and insights from supply chain professionals about the benefits and challenges of adopting AI in supply chain management. The survey consisted of both open-ended and Likert scale questionnaires. It was designed to answer research questions and was distributed online via email and LinkedIn. Responses were received from 50 employees in supply chain management, information systems, and technology strategy departments within different manufacturing companies. The respondents were chosen based on convenience and availability, which has led to challenges in gathering many respondents. The distribution of roles of respondents was as follows: 14% of the respondents held top management roles such as Chief Supply Chain Officer, Vice President of Excellence & Scaling, Head of Software and AI Engineering, and Senior Procurement Officer. 38% of the respondents held senior management roles such as Head of Supply Chain, Head of Procurement, Senior Director, and Senior Manager. 24% of the respondents held managerial roles such as Supply Chain Manager, Category Manager, and Data & Analytics Manager. Lastly, 24% held specialist roles such as Supply Chain Excellence Specialist, Buyer, and Planner. The distribution of respondents based on company size was as follows: 34% of the respondents worked in companies with over 10,001 employees. Another 34% worked in companies with a size of 5,001-10,000 employees. 22% of the respondents worked in companies with a size of 1,001-5,000 employees. Lastly, 10% of the respondents worked in companies with 1,000 employees or fewer. Among these, 70% were in the manufacturing industry and 52% had implemented, were currently implementing, or were planning to implement AI in their supply chain systems.

The thesis followed the convergent mixed method; a design that combined both quantitative and qualitative data to thoroughly analyze the research problem (Creswell and Creswell, 2017, p. 39). Both qualitative and quantitative analysis of the responses were conducted. The quantitative analysis followed Creswell & Creswell (2017) six steps, including reporting participant information, determining response, conducting descriptive statistical analysis, evaluating the instrument' reliability, identifying statistics and the statistical program, and presenting and interpreting results. The online survey included 12 Likert scale questions ranging from 1 (strongly disagree) to 5 (strongly agree) to measure various opinions. Statistical analysis using IBM SPSS grouped questions into two main variables, BQ and CQ, representing benefits and challenges. The overall level of experience was used as a dependent variable to show c§orrelations, with descriptive statistics organized by question concentration areas. The qualitative data, consisting of open-ended survey questions, was analyzed using a thematic analysis process. This involved data preparation, reviewing all data, beginning data coding, developing descriptions and themes, and presenting the descriptions and themes. The qualitative part of the thesis included five major open-ended questions focusing on key themes, along with questions about the respondent's role in the supply chain and their industry. These mandatory questions explored the use of AI technologies in supply chain operations, such as demand forecasting and inventory optimization, motivations for AI adoption, and the impact on various operations. Respondents also provided examples and perspectives on how AI could enhance competitive advantage and the challenges faced in implementation.

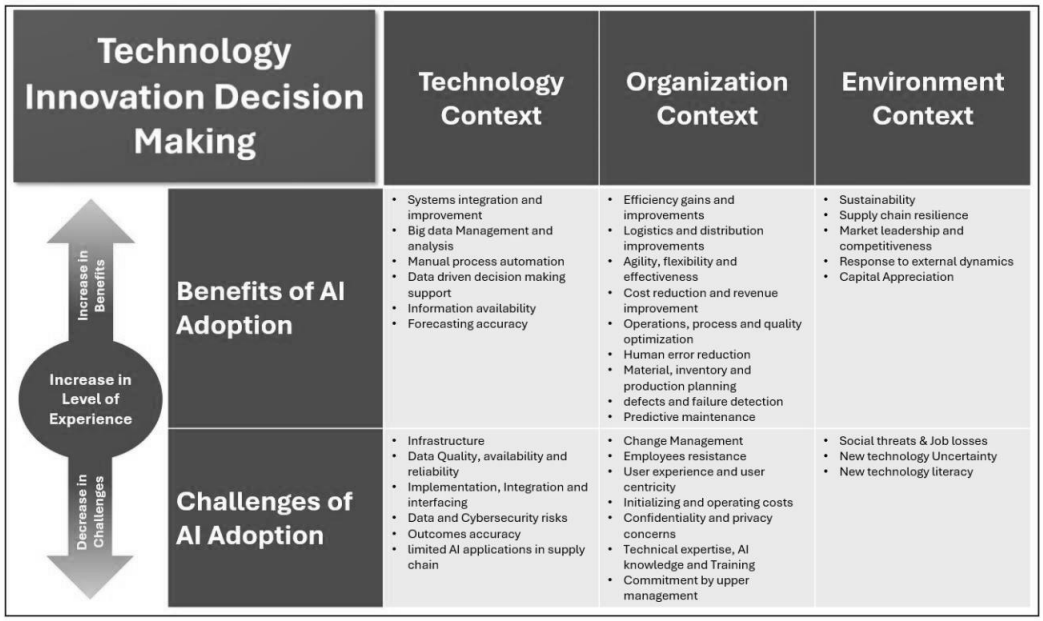
The key findings were then mapped to their corresponding contexts within the Technology-Organization Environment (TOE) framework (Yogesh et al., 2012). The TOE framework is a theoretical model at the organizational level, suggesting that a company's decision to adopt new technologies is influenced by three aspects i) the technological context, ii) the organizational context, and ii) the environmental context (Yogesh et al., 2012). This thesis finds the TOE framework suitable for understanding AI adoption in supply chain sectors for the following reasons: i) Technological: The framework covers the available AI technologies and applications, as well as the compatibility of AI with

existing supply chain systems. ii) Organizational: The framework allows organizations to identify obstacles and enablers for AI adoption and assess the readiness of the concerned organizations. iii) Environmental: The framework helps companies predict potential challenges and opportunities from the external environment (Yogesh et al., 2012).

The main themes identified from the findings include Technological Benefits, Technological Challenges, Organizational Benefits, Organizational Challenges, Environmental Benefits, and Environmental Challenges. The thesis identified several benefits of AI adoption in supply chain management, aligning with some key findings from other studies. Technological benefits include systems integration and improvement, big data management and analysis, manual process automation, data-driven decision making, information availability, and forecasting accuracy. Organizational benefits include AI impact of enhancing labor efficiency, logistics and distribution, agility, flexibility, and effectiveness. It also facilitates cost reduction, operations, process and quality optimization, and reduces human error. Environmental benefits showed that AI adoption promotes sustainability, supply chain resilience, market leadership and competitiveness, responsiveness to external dynamics, and capital appreciation. These benefits collectively contribute to the overall improvement of supply chain management, making it more efficient, effective, and sustainable. See figure 1.

Figure 1

Benefits and challenges of AI adoption in Supply Chain Management



The matrix in figure 1 illustrates the identified benefits and challenges of AI adoption, as wellas the relationship between the increase in the level of experience and the corresponding increase in adoption benefits and decrease in challenges. An increase in experience leads to anincrease in benefits and a concurrent decrease in challenges.

While AI adoption in supply chain management offers numerous benefits, it also presents several challenges. Technological Challenges include lack of data infrastructure, rigid infrastructure, quality, availability, and reliability of data, implementation, integration, and interfacing of AI with existing systems, data and cybersecurity risks, accuracy of outcomes, and limited number of AI applications that can be integrated into supply chain systems. Organizational challenges include change management, employee resistance, user experience and user centricity, lack of technical expertise, AI knowledge, and training, initializing and operating costs, confidentiality and privacy concerns, and

commitment by upper management. Moreover, environmental challenges include social threats and job losses, uncertainty about new technology, and new technology literacy. These challenges collectively contribute to the complexity of AI adoption in supply chain management, requiring careful consideration and strategic planning. The findings also revealed a relationship between the benefits and challenges of AI adoption and the level of experience of employees. It was observed that an increase in the overall level of experience leads to a decrease in challenges and an increase in benefits. See figure 1.

Conclusion

The primary contribution of this thesis is to provide insights about the technological, organizational, and environmental benefits and challenges associated with utilizing AI technologies in supply chain management. These findings will provide decision makers with a deeper understanding of the associated outcomes and equip them with the knowledge needed to overcome obstacles while utilizing AI. Furthermore, the findings will enable supply chain professionals in manufacturing companies to set clear expectations and select the relevant AI solutions needed to optimize various functions within their organizations. The main limitation of this master's thesis was the difficulty in obtaining a large number of survey responses within a short timeframe, as many targeted employees did not participate. Additionally, focusing on supply chain professionals and manufacturing companies posed challenges, given the relatively new adoption of AI technologies in both manufacturing and service sectors. Due to these limitations, a survey method was used for data collection. Future research could benefit from case studies in companies that have implemented AI in their supply chains, allowing for a detailed assessment of benefits and challenges over time. Expanding research to other sectors and using larger samples could also provide broader insights and enable generalization.

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