Barriers to AI Adoption in Supply Chain Management: Perspectives from Industry Leaders

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Article

Barriers to AI Adoption in Supply Chain Management: Perspectives from Industry Leaders

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Abstract: This study explores the adoption of artificial intelligence (AI) in supply chain management, focusing on the challenges, benefits, and strategic considerations organizations face when integrating AI technologies into their operations. The research investigates how AI is reshaping traditional supply chain models, enhancing decision-making, and improving efficiency across various sectors. Through qualitative analysis, the study identifies key barriers to AI adoption, including organizational resistance, lack of skilled personnel, high implementation costs, and insufficient data infrastructure. Furthermore, the research highlights the transformative potential of AI in optimizing supply chain processes such as demand forecasting, inventory management, and logistics coordination. It also examines the critical role of leadership in driving AI initiatives, emphasizing the need for strategic alignment, cross-functional collaboration, and a culture of continuous learning. The study's findings suggest that while AI adoption can lead to significant performance improvements, its successful integration depends on a combination of technological, organizational, and human factors. The paper concludes with a discussion on the future of AI in supply chain management, stressing the importance of addressing both technological and organizational challenges to fully realize the benefits of AI. This research contributes to the growing body of knowledge on AI in supply chain management, offering valuable insights for both academics and practitioners seeking to understand and navigate the complexities of AI implementation.

Keywords: artificial intelligence; supply chain management; AI adoption; logistics; digital transformation; barriers to AI; organizational change

1. Introduction

Artificial intelligence (AI) has emerged as a transformative force across various industries, and its potential to revolutionize supply chain management (SCM) is undeniable. With AI, organizations can unlock new levels of operational efficiency, optimize inventory management, enhance demand forecasting, and improve decision-making processes through intelligent automation and data analytics (Agarwal & Dhar, 2014). Despite these promising benefits, the adoption of AI in supply chain management has been far from universal, and many organizations still face significant barriers that prevent full-scale implementation. These challenges often range from technological limitations to organizational resistance, with each industry encountering its own set of obstacles (Avasarala & Martin, 2017; Baryannis et al., 2019). The supply chain is the backbone of any organization, influencing everything from product availability to customer satisfaction. Traditionally, supply chain management has relied on manual processes, historical data, and human decision-making to optimize the flow of goods and services. However, as global markets have become more complex and interconnected, organizations have started to realize the limitations of traditional methods, which have led them to explore more advanced technologies like AI to stay competitive (Lee & Billington, 1992; Mangan & Lalwani, 2016). AI, through machine learning, predictive analytics, and natural language processing, has the potential to address several challenges faced by supply chains, such as demand variability, inventory management, and transportation optimization (Baier & Ralston, 2021; Baryannis et al., 2019). For example, AI algorithms can process large volumes of real-time data, predict demand fluctuations with higher accuracy, and identify inefficiencies in supply

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chain processes, offering organizations a significant competitive edge (Van Hoek & Harrison, 2021). However, despite the substantial potential benefits of AI adoption in SCM, there are several significant barriers that organizations must overcome to integrate AI into their operations effectively (Emon & Khan, 2025). First, the complexity of supply chain networks and the diversity of functions involved create inherent challenges in designing and implementing AI systems (Gupta & Jain, 2020). The integration of AI requires not only the right technological infrastructure but also a deep understanding of the business processes, which may be complex and differ across various industries (Kouvelis & Zhao, 2012; Raut & Venkatesh, 2021). Moreover, organizations must address the significant issue of data quality, as AI systems are only as good as the data they process (Davis, 2017; Zhao & Lee, 2021). Many supply chains still operate with fragmented data across different departments and platforms, making it difficult to develop a unified and reliable data pool for AI applications (Jayaraman & Patterson, 2003; Helo & Shamsuzzoha, 2020). Inadequate data governance, security concerns, and the difficulty in integrating AI systems with legacy infrastructure often prevent organizations from fully realizing the potential of AI in SCM (Gupta & Kohli, 2006; Jha & Deshmukh, 2010). Another critical challenge is the reluctance and resistance to change within organizations. Traditional supply chain practices are deeply embedded in many companies' cultures, and any new technological implementation, such as AI, is often met with skepticism and fear of job displacement (Mitra & Ghosh, 2018; Tiwari & Awasar, 2020). Employees, particularly those in operational roles, may fear that AI systems will replace their jobs, even though AI is intended to complement human efforts rather than replace them. This cultural resistance can hinder the adoption of AI by slowing down the necessary organizational changes and hindering the collaboration required for successful implementation (Dufresne & Sethi, 2021). Moreover, the perception of AI as a "black-box" technology that is difficult to explain or understand also contributes to reluctance (Emon & Khan, 2025). Managers and decision-makers may be hesitant to trust AI-driven decisions if they cannot fully understand or interpret the reasoning behind them (Herhaus & Müller, 2021; Liao & Hu, 2018). The issue of cost is also a significant barrier to AI adoption in SCM. AI technologies are not only expensive to implement but also require continuous investments in training, maintenance, and upgrades to remain competitive (Davis, 2017; Gupta & Jain, 2020). Many organizations, especially smaller ones, face budget constraints that make it difficult to allocate sufficient resources to AI adoption, especially when the ROI from AI-driven supply chain improvements is not immediately apparent (Baier & Ralston, 2021). This issue is compounded by the uncertainty surrounding the long-term financial benefits of AI. Although AI promises to improve operational efficiency and reduce costs in the long term, the initial investment and the time required to see significant returns are often deterrents to adoption (Yadav & Goel, 2020; Soni & Kachru, 2018). In some cases, the costs of AI adoption are viewed as too high relative to the perceived benefits, especially for organizations that have not yet fully embraced digital transformation in their supply chains (Avasarala & Martin, 2017; Raut & Venkatesh, 2021). One of the most significant barriers that organizations face in adopting AI for SCM is the shortage of skilled talent. AI technologies require specialized knowledge in machine learning, data analytics, and advanced algorithms, which is in short supply in the labor market (Baryannis et al., 2019; Ivanov & Sokolov, 2021). The supply chain industry, traditionally not as tech-savvy as other sectors, faces particular challenges in attracting and retaining employees with the necessary AI expertise. Furthermore, existing employees may need extensive retraining to work effectively with AI systems, which requires time and resources (Dufresne & Sethi, 2021). The lack of skilled professionals can create a bottleneck, as organizations may struggle to implement AI solutions effectively without the right talent in place (Agarwal & Dhar, 2014; Tiwari & Awasar, 2020). Additionally, organizations often face difficulties in finding AI talent with specific expertise in supply chain management, which is crucial for tailoring AI solutions to the unique needs of supply chain processes (Liu & Zhang, 2020; Sun & Xu, 2019). Beyond these technical and organizational challenges, regulatory and ethical concerns also play a critical role in hindering AI adoption in SCM (Emon & Khan, 2024). As AI systems become increasingly integrated into business operations, issues related to data privacy, algorithmic bias, and the lack of clear regulatory frameworks come to the forefront

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(Davis, 2017; Helo & Shamsuzzoha, 2020). Organizations in regulated industries such as pharmaceuticals and healthcare must navigate complex legal frameworks surrounding data usage, which can significantly slow down the adoption of AI. Furthermore, the use of AI raises ethical concerns about decision-making transparency and accountability. The fear of AI systems making biased decisions—whether in procurement, demand forecasting, or inventory management—has led to caution in adopting these technologies in certain sectors (Gupta & Jain, 2020; Zhao & Lee, 2021). As the AI landscape evolves, the lack of standardized guidelines and regulations further complicates the adoption process, as organizations remain uncertain about the legal implications of using AI in their supply chains (Herhaus & Müller, 2021; Raut & Venkatesh, 2021). Despite these barriers, the potential of AI to reshape supply chain management cannot be ignored. The growing body of research on AI adoption in SCM highlights the need for a comprehensive approach to overcome these challenges. Organizations must invest in change management strategies to reduce resistance, build a data-driven culture, and ensure that employees are equipped with the skills needed to work with AI systems (Liao & Hu, 2018; Dufresne & Sethi, 2021). Moreover, collaboration between supply chain professionals, data scientists, and AI experts will be crucial for the successful integration of AI into supply chain processes (Mitra & Ghosh, 2018; Kang & Lee, 2018). As AI technologies continue to evolve and their capabilities expand, organizations will need to navigate these barriers carefully to unlock the full potential of AI in transforming supply chain management practices (Wang & Zhang, 2021; Raut & Venkatesh, 2021).

2. Literature Review

The adoption of Artificial Intelligence (AI) in supply chain management (SCM) has garnered significant attention in recent years, driven by the potential for AI to revolutionize traditional supply chain processes. AI's capabilities in automating decision-making, improving predictive analytics, and enhancing overall supply chain performance have been well-documented (Christopher & Peck, 2004; Helo & Shamsuzzoha, 2020). However, despite these promising advancements, the implementation of AI within supply chains has faced substantial barriers that hinder its widespread adoption (Khan et al., 2024). Researchers have explored the challenges, benefits, and implications of adopting AI, emphasizing the need for a deeper understanding of these factors to facilitate more efficient and effective AI integration (Davis, 2017; Liao & Hu, 2018). One of the primary challenges in AI adoption within supply chains is the organizational resistance to change and the fear of the unknown. Many organizations, especially those with traditional, manual processes, are hesitant to embrace AI due to concerns over job displacement, high implementation costs, and the complexity of integration with existing systems (Daneshvar & Guo, 2020; Gupta & Jain, 2020). In particular, firms that rely heavily on legacy systems or have not invested significantly in digital infrastructure face difficulties in integrating AI-driven solutions (Dufresne & Sethi, 2021). These barriers are compounded by the lack of skilled personnel with the necessary expertise to implement and maintain AI technologies (Kang & Lee, 2018). According to Gupta and Kohli (2006), enterprise resource planning (ERP) systems, which are widely used across industries, may face compatibility issues with AI systems, further complicating the adoption process. Despite these challenges, the potential benefits of AI adoption in supply chains are vast. AI enables improved decision-making, particularly in the areas of demand forecasting, inventory management, and transportation logistics (Baryannis et al., 2019; Tiwari & Awasar, 2020). For example, machine learning algorithms can predict future demand more accurately than traditional statistical models, which can significantly reduce inventory costs and improve customer satisfaction by ensuring the right products are available at the right time (Jha & Deshmukh, 2010). Moreover, AI can optimize routing decisions in logistics, leading to reduced transportation costs and enhanced operational efficiency (Mitra & Ghosh, 2018). The ability of AI to process and analyze large volumes of data from various sources allows for more informed decision-making, enabling firms to adapt quickly to changing market conditions (Xu & Liu, 2021). Another significant advantage of AI in SCM is its ability to enhance supply chain resilience. As global supply chains become increasingly complex and vulnerable to disruptions, such as natural disasters, geopolitical

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tensions, or pandemics, AI provides the tools to anticipate and mitigate potential risks. AI's predictive capabilities allow for early identification of potential disruptions, enabling supply chains to respond proactively rather than reactively (Christopher & Peck, 2004). AI can also support real-time monitoring of supply chain operations, ensuring that any issues are detected promptly and corrective actions are taken before they escalate into major problems (Herhaus & Müller, 2021). This capacity for real-time monitoring and risk mitigation is particularly important in today's fast-paced, globalized business environment, where delays and disruptions can have far-reaching consequences. Despite the recognized advantages, the barriers to AI adoption are substantial, and overcoming them requires strategic planning and investment. One critical factor is the lack of a clear strategy for AI implementation within organizations. According to Ivanov and Sokolov (2021), many firms lack a well-defined roadmap for integrating AI into their supply chain operations, which leads to fragmented and inefficient adoption efforts. Furthermore, the integration of AI technologies requires substantial investments in both hardware and software, as well as in employee training and development (Soni & Kachru, 2018). This financial and resource-intensive nature of AI implementation can be a deterrent for smaller firms or those with limited resources, further exacerbating the divide between organizations that can successfully adopt AI and those that cannot (Van Hoek & Harrison, 2021). The role of AI in transforming supply chains is not limited to automation and optimization; it also plays a crucial role in driving innovation. AI enables firms to explore new business models, create value-added services, and develop innovative products that cater to evolving customer demands (Wang & Zhang, 2021). The integration of AI with the Internet of Things (IoT), for example, allows for real-time tracking of goods, providing customers with greater visibility and control over their orders (Wu & Ho, 2014). This level of transparency not only enhances customer satisfaction but also improves the efficiency of supply chain operations by providing better insights into the movement of goods (Sun & Xu, 2019). Additionally, AI-driven automation allows for the development of more personalized customer experiences, which is increasingly becoming a competitive differentiator in the marketplace (Raut & Venkatesh, 2021). Moreover, AI can facilitate the integration of supply chain activities across different stakeholders. The ability to connect and integrate data from suppliers, manufacturers, distributors, and customers is essential for creating a seamless, efficient supply chain (Hong & O'Kane, 2012). AI provides the tools to analyze and optimize these integrated networks, ensuring that all stakeholders are working towards common goals and that resources are utilized efficiently (Ketchen & Hult, 2011). This level of integration is particularly important as organizations increasingly look for ways to collaborate with external partners to drive efficiencies and innovation (Mangan & Lalwani, 2016). However, this also presents its own set of challenges, including data privacy concerns, security risks, and the need for standardized protocols for data sharing (Gupta & Kohli, 2006; Liao & Hu, 2018). These challenges require careful consideration and robust solutions to ensure that AI can be implemented successfully in collaborative supply chain environments (Khan & Emon, 2025). One of the key challenges highlighted in the literature is the uncertainty surrounding the return on investment (ROI) for AI adoption in supply chains. While the potential benefits are evident, firms are often unsure of how to quantify these benefits in terms of cost savings, improved efficiency, and increased revenue (Tiwari & Awasar, 2020). This lack of clear ROI metrics can make it difficult for organizations to justify the upfront costs of AI implementation, especially in industries with thin margins or limited resources (Davis, 2017). To address this challenge, researchers suggest the development of more robust and standardized frameworks for evaluating AI's impact on supply chain performance (Dufresne & Sethi, 2021). These frameworks could provide organizations with the tools to assess the effectiveness of their AI investments and make more informed decisions regarding future AI projects. In conclusion, while the adoption of AI in supply chains offers significant opportunities for innovation, optimization, and resilience, the implementation of these technologies faces numerous challenges (Emon & Khan, 2024). The barriers to AI adoption, including organizational resistance, integration complexities, and resource limitations, must be addressed to unlock the full potential of AI in supply chain management. Future research should focus on developing strategies to overcome these barriers, as

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well as on creating frameworks for evaluating the ROI of AI investments. By doing so, firms can more effectively leverage AI to drive improvements in supply chain performance and enhance their competitive advantage in the market (Gupta & Jain, 2020; Zhao & Lee, 2021). As AI continues to evolve and its applications in SCM expand, it is likely that these challenges will be mitigated, paving the way for more widespread adoption and transformation of global supply chains.

3. Materials and Method

The research adopted a qualitative approach to explore the barriers to the adoption of artificial intelligence in supply chain management. This method was deemed appropriate due to the exploratory nature of the study and the need to gather in-depth insights from industry professionals with direct experience in supply chain operations and technology adoption. The focus was on understanding the perceptions, challenges, and organizational dynamics that influence the implementation of AI technologies within supply chains. Data collection was carried out through semi-structured interviews, which allowed for flexibility in probing deeper into specific themes while maintaining consistency across all participants. The interview protocol was developed based on an extensive review of existing literature, ensuring that the questions addressed known barriers while also leaving space for new insights to emerge. The questions were designed to elicit detailed responses regarding technological, organizational, and strategic obstacles to AI adoption. To ensure the clarity and relevance of the questions, a pilot interview was conducted with one industry expert, after which minor modifications were made to refine the interview guide. The study employed purposive sampling to select participants who held managerial or strategic roles in supply chain functions across various industries. This sampling strategy ensured that respondents had the knowledge and experience required to provide meaningful insights into the topic. A total of 22 professionals participated in the study. These individuals were drawn from a range of sectors, including manufacturing, retail, logistics, and technology services, thereby allowing for a diverse range of perspectives. All participants were contacted via email or professional networking platforms, and interviews were scheduled at mutually convenient times. Each interview was conducted virtually using video conferencing tools, owing to geographical dispersion and logistical considerations. The interviews were audio recorded with the consent of the participants and subsequently transcribed verbatim to ensure the accuracy of the data. The average duration of the interviews was approximately 45 minutes. Ethical considerations were upheld throughout the study, with all participants provided with an informed consent form outlining the purpose of the research, the voluntary nature of participation, confidentiality measures, and the option to withdraw at any stage. Thematic analysis was employed to analyze the qualitative data collected. The analysis followed a systematic process of familiarization, coding, theme development, and refinement. The initial stage involved reading through all transcripts to gain a general sense of the data. Coding was then carried out manually, identifying patterns, recurring concepts, and significant statements. These codes were subsequently organized into themes that captured the key barriers to AI adoption in supply chains, such as technological limitations, organizational resistance, skills shortages, and strategic misalignment. To enhance the credibility and reliability of the findings, member checking was conducted by sharing summaries of the interpreted data with a subset of participants for validation. Their feedback was incorporated to ensure that the analysis accurately reflected their views. Additionally, peer debriefing was employed, wherein findings were discussed with fellow researchers to reduce individual bias and improve interpretive rigor. The methodology enabled the identification of nuanced and context-specific insights that may not have been captured through quantitative methods alone. The richness of the qualitative data provided a comprehensive understanding of the challenges organizations face in adopting AI technologies within supply chains, contributing valuable knowledge to both academic research and practical applications in the field.

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4. Results and Findings

The analysis of the data collected from the 22 interview participants revealed several significant findings regarding the barriers to the adoption of artificial intelligence (AI) in supply chain management. The participants represented a diverse cross-section of industries, including manufacturing, retail, logistics, and technology services, providing a broad range of perspectives on the topic. The primary themes that emerged from the data include technological limitations, organizational challenges, financial constraints, skills gaps, and strategic misalignment. These themes reflect the complex and multifaceted nature of AI adoption in supply chains and highlight the variety of factors that companies must consider when attempting to integrate AI into their operations. One of the most frequently discussed barriers was technological limitations. Many participants pointed out that the infrastructure required to support AI technologies was often inadequate. Existing IT systems in many organizations were not designed to handle the volume, velocity, and variety of data required for AI algorithms to function effectively. This was particularly true for companies that had legacy systems in place, which were often incompatible with newer AI technologies. The integration of AI into these systems was described as a significant technical challenge, requiring extensive customization and a complete overhaul of existing IT frameworks. Even for companies with more modern systems, the complexity of AI solutions was cited as a major hurdle, with some participants mentioning that they lacked the technological maturity needed to leverage AI tools effectively. Another key finding was the organizational resistance to change. Many participants described a general reluctance within their organizations to embrace AI, particularly from middle management and frontline employees who were concerned about the potential disruption to their roles. AI adoption was often seen as a threat rather than an opportunity, and there was a widespread fear that automation would lead to job losses. This resistance to change was compounded by a lack of understanding of AI technologies and their potential benefits. Some participants noted that their organizations had made little effort to educate employees about AI or to involve them in the decision-making process regarding its adoption. Without clear communication and a strategic vision for how AI could enhance their operations, employees were often skeptical of the technology and hesitant to use it. Financial constraints also emerged as a significant barrier to AI adoption. Several participants from smaller organizations mentioned that the cost of implementing AI technologies was prohibitively high, particularly when it came to investing in the necessary hardware and software. While larger companies with more substantial budgets were able to allocate resources for AI projects, smaller organizations struggled to justify the investment without clear evidence of a return on investment (ROI). The high upfront costs, coupled with the uncertainty surrounding the long-term benefits of AI, made it difficult for many companies to commit to large-scale AI initiatives. In addition, the cost of hiring skilled professionals to implement and maintain AI systems was seen as another financial burden, with some companies opting to delay AI adoption until they could secure the necessary funds. The skills gap was another prominent barrier identified in the study. Many participants noted that their organizations lacked the in-house expertise required to successfully implement AI technologies. While there was a general recognition of the importance of AI, finding employees with the right technical skills—such as data science, machine learning, and AI programming—was a significant challenge. Companies often had to outsource AI-related tasks to external consultants or service providers, which added to the cost and complexity of the adoption process. Even when companies were able to find skilled professionals, there was concern about the ability to retain them long-term, given the competitive demand for AI talent. In some cases, organizations tried to address the skills gap by providing training to existing employees, but this was not always effective, as many participants expressed frustration with the lack of suitable training programs that could equip their teams with the necessary AI skills. Strategic misalignment was another issue that emerged from the data. Many organizations struggled to align their AI initiatives with broader business goals. AI projects were often implemented in isolation, without a clear strategy for how they would integrate with other supply chain functions or contribute to overall business objectives. This lack of strategic alignment led to fragmented and inefficient AI solutions that failed

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to deliver the desired results. Additionally, some participants pointed out that there was a lack of leadership and vision regarding AI adoption within their organizations. While senior management often recognized the importance of AI, they were frequently unable to communicate a clear vision or set realistic goals for AI implementation. This lack of direction contributed to a sense of confusion and indecision within the organization, further hindering the adoption process. Despite these barriers, several participants highlighted the potential benefits of AI in supply chain management. Improved efficiency, enhanced decision-making, and better demand forecasting were among the most commonly cited advantages. AI was seen as a powerful tool for automating routine tasks, such as inventory management and order processing, freeing up employees to focus on more strategic activities. The ability to analyze large volumes of data in real-time was also identified as a key benefit, enabling organizations to make more informed decisions and respond more quickly to changes in the market. For example, AI-based predictive analytics could help companies anticipate demand fluctuations, optimize supply chain routes, and reduce lead times, all of which could contribute to cost savings and improved customer satisfaction. Another benefit discussed by several participants was the potential for AI to enhance supply chain resilience. Many participants noted that AI could help organizations better manage disruptions, such as supply chain delays or shortages, by providing real-time data on inventory levels, supplier performance, and other critical factors. This capability could enable companies to respond more quickly and effectively to unforeseen events, reducing the impact of disruptions on their operations. Furthermore, AI could help organizations identify potential risks in their supply chains before they become major issues, allowing for proactive risk mitigation strategies. In terms of adoption strategies, the findings revealed that many organizations were taking a gradual, phased approach to implementing AI. Rather than implementing AI technologies across the entire supply chain at once, many companies started with small pilot projects in specific areas, such as demand forecasting or inventory optimization, to test the viability of the technology. This approach allowed organizations to assess the effectiveness of AI in a controlled environment before committing to larger-scale implementations. Some participants also mentioned that their organizations were collaborating with technology vendors and consultants to help navigate the complexities of AI adoption and to ensure that the right solutions were being implemented. By leveraging external expertise, companies were able to overcome some of the technical and operational challenges associated with AI adoption. Despite the challenges, there were also instances where organizations were able to successfully implement AI and achieve significant improvements in supply chain performance. One example cited by a participant was the use of AI to optimize transportation routes, which resulted in reduced fuel consumption and lower transportation costs. Another example involved the use of AI for predictive maintenance, which helped a manufacturing company minimize downtime and extend the lifespan of its machinery. These success stories demonstrated the potential of AI to transform supply chain operations, even in the face of significant barriers.

Table 1. Technological Limitations.

Sub-Themes	**Description**
Legacy System Constraints	Difficulty integrating AI with outdated or rigid legacy systems
Data Infrastructure Deficiencies	Inadequate systems for managing big data required by AI algorithms
System Compatibility Issues	Challenges in ensuring new AI tools work with current software architecture
Limited Automation Capabilities	Existing technologies not supportive of advanced AI-driven automation

Organizations often struggled to embed AI technologies into existing technological ecosystems. The incompatibility of new AI systems with legacy infrastructure created significant technical barriers, requiring either full system overhauls or complex customization. This incompatibility

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frequently resulted in delayed implementation and additional costs. In some environments, data architecture lacked the robustness to support AI's processing needs, which impacted performance and outcomes. Companies that lacked foundational automation also found it difficult to scale AI applications effectively, often leading to underutilized investments.

Table 2. Organizational Resistance.

Sub-Themes	Description
Fear of Job Displacement	Employee concerns about automation replacing human roles
Change Aversion	General reluctance to embrace new technologies within established workflows
Communication Gaps	Lack of clarity around AI initiatives and objectives
Managerial Inertia	Hesitance from leadership or middle management to support AI transitions

The reluctance within companies to embrace AI stemmed largely from internal unease about its impact on workforce roles and daily operations. Employees frequently saw AI as a threat to their job security, while leadership sometimes lacked the commitment or urgency to lead change efforts. In many cases, there was a communication disconnect between strategic leadership and operational teams, which left employees unclear about how AI would benefit or affect them. Such organizational dynamics created a hesitant environment, slowing progress and adoption timelines.

Table 3. Financial Constraints.

Sub-Themes	Description
High Initial Investment	Substantial capital required for software, hardware, and systems integration
Budget Allocation Challenges	Difficulty prioritizing AI in financial planning
ROI Uncertainty	Concerns regarding the measurability and timeline of returns on AI investment
Cost of External Expertise	Additional expenses from consultants and third-party AI vendors

Financial factors emerged as a decisive element in determining whether companies moved forward with AI integration. The cost implications of purchasing and integrating AI tools were significant, especially for small to mid-sized enterprises. Even larger companies expressed hesitance due to the unpredictability of return on investment and the lack of quantifiable short-term outcomes. Relying on external experts further inflated budgets, and with internal stakeholders often unsure about financial justification, many initiatives remained in early-stage discussions rather than execution.

Table 4. Skills and Knowledge Gaps.

Sub-Themes	Description
Lack of Technical Expertise	Insufficient in-house capabilities to design and implement AI systems
Training Deficiencies	Inadequate training programs for current staff to upskill in AI
Talent Acquisition Issues	Difficulty recruiting professionals with AI-specific competencies
Retention Challenges	Struggles to keep skilled AI professionals amid industry competition

Workforce capabilities remained a significant barrier to AI progression in supply chains. Many organizations lacked personnel with the technical knowledge necessary for even foundational AI projects. While some attempted to upskill existing teams, appropriate training programs were often unavailable or insufficiently targeted. Recruiting externally presented another challenge, with

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demand for AI talent outstripping supply. Even those who succeeded in hiring skilled professionals often found it difficult to retain them due to competitive job markets and more lucrative offers elsewhere.

Table 5. Strategic Misalignment.

Sub-Themes	Description
Lack of Unified Vision	Absence of a cohesive AI strategy across departments
Isolated Initiatives	Fragmented AI efforts with minimal cross-functional integration
Poor Goal Definition	Undefined or unrealistic objectives for AI adoption
Leadership Ambiguity	Unclear leadership roles and responsibilities concerning AI deployment

Strategic coherence was lacking in many organizations, with AI initiatives often being carried out in silos without alignment to overarching business goals. Without a shared vision or roadmap, departments acted independently, which led to inefficiencies and missed synergies. Some initiatives were launched without clearly defined outcomes, making it difficult to measure success or pivot direction. Uncertainty over who should lead AI implementation further contributed to confusion and a lack of accountability in execution.

Table 6. Perceived Value of AI.

Sub-Themes	Description
Operational Efficiency	AI seen as a tool for automating tasks and reducing manual errors
Enhanced Decision-Making	Ability to support complex data-driven decisions in real time
Demand Forecasting Improvement	Advanced prediction models improving accuracy in planning and logistics
Supply Chain Resilience	AI tools enhancing the capacity to respond to disruptions and variability

Despite facing numerous barriers, organizations widely acknowledged the potential benefits that AI could deliver. Many saw it as a transformative force capable of significantly improving efficiency and reducing operational bottlenecks. The ability of AI to process large volumes of data in real time was recognized as a game-changer for decision-making and responsiveness. Forecasting demand with higher accuracy and building more adaptive supply chains were key areas where businesses expected long-term returns, even if immediate benefits were not always apparent.

Table 7. Implementation Approaches.

Sub-Themes	Description
Pilot Projects	Small-scale initiatives to test AI's viability before wider deployment
External Collaborations	Partnerships with consultants or vendors for AI implementation
Gradual Integration	Step-by-step incorporation into supply chain processes
Feedback-Driven Adjustments	Iterative learning and course correction based on pilot results

When moving forward with AI adoption, companies often chose cautious and methodical approaches. Initial implementations were commonly limited in scope to evaluate feasibility and risk before scaling up. Collaborations with external partners were used to offset internal capability gaps and minimize risk. This phased integration allowed businesses to adapt incrementally and refine their strategies through iterative feedback. These early, controlled experiences helped inform broader AI roadmaps and gave stakeholders confidence in future expansion.

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The findings revealed a complex landscape surrounding the adoption of artificial intelligence in supply chain management, shaped by a multifaceted interplay of technological, organizational, financial, and strategic elements. Many organizations encountered significant technological constraints, particularly when integrating AI with legacy systems that lacked compatibility or adequate data infrastructure. These technical challenges were compounded by internal resistance, as employees expressed concerns about job security and leadership often failed to communicate a clear vision or offer decisive support. Financial limitations further inhibited progress, with companies struggling to justify the high initial investments and long-term return on investment amidst competing budgetary priorities. A major recurring issue was the widespread shortage of internal expertise; organizations lacked both the technical talent required to deploy AI and the training programs needed to upskill their current workforce. Strategic disconnects within organizations also emerged, with AI initiatives frequently occurring in isolation, absent alignment with broader business goals or cross-functional collaboration. Despite these challenges, there was a strong consensus around the potential value of AI in enhancing operational efficiency, improving decision-making, strengthening demand forecasting, and building more resilient supply chains. Companies that had made progress typically employed cautious, phased approaches such as pilot programs, external partnerships, and feedback-informed adjustments to mitigate risks and build internal momentum. Collectively, these findings illustrate that while the path to AI adoption in supply chains is riddled with challenges, many organizations are actively learning, adapting, and gradually moving toward more technologically advanced and agile operations.

5. Discussion

The results of the study highlighted a nuanced and evolving relationship between artificial intelligence adoption and supply chain management practices. Participants' experiences and insights illustrated that while AI holds immense potential to revolutionize supply chains through automation, predictive analytics, and real-time decision-making, its successful implementation remains challenging due to both internal and external factors. One of the most notable findings was the discrepancy between awareness of AI's potential and the actual readiness of organizations to integrate it effectively. Many supply chain professionals expressed optimism about AI's long-term value, yet their organizations struggled to move beyond early experimentation due to a lack of strategic clarity, insufficient digital infrastructure, and underdeveloped change management practices. The cultural and structural inertia within organizations also emerged as a critical challenge. Employees often viewed AI with skepticism or fear, particularly in environments where communication about technological change was limited or unclear. Without deliberate efforts to foster a culture of innovation and continuous learning, many companies found themselves stuck in pilot phases, unable to transition to full-scale deployment. Moreover, leadership commitment was inconsistent across cases. In organizations where top management demonstrated clear support, provided resources, and prioritized cross-functional collaboration, AI initiatives progressed more smoothly. Conversely, in firms lacking decisive leadership or strategic alignment, projects frequently stalled or were deprioritized. This emphasizes the importance of leadership not just as a decision-making body, but as an enabler of trust, vision, and adaptability within the workforce. Financial considerations played a pivotal role, as companies weighed the cost of AI implementation against uncertain returns. Despite recognition of AI's capacity to deliver long-term efficiency gains and competitive advantages, immediate budget constraints and short-term performance pressures often inhibited investment. The tension between innovation and operational pragmatism was particularly pronounced in smaller organizations or those in low-margin industries. In addition, participants reported difficulties in accessing or managing data in a way that would support robust AI models. Poor data quality, fragmented data systems, and concerns around data governance limited the performance and reliability of AI tools, undermining stakeholder confidence in their practical utility. Talent shortages compounded these issues. While external vendors and consultants were sometimes engaged to bridge knowledge gaps, this approach was not always sustainable or cost-effective in the

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long term. Many companies lacked internal talent with sufficient understanding of both AI and supply chain dynamics, resulting in misaligned solutions that failed to address core operational challenges. This gap also affected the ability to evaluate vendor proposals or integrate third-party systems effectively. Organizations that had made the most progress in AI integration often invested in continuous professional development, partnered with academic institutions, or built internal centers of excellence focused on innovation. A recurring theme was the importance of iterative learning and agile implementation. Rather than attempting full-scale transformation at once, organizations that achieved tangible results typically started with targeted use cases—such as demand forecasting, inventory optimization, or transportation routing—and used early outcomes to refine their approach. This incremental method allowed for internal buy-in, identification of unforeseen challenges, and gradual scaling based on proven results. Additionally, collaborative ecosystems, including partnerships with technology providers, research institutions, and industry consortia, proved beneficial in overcoming internal limitations and accelerating knowledge transfer. The findings also suggested that industry context significantly influenced AI adoption. Sectors with higher complexity, variability, and customer responsiveness requirements—such as retail, healthcare, and consumer goods—were often more motivated to pursue AI solutions than those in more stable or traditional industries. However, these same sectors also faced greater integration challenges due to legacy systems, diverse product lines, and rapidly changing market conditions. In this context, flexibility and strategic foresight emerged as vital attributes for organizations seeking to navigate the uncertainties of digital transformation. Despite the obstacles, there was a clear trend toward viewing AI as a necessary evolution rather than a speculative luxury. Participants generally recognized that competitive pressure, customer expectations, and global disruptions such as pandemics and geopolitical instability were accelerating the need for more intelligent, adaptive, and resilient supply chains. AI was increasingly seen as a strategic asset capable of enabling real-time responsiveness, risk mitigation, and more informed decision-making. As such, the study underscored that the future of AI in supply chain management would likely be shaped not just by technological advancement, but by organizations' willingness to adapt their structures, cultures, and strategies to embrace a more digital and dynamic operating environment.

6. Conclusion

This study has explored the intricate dynamics surrounding the adoption of artificial intelligence in supply chain management, revealing a landscape marked by both significant promise and considerable challenges. While the transformative potential of AI is widely acknowledged among industry professionals, the journey from conceptual appreciation to practical implementation is far from straightforward. The findings demonstrate that technological readiness alone is insufficient; successful integration depends equally on cultural adaptability, strategic alignment, leadership commitment, and a clear understanding of organizational capabilities. AI is not merely a tool to optimize existing processes but a catalyst that necessitates a fundamental shift in how supply chains are conceptualized, managed, and evolved. Organizations that have made meaningful progress in AI implementation often did so by embracing change iteratively, starting with specific, manageable projects, and gradually building the capabilities and confidence necessary for broader transformation. However, this progression requires strong cross-functional collaboration, investment in digital skills, and robust data infrastructure. Without these foundational elements, even the most advanced AI solutions may fail to deliver their intended value. It is also evident that the barriers to AI adoption are not uniform across industries or companies; instead, they are shaped by a complex interplay of internal dynamics and external market forces. This highlights the need for contextual strategies that are sensitive to sector-specific realities while remaining forward-looking. Furthermore, the study underscores the importance of leadership in driving AI initiatives. Leaders who can articulate a compelling vision, allocate resources wisely, and foster a culture of experimentation and learning are better positioned to navigate the uncertainties of digital transformation. At the same time, the importance of employee engagement and change management cannot be overstated. AI

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adoption impacts job roles, workflows, and decision-making processes, making it essential to involve employees early and often to build trust and reduce resistance. Organizations that neglect the human dimension of technological change risk undermining their own progress. In sum, while AI holds the potential to redefine supply chain performance through enhanced efficiency, agility, and responsiveness, its realization depends on more than just access to technology. It calls for a holistic approach that balances innovation with pragmatism, strategy with execution, and ambition with preparedness. As the business environment continues to evolve, the integration of AI in supply chains will likely move from being a competitive advantage to a fundamental requirement. Those organizations that can effectively navigate this transition—by aligning their structures, people, and processes with the demands of intelligent technologies—will be best positioned to thrive in an increasingly complex and fast-paced global market.

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