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ALIGNING DIGITAL TRANSFORMATION WITH STRATEGIC MANAGEMENT IN LOGISTICS

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Abstract: Digital transformation plays a vital role in enhancing competitiveness within the logistics sector, yet many organizations struggle to align technological innovation with strategic goals. To address this gap, the study examines how decision making enhances the adoption of digital technologies to strengthen competitive advantage. A five-stage methodology, including case study analysis and expert evaluation, ensures analytical depth and practical relevance. Using a mixed-methods approach, the research integrates qualitative insights from logistics professionals with ordinal logistic regression analysis to evaluate their impact on competitiveness. Findings confirm a positive and statistically significant relationship between digital implementation and performance outcomes, emphasizing the importance of strategic foresight and implementation planning. The study underscores the need to assess technological investments through a long-term strategic lens. These findings offer both academic and managerial value, providing a roadmap for logistics firms seeking to enhance resilience, efficiency, competitive advantage, and strategic alignment in a rapidly evolving digital environment.

Keywords: strategic decision making, integrated framework, digital technologies, logistics sector, competitiveness.

1. INTRODUCTION

Strategic management in the logistics sector is a critical component of organizational operations, driving efficient project management, optimizing supply chains, and ensuring a competitive advantage. Organizations increasingly rely on advanced technologies to maintain competitiveness and efficiency in today's fast-paced and dynamic global markets. As a complex and multifaceted domain, logistics management demands continuous decision making and the ability to rapidly adapt to shifting market conditions (Chandler, 1969; Porter, 1980, 1985). A key element of modern logistics management is integrating technology, which enhances supply chain planning, monitoring, and management while promoting transparency, operational speed,

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and cost reduction (Gunasekaran & Ngai, 2003; Wamba & Chatfield, 2009). Adopting digital solutions and information systems allows organizations to analyze data better, optimize transport routes, and manage inventories, enhancing overall supply chain resilience and enabling agile responses to market changes (Christopher, 2016; Meijer, 2000). Despite these clear advantages, the integration of digital technologies often faces significant challenges. According to Garner (2024), 52% of companies fail to achieve the expected outcomes from their digital technology adoption efforts. These failures often lead to inefficiencies, missed opportunities, and an inability to realize the potential of technological investments fully. This highlights a critical research gap—a lack of structured frameworks or decision support tools that guide organizations through the complexities of technology adoption and integration in logistics operations. Previous studies have explored various aspects of technology adoption in logistics (Christopher, 2016; Meijer, 2000), but few have specifically addressed how structured project management methodologies can support the effective integration of these technologies. This gap underscores the urgent need for a more strategic and systematic approach to managing digital transformations in logistics.

This research addresses the gap in understanding how decision making can enhance the successful adoption of digital technologies in logistics operations to increase competitiveness. The hypothesis examined in this study is: *"The implementation of digital technologies (IDT) in logistics positively impacts competitive advantage (CC)."* Specifically, the study investigates the role of decision making in facilitating the adoption of digital technologies within the logistics sector. The study employs a mixed-methods approach to support this hypothesis, combining qualitative research (semi-structured interviews with logistics executives and technology experts) with ordinal logistic regression analysis of technology adoption trends derived from case studies and industry data. This approach provides valuable insights into how decision-making influences the successful implementation of digital technologies in logistics. The results section primarily focuses on identifying key factors contributing to the success or failure of digital transformations in logistics through ordinal logistic regression analysis.

The paper is structured as follows: Section 2 provides a literature review on the theoretical foundation of strategic management, the importance of technology implementation in strengthening logistics ecosystems, and the role of technology in decision-making. Section 3 outlines the research methodology, detailing the mixed-methods approach used to analyze trends in technology adoption. Section 4 presents the research findings, drawing insights from expert interviews and data analysis. Section 5 offers a discussion and concludes with the implications of the findings.

2. LITERATURE REVIEW

This section offers a comprehensive review of academic literature concerning strategic management, technological advancement, and decision-making processes within the logistics domain. In light of increasing market complexity and competitiveness, the integration of strategic planning and technological innovation has emerged as a critical enabler of robust and efficient logistics ecosystems. The review is organized into three main subsections, each addressing a core thematic area.

2.1. Theoretical Foundations of Strategic Management

The concept of strategic management has evolved over the decades, drawing on diverse theoretical frameworks that emphasize its multifaceted nature. Strategic management is a systematic process that enables organizations to define long-term objectives, align resources,

and navigate complex and dynamic market environments. Classical strategic management theories, such as those proposed by Chandler (1969), highlight the alignment between structure and strategy, suggesting that a firm's organizational architecture must support its strategic intent. Similarly, Porter's (1980, 1985) competitive strategy frameworks underscore the role of industry structure and positioning in determining competitive advantage, which laid the foundation for market-based strategic thinking. White (2017) and Rahman (2019) further expanded these ideas, conceptualizing strategic management as an integrative process involving environmental analysis, goal setting, implementation, and control, all within a feedback-driven loop. They assert that effective strategy is dynamic—requiring continuous evaluation and refinement to respond to environmental volatility. Similarly, Ansoff (1987) and Saloner et al. (2005) emphasized the strategic importance of decision making in resource allocation, competitive positioning, and innovation. In particular, Ansoff (1987) was among the first to emphasize technology management as a strategic driver, arguing that the ability to assimilate and leverage new technologies offers a sustainable competitive edge. With the growing importance of digital transformation, scholars have introduced new dimensions to strategic thinking. Henry (2021) notes that organizations embracing digitalization are better positioned to anticipate and shape market trends, thus sustaining long-term leadership. Parnell (2013) supports this by highlighting technology-driven strategic models that optimize internal processes such as logistics and supply chain efficiency. From a decision-making perspective, strategic management involves making high-stakes choices under uncertainty, synthesizing data, forecasting trends, and balancing short-term trade-offs with long-term vision. This aligns with Mintzberg's (1994) view that strategy is a blend of deliberate planning and emergent adaptation. In the context of logistics, strategic decision making is critical for strengthening the logistics ecosystem. As Gregson (1976) noted, logistics management must be approached systemically, integrating decisions across the entire supply chain. Lewis et al. (2018) highlighted the effectiveness of multi-criteria decision making (MCDM) methods in optimizing logistics performance, enabling firms to make informed and balanced operational choices. Apak et al. (2013) further developed a decision-making model for evaluating supply chain execution, emphasizing that structured decision frameworks improve efficiency and responsiveness. Additionally, Charłampowicz et al. (2024) stressed the importance of integrating sustainability into strategic logistics decisions. They argue that this approach enhances both ecological outcomes and the resilience of the logistics network. An example of strategic decision making in logistics can be seen in Zara's logistics model, which integrates rapid decision-making processes to align supply chain activities with market trends. This allows the company to minimize inventory waste and maximize product availability—key enablers of Zara's sustained market advantage.

2.2. The Importance of Technology Implementation in Strengthening Logistics Ecosystems

In modern logistics management, the integration of technology has become essential for ensuring efficiency, agility, and long-term competitiveness. Digital tools, information systems, and real-time data processing capabilities allow logistics organizations to dynamically respond to demand changes, streamline operations, and improve customer service levels. Jurczak (2020) highlights that information technology enables companies to analyze data more effectively, optimize transport routes, and ensure operational transparency. Meijer (2000) introduced the concept of knowledge logistics, emphasizing that organizations with effective knowledge management systems are better equipped to reduce uncertainty and coordinate complex operations. Gunasekaran and Ngai (2003) investigated management strategies in small and

medium-sized logistics enterprises, showing that technological adoption reduces operational costs while simultaneously enhancing service quality. Varella and Buss Gonçalves (2013) also demonstrated that integrating IT into strategic planning enhances flexibility and adaptability in logistics. Christopher (2016) emphasizes the importance of real-time data exchange and digital tracking systems, which enhance supply chain visibility and resilience by predicting disruptions, improving inventory accuracy, and enabling proactive decision making. Further advancing these concepts, Wamba and Chatfield (2009) introduced an integrated framework for Big Data analytics in logistics, demonstrating how real-time analytics tools can enhance strategic alignment and decision making. Their study suggests that firms leveraging advanced analytics achieve superior demand forecasting, inventory optimization, and transportation management performance. Huo et al. (2014) examined the mediating role of IT capability in the relationship between supply chain integration and firm performance, concluding that IT acts as a critical enabler of cross-functional coordination, particularly within logistics operations. Donald et al. (2020) also developed a framework for logistics information systems, emphasizing that technology integration should be aligned with strategic goals such as responsiveness, cost leadership, and customer service enhancement. From a systems design perspective, Melnyk et al. (2010) proposed a framework for "designing for supply chain resiliency," emphasizing the role of technology in building agile logistics networks capable of withstanding disruptions. Their work demonstrates that firms with stronger technological infrastructures are more resilient and adaptive. Despite these benefits, implementing technology presents challenges. High initial investment costs, data security concerns, and the need for specialized workforce training can impede effective adoption (Zhao et al., 2024; Wamba & Chatfield, 2009). Nonetheless, aligning technological capabilities with business objectives is crucial for sustaining competitive advantage in an increasingly volatile global market.

2.3. The role of technology in decision making in logistics

Technology's role in logistics decision making is essential for optimizing operational performance and maintaining a competitive advantage. When decision making frameworks are combined with the strategic application of technology, logistics companies are empowered to make more informed, efficient, and agile decisions. Several scholars have examined the intersection of technology and decision making in logistics, contributing significantly to the development of decision-making frameworks that guide technology adoption and integration. A significant contribution to understanding decision making frameworks in logistics technology comes from Christopher (2016), who discusses how technological innovations in logistics, such as automation, AI, and data analytics, have profoundly impacted supply chain and logistics decision making. Christopher suggests that digital technologies facilitate data-driven decision making, enabling logistics managers to respond more effectively to real-time changes in demand, inventory levels, and supply chain disruptions. This results in more precise and timely decision making, which enhances efficiency and reduces costs. Another key perspective is provided by Klaus and Krieger (2013), who propose a conceptual framework for decision making in logistics that integrates both traditional and digital technologies. They emphasize the importance of aligning technology adoption with business strategy, arguing that decision making frameworks must account for technological capabilities and their potential to provide operational flexibility. This alignment ensures that logistics companies can adapt swiftly to changing environments while fully capitalizing on the benefits of new technologies. Moghaddam et al., (2025) explore the impact of artificial intelligence (AI) on decision making frameworks in logistics, particularly regarding route optimization and inventory management. The authors argue that AI technologies provide logistics companies with advanced decision-

making tools that automate processes, reduce human error, and improve forecasting accuracy. Moreover, Wang et al., (2016) analyze the role of big data in logistics decision making, proposing a decision-making framework that incorporates the use of big data analytics to enhance supply chain visibility. They highlight big data's potential to offer decision makers valuable insights into demand forecasting, inventory management, and transportation planning. By leveraging big data, logistics companies can make more accurate and timely decisions, improving overall performance. Zhang et al. (2023) extend this discussion by focusing on decision making frameworks within the context of digital transformation and Industry 4.0 technologies in logistics. Their integration into decision making frameworks helps logistics companies improve operational efficiency and increase transparency. Despite these advancements, integrating advanced technologies presents several challenges, as highlighted by Trstenjak et al. (2022). Their findings suggest that a well-structured decision-making framework, combined with the right technology and change management strategies, can significantly improve decision making processes in logistics. Ultimately, successful technology integration within logistics requires a well-structured decision-making framework, backed by strategic planning and change management strategies, to capitalize on the benefits of innovation and maintain long-term competitiveness in an evolving market.

3. DATA AND METHODOLOGY

This research aims to bridge the gap in understanding how decision-making can enhance the successful adoption of digital technologies in logistics operations to boost competitiveness. The hypothesis it examines is: "The implementation of digital technologies (IDT) in logistics positively impacts competitive advantage (CC)." The study particularly investigates the role of decision-making in facilitating the adoption of digital technologies within the logistics sector. Employing a mixed-methods approach, the research combines qualitative insights from semi-structured interviews with logistics executives and technology experts, along with ordinal logistic regression analysis of technology adoption trends derived from case studies and industry data. This methodology provides valuable insights into how decision-making influences the successful implementation of digital technologies in logistics.

The research continues by analyzing data from a survey conducted in EU countries in 2025. This study employs a five-stage methodology systematically designed to achieve the defined research objectives.

In the first stage, a structured questionnaire is developed to guide semi-structured interviews to evaluate the impact of digital technology implementation in logistics.

The second stage involves the selection of experts for the semi-structured interviews. These experts are C-level executives, senior managers, and project and process managers with over 10 years of experience in the field. Their extensive knowledge and experience provide critical insights into the challenges and strategies associated with adopting digital technologies, ensuring the validity and relevance of the gathered data.

The third stage consists of conducting the semi-structured interviews with the selected participants. Their responses are carefully recorded and analyzed to extract meaningful insights for further research.

In the fourth stage of this study, ordinal logistic regression analysis is employed to address the research questions by examining the relationships between the ordinal dependent variable and one or more independent variables. This technique allows researchers to estimate the odds of a particular outcome in the dependent variable based on the values of the independent variables, while controlling for other factors. Ordinal logistic regression is particularly useful when the dependent variable is categorical with ordered levels, as it models

and quantifies the relationship between the dependent and independent variables (Hair et al., 2010). Regression analysis has been widely applied in logistics research to understand the dynamic interactions between technological advancements and performance metrics. For instance, Yu et al., (2021) used regression models to explore the impact of technology adoption on logistics performance, focusing on how information technologies affect operational efficiencies in supply chains. Zhang et al., (2023) examined the influence of digital transformation on the performance of logistics service providers, highlighting how advanced technologies affect service quality and cost efficiency. Lu et al. (2020) investigated the relationship between big data adoption and logistics performance, identifying how data-driven decisions enhance logistics effectiveness and improve responsiveness to market changes.

Furthermore, Shee et al. (2018) studied the effect of cloud-based logistics platforms on inventory management and supply chain coordination, while Yuan et al. (2023) assessed the role of digitalization in reducing supply chain disruptions and its impact on operational resilience. These studies illustrate the widespread application of regression analysis in logistics, particularly in understanding how digital technologies influence various performance outcomes, such as efficiency, sustainability, and resilience. This study employs ordinal logistic regression analysis to examine how the implementation of digital technologies in logistics influences competitiveness. Additionally, ordinal logistic regression enables the estimation of outcome probabilities across ordered categories based on identified relationships, offering valuable insights into technology adoption patterns and their strategic implications for logistics management (Eq. (1)).

$$Y = c_1 + c_2{}^{*}X \tag{1}$$

Y– competitive advantage (CC); X– implementation of digital technologies (IDT); c_1 – intercept; c_2 – coeficient for X

The use of EViews facilitated a more precise and efficient execution of the ordinal logistic regression techniques, enabling a systematic approach to identifying meaningful relationships between competitive advantage (CC) and decision-making processes in the implementation of digital technologies (IDT).

The hypothesis examined in this study is: "The implementation of digital technologies (IDT) in logistics positively impacts competitive advantage (CC)."

Table 1 below provides a comprehensive overview of various technological areas, their operational purposes, and the corresponding technologies used in different operational domains. It also includes the Web of Science citation counts for each technology, which indicates the level of academic recognition and relevance within the field.

Table 1. Technologies in Operations and Their Academic Recognition

Technological Area	Technology	Web of Science number of citations for authors
Warehousing	Warehouse Management System (WMS)	120
	Intralogistic Automation	1
	Coreless Stretch Film	9
	Inventory Automatization	2
Automation / Material Handling	AGV/AMR	391
Safety and Security	SLAM/Lidar	102
Picking and Packing	Artificial Intelligence	1069
	RPA	15
	Omni	78
	Inventory Control System	38
	ERP	94
	Inventory Management	242
Picking and Packing / Data Analysis	SAP	56
Transport Management	C3 Computed Tomography Scanners	65
	MyDello	-
	Ortec	2
	TPS ABM Cloud	120
	Routing Solution	218
	Cargo Tracking System	86
Data Analysis, Interpretation and Exploration	DVS	322
	ESRI/ArcGIS	20
	Web Self-Invoice	4
	Digital Integration	630
	Operations Time Tracking Software	310
	IFS	78
	CRM	215
	Qlik	-

In the fifth and final stage, the descriptive and ordinal logistic regression analysis results were assessed for the chosen technologies, providing robust evidence to support the research criteria.

4. RESULTS

The results section is divided into two parts: the descriptive and ordinal logistic regression analyses, each providing valuable insights into the relationships and differences among the variables under study.

Descriptive analysis results. The descriptive analysis evaluates various digital technology implementation cases within business operations, highlighting successful integrations and notable challenges in decision making and deployment strategies.

One of the most prominent success cases is implementing the MyDello platform, which enables clients to access optimal international shipping options instantly. The platform provides immediate multi-modal transport solutions, significantly reducing proposal waiting times and enhancing customer satisfaction. This solution also contributes to internal process optimization by minimizing manual involvement in logistics planning. Another positive example is the deployment of the TPS ABM cloud solution, which successfully optimized routing processes and resulted in a 20% reduction in logistics costs. Similarly, the inventory automation system, implemented following a successful pilot in Europe, proved the effectiveness of automated inventory management. It aimed to minimize manual errors, enhance stock visibility, and

improve fulfillment speed—successfully achieved objectives. Implementing the Warehouse Management System (WMS) in two operational warehouses also yielded positive outcomes. A strategic approach was taken by aligning the system rollout with the annual inventory process, ensuring minimal disruption to operations. As a result, a higher volume of order lines was processed with the same number of employees, leading to faster delivery times and improved service levels. However, several cases highlighted the complexities and risks associated with digital transformation. WMS migration from the legacy system to a new solution failed to adhere to a structured implementation plan. Consequently, order processing was halted for an entire week. This case underscores the importance of phased rollouts and the presence of in-house IT expertise. A similar scenario occurred during the deployment of a routing solution, where decisions were made without a detailed operational framework. The implementation process lacked coordination and revealed gaps in internal technological competencies, resulting in suboptimal performance.

In contrast, a tracking system proved a strategic advantage, enabling process optimization and reinforcing customer-centric flexibility. This technology differentiated the company in a competitive market and paved the way for further digital process innovations. Respondents emphasized the critical role of structured decision-making methods in successfully adopting digital technologies. Approximately 45% of respondents rated decision making in digital transformation as very important, 36% as high importance, 15% as moderately important, and only 3% considered it of low importance. These findings highlight a broad recognition of the strategic value of well-grounded decisions during technological change. Overall, the implementation of technologies such as MyDello, DVS, ESRI/ArcGIS, third-generation (C3) computed tomography scanners, routing systems, WMS, inventory automation, digital integration, RPA, SAP, and IFS was largely perceived as well-executed and effectively integrated. However, other solutions—particularly ERP, inventory management systems, AI, AGV/AMR, and Ortec—revealed a need for improved decision-making processes and more structured implementation strategies. Ultimately, the findings demonstrate that technological success is not solely determined by the tools adopted but by the quality of decisions and the adaptability of implementation strategies.

Ordinal logistic regression analysis results. To analyze decision-making in the context of competitiveness, statistical data were processed using the EViewer statistical package. The data were analyzed using an ordered logistic regression model, where the dependent variable, CC, consists of three ordered categories. The independent variable included in the model was IDT. The estimated model equations are presented in Equations (2) and (3).

$$\text{logit}\left(\text{P}(\text{Y} \leq 1)\right) = 4.84 - 1.4^{*}X \qquad (2)$$

$$\text{logit}\left(\text{P}(\text{Y} \leq 2)\right) = 6.88 - 1.4^{*}X \qquad (3)$$

X represents the independent variable; lowest 4.84 and middle 6.88 are the threshold parameters (cutpoints) that define the boundaries between the ordinal categories; -1.40 is the estimated coefficient for IDT (note that the ordered logit formulation subtracts the linear predictor from each threshold)

The results indicate that higher values of IDT are associated with a decreased likelihood of being in the lower categories of CC, and thus increase the probability of falling into higher outcome categories. The IDT coefficient is statistically significant ($p = 0.012$), suggesting a meaningful relationship between IDT and the ordering of the dependent variable. Model fit statistics support the adequacy of the model, with a pseudo R^2 value of 0.30, and a statistically significant likelihood ratio test (LR statistic = 20.86, $p < 0.001$). These indicators suggest that the model explains a substantial proportion of the variance in outcomes. Furthermore, the model

includes two statistically significant threshold points—LIMIT_4: C(2) = 4.84 (p = 0.035) and LIMIT_5: C(3) = 6.88 (p = 0.005)—which delineate the three ordinal categories and define the latent scale underlying respondents' transitions between levels of perceived competitive advantage.

Dependent Variable: CC
Method: ML - Ordered Logit (Newton-Raphson / Marquardt steps)
Date: 04/13/25 Time: 17:25
Sample: 1 33
Included observations: 33
Number of ordered indicator values: 3
Convergence achieved after 7 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
IDT	1.408221	0.561960	2.505910	0.0122
Limit Points				
LIMIT_4:C(2)	4.843998	2.304195	2.102252	0.0355
LIMIT_5:C(3)	6.888062	2.457820	2.802508	0.0051

Pseudo R-squared	0.303363	Akaike info criterion	1.633191
Schwarz criterion	1.769237	Log likelihood	-23.94765
Hannan-Quinn criter.	1.678966	Restr. log likelihood	-34.37611
LR statistic	20.85691	Avg. log likelihood	-0.725686
Prob(LR statistic)	0.000005		

Figure 1. Results of ordinal logistic regression Analysis

Figure 1 presents the results of the ordinal logistic regression model that was employed to investigate the effect of digital technology implementation (IDT) on the perceived level of competitive advantage (CC) within the logistics sector. The dependent variable, CC, represents an ordinal measure of competitive advantage, categorized into three ordered levels ranging from low to high. The model was estimated using the maximum likelihood method and achieved convergence after seven iterations, based on a sample of 33 observations. The estimated coefficient for IDT is 1.40 (standard error = 0.5620, z = 2.506, p = 0.0122), indicating a statistically significant positive effect. This suggests that higher levels of digital technology implementation are associated with an increased likelihood of reporting stronger competitive advantage. Overall, the findings provide empirical evidence that the implementation of digital technologies significantly contributes to enhancing competitive advantage in the logistics sector, underscoring the strategic importance of digital transformation in modern logistics operations.

Figure 2 presents the histogram and descriptive statistics of the residuals from the regression model. The distribution is centered around zero, with a mean of approximately 3.64×10^{-13} and a median of 0.007, suggesting no systematic bias. The residuals range from –0.77 o 0.89, indicating a moderate spread, as further confirmed by the standard deviation of 0.44.

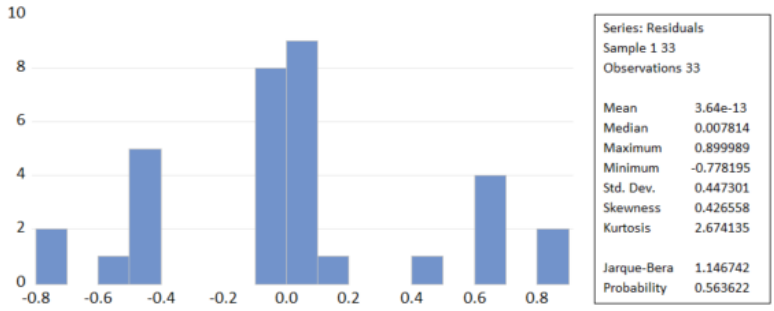

Figure 2. Histogram and descriptive statistics of model residuals

The residuals exhibit slight positive skewness (0.43) and a kurtosis of 2.67—both values reasonably close to those of a normal distribution. The Jarque-Bera statistic of 1.15 and its associated p-value of 0.56 indicate that the null hypothesis of normality cannot be rejected, thus supporting the assumption of normally distributed residuals. These diagnostic results confirm that the error terms behave in accordance with the assumptions of the regression model, reinforcing the reliability and validity of the estimated results.

5. DISCUSSIONS

This study makes a significant contribution to the existing literature on the strategic implementation of digital technologies in logistics by addressing several research gaps identified in prior academic works. While numerous scholars have emphasized the theoretical foundations of strategic management (e.g., Chandler, 1969; Porter, 1980; Mintzberg, 1994; Ansoff, 1987), there has been a lack of empirical research exploring how these principles are operationalized in the context of real-world digital technology implementation within logistics systems. This research bridges that gap by combining theoretical insights with field-based evidence drawn from semi-structured interviews and regression analysis, offering a more nuanced understanding of how technology implementation decisions translate into competitive advantage. Importantly, this research also offers methodological originality by applying a replicable regression model that incorporates industry-specific variables and decision-making dimensions rarely captured in previous studies. The integration of qualitative and quantitative data sources—namely, semi-structured interviews triangulated with organizational performance metrics—provides a multi-dimensional approach that enhances both analytical robustness and practical relevance. The uniqueness of the sample, drawn from diverse logistics firms across the EU, and the inclusion of variables, strategic alignment, and implementation quality make this model a valuable tool for future academic and managerial application. Building upon the methodological foundation, this study further explores the strategic implications of technology adoption in logistics. Several existing studies (e.g., Gunasekaran & Ngai, 2003; Christopher, 2016; Wamba & Chatfield, 2009) have highlighted the role of technology in enhancing logistics performance, particularly through automation, data analytics, and real-time information systems. However, relatively few have examined how structured decision-making frameworks influence the successful adoption and integration of these technologies. This article responds to that gap by demonstrating that decision quality and implementation strategy are equally important, or potentially more influential, than the technologies themselves. Furthermore, while Moghaddam et al., (2025) and Zhang et al., (2023) have explored the influence of AI and Industry 4.0 technologies on logistics decision-making,

they have largely focused on conceptual frameworks without empirical validation. This study extends their work by presenting statistically significant evidence ($\beta = 0.4552$, $p = 0.0293$) supporting the relationship between the implementation of digital technologies (IDT) and competitive advantage (CC), using real-world data from logistics firms operating in the EU. By empirically validating a regression model that quantifies this relationship, the study provides a concrete framework for assessing the direct impact of digital technologies on competitive advantage in logistics. This study also addresses a notable gap in the literature concerning failed or suboptimal technology implementations. While most existing research emphasizes success stories (e.g., Donald et al., 2020; Varella et al., 2013), this article presents counterexamples—such as failed WMS migrations and routing system deployments—that underscore the consequences of poor planning and insufficient decision support. These findings contribute to the underexplored discussion on risk management and strategic preparedness in logistics transformations. In addition, although authors such as Apak et al., (2013) and Faulin et al., (2018) have discussed decision-making models in logistics, they do not fully integrate sustainability or resilience as strategic dimensions. This study builds on the recent findings of Charłampowicz et al. (2024), emphasizing that integrating sustainability into decision-making is not merely an ethical imperative but also a strategic one. Our results confirm that well-structured digital transformation initiatives can simultaneously support environmental objectives and enhance systemic resilience. Lastly, while Zhou et al., (2024) and Melnyk et al., (2010) have emphasized the importance of IT capability and supply chain resilience, they stop short of providing concrete frameworks for assessing technology's direct influence on competitive advantage. This study fills that gap by empirically validating a regression model that quantifies this relationship, offering a practical tool for both academics and practitioners to assess the strategic value of digital transformation initiatives.

Despite the breadth of these insights, several limitations merit consideration. The geographic focus on EU-based logistics firms may constrain the generalizability of findings to other regions with different regulatory or operational environments. Additionally, although triangulation was employed, the reliance on self-reported data from interviews introduces a degree of subjectivity that may influence interpretation. However, the study did not delve into the full complexity of each technology, nor did it encompass all digital solutions currently utilized in the logistics sector. Additionally, experts did not identify specific success factors for every technology, which may restrict the broader applicability of the results.

Future research could benefit from longitudinal studies or in-depth case analyses to address these limitations and assess the lasting effects of digital transformation strategies. Expanding the investigation to include a broader range of decision-making factors would also contribute to a deeper and more nuanced understanding of how companies can effectively harness digital technologies to maintain a competitive edge. Such inquiries could help refine strategic frameworks and guide evidence-based technology investments.

6. CONCLUSION

Strategic management in the logistics sector is undergoing a profound transformation driven by digital technologies, data analytics, and dynamic project management frameworks. Successful digital transformation requires integrating technological capabilities with strategic foresight, robust project management, and a culture of continuous learning and adaptation.

This multi-stage research provides a rigorous and structured approach to evaluating the strategic impact of digital technology implementation in the logistics sector. The study offers a comprehensive understanding of how digital transformation shapes competitive advantage by integrating qualitative insights from experienced professionals and quantitative analysis via

regression modeling. The five-stage methodology ensured a thorough examination of both expert perspectives and empirical data. The research maintains methodological robustness and practical relevance, from developing a targeted questionnaire and engaging seasoned logistics professionals to applying advanced statistical tools like ordinal logistic regression analysis using EViews.

Theoretical insights and empirical findings jointly reveal that effective strategic management is not limited to adopting advanced technologies—it also demands well-structured decision-making processes, organizational readiness, and alignment between technological initiatives and business objectives. The analysis of results provides a comprehensive overview of how digital technology implementation influences competitiveness in the logistics sector. The descriptive analysis reveals that while many digital transformation initiatives—such as MyDello, TPS ABM, inventory automation, and WMS systems—led to clear operational and strategic benefits, success was largely contingent upon structured decision making and careful implementation planning. Conversely, failed or problematic cases, particularly those involving ERP, routing systems, or AI integration, highlight the risks associated with insufficient preparation, lack of internal expertise, and inadequate project coordination. Respondent feedback confirms the central role of decision-making quality, with over 80% rating it as highly or very important in the context of digital transformation. Furthermore, the research validates that decision making is central to technology-driven transformation. Respondents overwhelmingly recognized structured and informed decision making as a critical success factor.

The hypothesis that "digital technology implementation (IDT) in logistics positively impacts competitive advantage (CC)" was supported by ordinal logistic regression analysis. Based on a sample of 33 observations, the results show that higher levels of IDT significantly increase the likelihood of stronger competitive advantage. Two significant threshold points delineate the ordinal categories of CC, and model fit statistics confirm adequate specification. The findings underscore the strategic importance of digital transformation in enhancing competitiveness within logistics operations. The results also emphasize the need for informed decision-making, structured implementation, and adaptability to context-specific challenges. Additionally, the analysis of residuals confirms that the model accurately captures the relationship between IDT and competitive advantage, with no significant bias or skewness. Overall, the regression model is well-specified and appropriate for examining the impact of digital technology in logistics.

Moreover, the descriptive and ordinal logistic regression analyses further validated these findings' consistency across different technological domains. Incorporating citation metrics from the Web of Science reinforces the selected technologies' academic relevance, bridging the gap between theory and practice.

Based on these findings, it is recommended that logistics companies conduct a strategic impact assessment before implementing new technologies. This assessment should evaluate not only the technological but also the long-term business impact. Such an approach would allow for better anticipation of the threats and opportunities associated with adopting innovations.

Ultimately, this study offers a roadmap for logistics firms seeking to enhance competitiveness and resilience by strategically embedding digital transformation into the heart of their decision making and management practices.

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