

Methodological Literature Review on the Impact of Digital Technology Adoption on Supply Chain Performance

Revue de littérature méthodologique sur l'impact de l'adoption des technologies numériques sur la performance de la chaîne logistique

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Abstract

This paper provides a methodological literature review on the approaches used to study the effect of digital technology adoption on supply chain performance, by systematically sampling 15 peer-reviewed articles from Scopus and Web of Science. The paper identifies the dominant methodologies, evaluates their strengths and weaknesses, and identifies gaps in the literature. The findings suggest two main themes of quantitative methodologies (especially structural equation modeling (SEM)), and under studied qualitative or mixed methodologies. This paper calls for a methodologically balanced future towards a mixed, three-phase method approach which includes qualitative exploration, quantitative validation and triangulation. It provides a more holistic and defensible model for future empirical research. We also detail the normative process we took to ensure methodological rigor and transparency, including our use of standard practices such as PRISMA reporting, and using data visualization techniques of word clouds and co-authorship networks.

Keywords: Digital technologies, Supply chain, Methodology, Structural Equation Modeling, PRISMA, Mixed methods.

JEL Classification : M11, M15, L23, O33, C83.

Paper type: Theoretical Research

Résumé

Cet article propose une revue méthodologique de la littérature sur les approches utilisées pour étudier l'effet de l'adoption du numérique sur la performance de la chaîne d'approvisionnement, en échantillonnant systématiquement 15 articles évalués par des pairs issus de Scopus et de Web of Science. L'article identifie les méthodologies dominantes, évalue leurs forces et leurs faiblesses, et identifie les lacunes de la littérature. Les résultats suggèrent deux thèmes principaux : les méthodologies quantitatives (notamment la modélisation par équations structurelles (MES)) et les méthodologies qualitatives ou mixtes, peu étudiées. Cet article appelle à un avenir méthodologiquement équilibré, vers une approche mixte en trois phases, incluant l'exploration qualitative, la validation quantitative et la triangulation. Il fournit un modèle plus holistique et défendable pour les recherches empiriques futures. Nous détaillons également le processus normatif que nous avons suivi pour garantir la rigueur et la transparence méthodologiques, notamment notre recours à des pratiques standard telles que les rapports PRISMA, et l'utilisation de techniques de visualisation de données par nuages de mots et de réseaux de co-auteurs.

Mots clés: Technologies numériques, Chaîne logistique, Méthodologie, Modélisation par équations structurelles, PRISMA, Méthodes mixtes.

Classification JEL : M11, M15, L23, O33, C83.

Type de papier: Recherche théorique

1. Introduction

The digitalization of supply chains is at the forefront of contemporary supply chain management and encompasses many innovations in technological developments like blockchain, the Internet of Things (IoT), and artificial intelligence (AI). These technologies have improved transparency, efficiency, and forecasting within logistics processes and have allowed for real-time management of product and information flows. For example, blockchain technology enables improvement of traceability and security of transactions; IoT refers to the ability to continuously monitor inventory and transportation; and AI supports data-driven decision-making, reduced costs, and better responsiveness in supply chains.

In recent years, the digital transformation of supply chains has attracted growing attention from both researchers and practitioners (Ivanov & Dolgui, 2021; Dubey et al., 2020). The integration of these technologies has not only reshaped operational processes but also redefined strategic models of collaboration and performance across industries. Several studies (Bag et al., 2021; Queiroz et al., 2022; Al Tera et al., 2024) have highlighted how digital technologies enhance agility, resilience, and sustainability, thus positioning digitalization as a critical driver of competitive advantage. However, the magnitude and nature of this impact remain difficult to assess consistently across different studies and contexts.

Despite the amount of literature examining the effects of these technologies on supply chain performance, there remains a significant gap in comparative studies regarding the methods in which studies have examined the adoption of these technologies. The variation in research designs (qualitative, quantitative, and mixed methods), together with industrial and geographical contexts, creates uncertainty about the best methods for evaluating digital transformation projects. This gap has implications for both theory and practice. From a theoretical standpoint, without a methodology benchmark, studies may be vague and cannot be compared to one and other, which would inhibit any meaningful impact on theory. From a practice perspective, without a clearly defined methodology, practitioners may not be able to make evidence-based, effective decisions relating to supply chain digitalization and its interventions.

Indeed, a growing number of reviews have addressed digital transformation in supply chains (e.g., Moktadir et al., 2018; Jamwal et al., 2022), but few have explicitly analyzed the methodological diversity of these studies. This lack of methodological synthesis limits the ability to generalize findings or identify patterns in research design. Therefore, understanding how scholars have approached the study of digital technology adoption—what methods they used, why, and in what contexts—constitutes a relevant and necessary contribution to the existing body of knowledge.

As a result, this paper has two main objectives. First, to review the methods used for studying supply chain digitalization in a systematic way by commenting on methods' capabilities, shortcomings, and usages. Second, the paper offers an integrated hybrid method that would assist researchers in future research, maximizing the rigor of quantitative validation and the depth of qualitative methods. With this proposal, the paper aims to guide researchers to systematically steer them toward rigorous and contextually relevant studies on the adoption of digital technology in supply chains.

Accordingly, the central research question guiding this study is: *How have researchers methodologically examined the relationship between digital technology adoption and supply chain performance, and what methodological insights can be drawn for future investigations?* This methodological perspective is justified by the need to clarify the strengths and weaknesses of current approaches, and to provide a conceptual foundation for future empirical research. By focusing on the methodological aspects of prior studies, this article contributes to both academic rigor and managerial relevance. It helps scholars design more robust research models and assists

practitioners in interpreting research findings with a better understanding of their methodological underpinnings. The remainder of this paper is organized as follows: Section 2 presents the theoretical background and related work; Section 3 outlines the research methodology; Section 4 discusses the main results and implications; and Section 5 concludes with recommendations and directions for future research.

2. Methodology

2.1 Requests

In our research, we developed two textual queries of: "Digitalization" and "Supply Chain" as well as "Digital Technologies" and "Supply Chain." These queries helped us accumulate an enormous amount of articles and brought us to the general area we want to research. The key to successful and relevant research is a strong textual query. To make sense of this query, digitalization means converting analog information into a digital representation, allowing for the inclusion of digital technologies in any number of processes and operations. Digitalization uses digital technologies to help automate, enhance and innovate workflows and services. Digitalization enables traditional business practices to leverage real-time data processing and access, automation of labor, and improved communications between many channels. Digitalization can improve efficiencies of operation but has also enabled new business models and new opportunities for innovation. Digital technologies comprise the tools and systems that facilitate digitalization, e.g. cloud computing, artificial intelligence (AI), the Internet of Things (IoT), big data analytics, and blockchain are all innovations of the digital technologies. These technologies make it possible for organizations to collect, store, analyze and act upon data in ways that help organization make decisions, modernize customer experiences, and improve supply chain operations. On the other hand, the term supply chain identifies the network of all parties involved in producing, delivering and consuming a product: Suppliers, manufacturers, wholesalers, distributors, retailers, and customers. Supply chains identify the entire life cycle of a product including the sourcing of raw material, processing of inputs, production management, storage, transportation, and finally delivering the final product to the end consumer using a retailer. To accomplish this, active supply chain management involves coordinating the collective to maximize efficiency, minimize costs, and provide customers the greatest satisfaction and experience possible. In asking this question, we can better understand (1) the digitalization of supply chain, (2) how supply chains digitalize, and (3) how they each affect and impact one another. Specifically, we can learn about a variety of digital technologies that can get us thoughts or ideas on how develop digital approaches to understand our supply chain processes to improve performance and resilience.

2.2 Scientific Databases

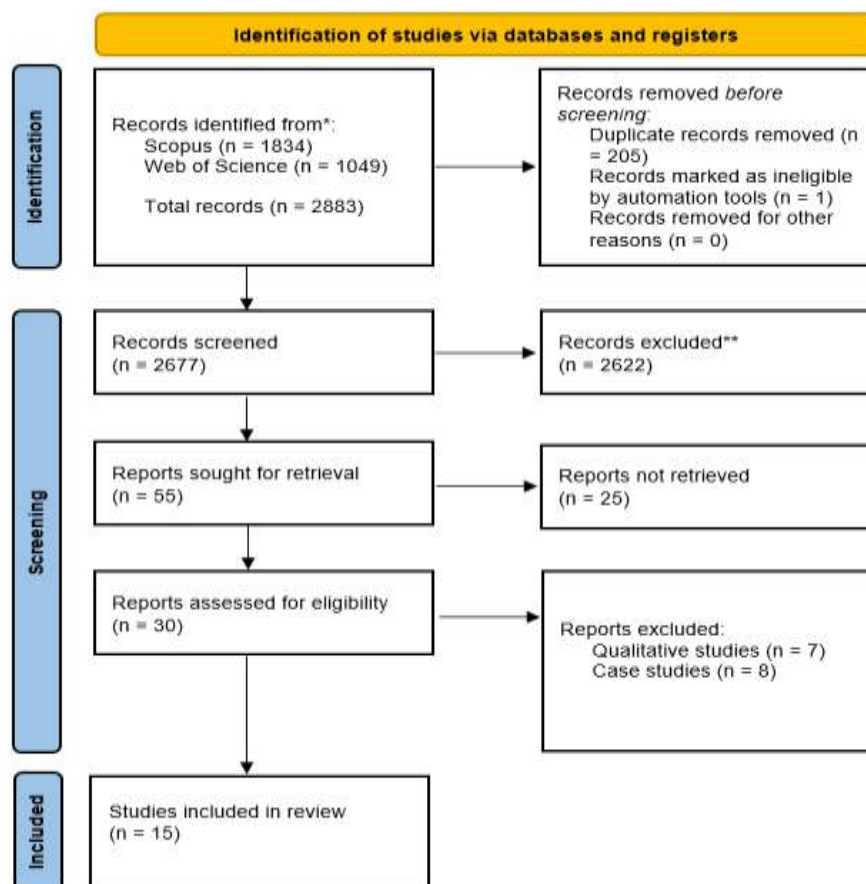
With regard to the databases we used for resources, we used two main databases, Scopus and Web of Science. These databases are paramount for our research because they allow us to collect many articles. Scopus is an abstracting and citation database, covering a wide range of disciplines, and giving access to a multitude of peer-reviewed literature, conference proceedings, and patents. This type of database has indexing and citation analysis tools, which can be useful for assessing the impact of published works, also for making sure we do research with acceptable reliability. In turn, Web of Science is an important research database provider, providing access to a limited number of legitimate scholarly content, which is differentiated across types of content. It too had various citation indexes which allow research to perform citation analysis to tap into the influence of articles for their disciplines. By considering these reputable databases, we established the relevance and quality of the articles we gathered into

our systematic literature review. Using Scopus and Web of Science allowed us to conduct comprehensive reviews of existing literature, but more explicitly allowed us to gauge themes, approaches, and gaps in the literature on the digitalization of supply chain management.

2.3 PRISMA

To systematically and quantitatively assess our references, we applied the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analyses) process illustrated in the flow diagram below. PRISMA is a commonly recognised process to assist researchers to transactionally undertake systematic reviews and meta-analyses. The PRISMA process supports transparency and reproducibility in research by following a structured pathway to reporting the selection procedure undertaken for research studies. The PRISMA method is defined by a four-phase flow diagram which consists of, Phase 1. Identification: This phase retains all studies found through the relevant databases that produce the total number of records identified by database searching and other sources. Phase 2. Screening: This phase removes duplicate searching and undoes initial or incomplete screening based on the pre-determined inclusion/exclusion criteria, retaining those studies for further evaluation. Phase 3. Eligibility: This phase undertakes a full-text review of the remaining studies based on eligibility against the defined criteria. Phase 4. Inclusion: Reviews the number of studies that are included in the systematic review. This final number represents the relevant articles for the systematic review and meets the purpose of this research.

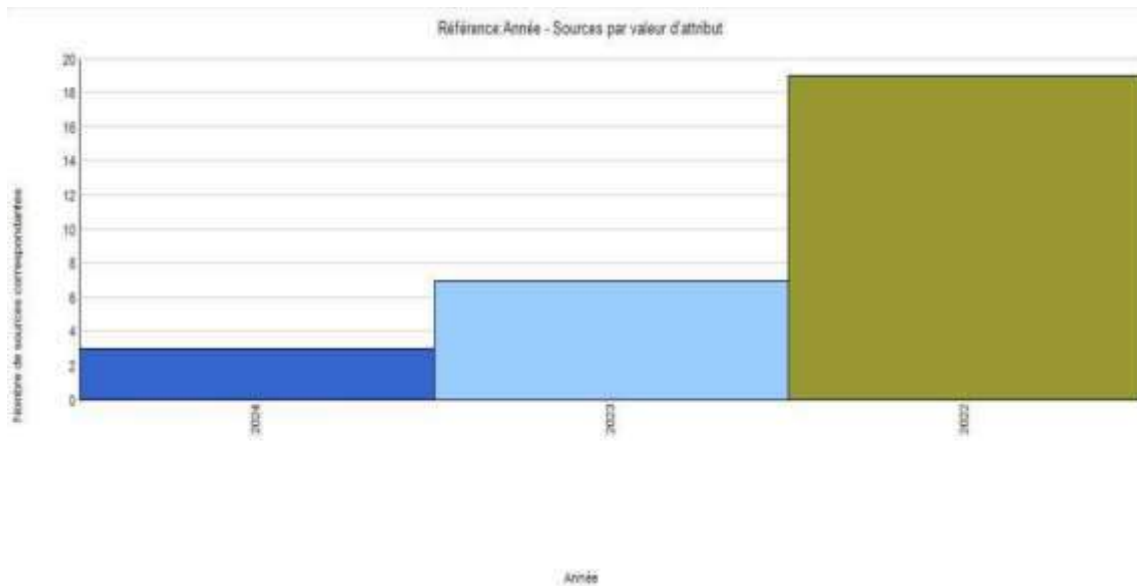
Figure 1: PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only



Source: Developed by the author

Structural Equation Modeling (SEM) for analyzing relationships and Delphi methods for expert consensus building.

Figure 3: Reference Year - Sources by Attribute Value



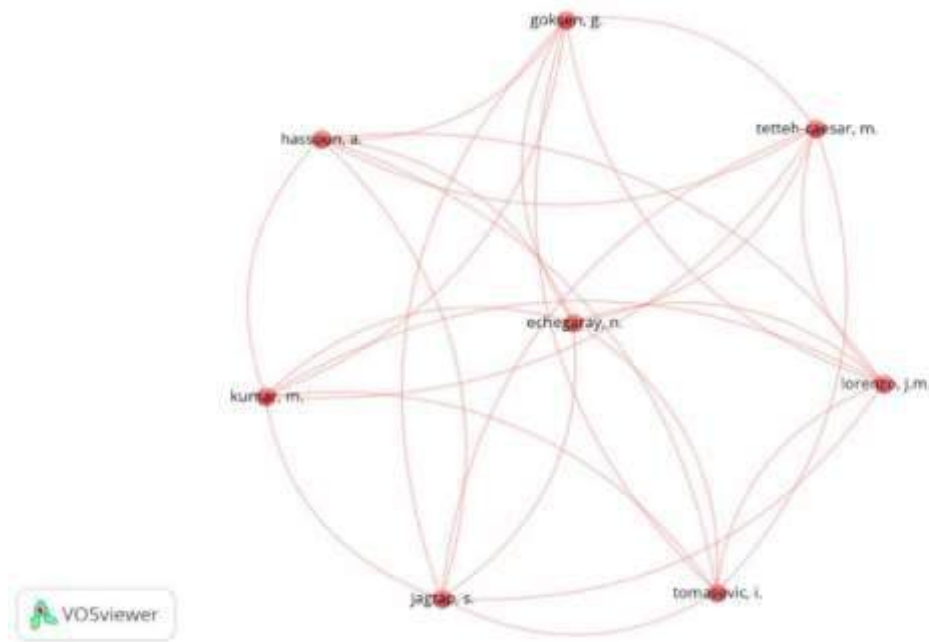
Source: Developed by the author

The aim of this graph is to show the amount of publications a year. It can be understood as mapping scientific output as it relates to digital technologies applied to supply chain management, showing the trends over time. A sharp increase in total number of publications is seen in 2022, which demonstrates more interest and research activity being conducted in that year. The increase may be due to the increasing significance of digital transformation in supply chains due to factors like various new technologies or the need for businesses to operate under changing conditions in the market. Examples of these events are especially relevant when contextualized in 2022. What stands-out is the steep drop in publication amounts as findings lok ahead to 2024 compared to, most recently, the even steeper drop compared to 2022. The sharp drop displays either a decline of activity or interest on the subject. As such you may ask questions about the ongoing relevance of digital technologies in supply chain management, or if the subject is trying to migrate to new topics of research. Overall the graph illustrates the research space and its intensity, highlighting a short period of increasing we can say higher focus of researchers on the topic, as well as future gaps occurring amongst higher scholarly exploration of it.

3.2. Word Cloud (VoS Viewer)

The word cloud visualization highlights dominant themes such as “supply chain,” “technology,” and “digitalization,” underscoring the focus areas of the reviewed studies. Diagram of Collaborating Authors: This diagram shows the network of authors who have collaborated on publications related to the topic of our research. This representation illustrates the clusters of researchers working together closely, which could indicate a research partnership or collaborative initiative. The size of each cluster may represent the impacting frequency of collaboration, with bigger nodes representing bigger partnerships. This information representation can assist researchers with learning who the key influencers or thought leaders are in the discipline and to map the networks that can be leveraged for research.

Figure 4: Co-Authorship Network Visualization



Source: Developed by the author

3.3 Research Methods: Description

3.3.1 Quantitative Approaches

Quantitative methods form the backbone of much of the existing research, allowing for rigorous statistical analysis and generalizable findings. Structural Equation Modeling (SEM), a sophisticated statistical technique, emerges as the predominant tool. SEM is particularly effective for examining causal relationships and testing theoretical models, making it a cornerstone in supply chain digitalization studies. Examples include:

- Al Tera et al. (2024):
 - Type: Descriptive and Quantitative
 - Objective: Investigated the impact of supply chain visibility on digital transformation.
 - Methodology: SEM was employed to assess both direct and indirect relationships among variables such as technology adoption, visibility, and operational efficiency.
 - Findings: Highlighted the critical role of visibility in accelerating digital transformation processes.
- Abourokbah et al. (2023):
 - Type: Correlational and Quantitative
 - Objective: Explored the linkage between digital capabilities and innovation performance.
 - Methodology: Used SEM to quantify the effects of capabilities such as IT infrastructure and employee skills on organizational innovation.
 - Findings: Demonstrated a strong positive correlation, emphasizing the importance of digital readiness. Despite their strengths, quantitative approaches like SEM may oversimplify complex organizational phenomena by focusing predominantly on numerical relationships, thereby missing nuanced, context-specific dynamics.

3.3.2 Qualitative Approaches

Qualitative methods, while less frequently employed, provide nuanced and context-specific insights that quantitative methods often overlook. These approaches are particularly valuable

for exploring complex, multifaceted issues where statistical data alone may fail to capture the full picture. Examples include:

- Kumar & Raut (2021):
 - Type: Descriptive and Qualitative
 - Objective: Identified barriers to digitalization within the context of Indian warehouses.
 - Methodology: Employed the Delphi method, a structured process involving multiple rounds of expert consultations to build consensus on key challenges.
 - Findings: Revealed significant barriers such as lack of technical expertise, resistance to change, and inadequate infrastructure. The study offered actionable recommendations to overcome these challenges.

Qualitative methods excel in uncovering cultural, behavioral, and managerial nuances, offering a depth of understanding that quantitative techniques cannot achieve. However, their subjective nature and limited scalability can pose challenges for generalization.

3.3.3 Mixed Methods

Mixed methods integrate quantitative and qualitative techniques, capitalizing on the strengths of both to provide a comprehensive understanding of research problems. This approach is particularly effective for validating findings through triangulation and contextualizing numerical data with detailed insights. For example:

- Abourobkbah et al. (2023):
 - Type: Mixed Methods (Descriptive and Correlational)
 - Objective: Studied the interplay between digital capabilities and organizational outcomes.
 - Methodology:
 - Conducted quantitative surveys to gather data on digital practices across multiple organizations.
 - Complemented this with qualitative expert interviews to contextualize and validate the survey findings.
 - Findings: The combined approach offered a robust analysis, highlighting practical implications of digital transformation initiatives while addressing industry-specific challenges.

By blending methods, mixed approaches ensure a holistic understanding of the research problem. However, they require careful integration of datasets and alignment of findings to ensure reliability and coherence.

4. Discussion

4.1. Comparison of Methodologies

The study confirms a strong reliance on quantitative approaches, especially Structural Equation Modeling (SEM) approaches; these approaches have appealing statistical rigor and are often generalizable, which makes them appealing in evaluating hypotheses related to digital adoption and supply chain performance. However, these approaches often oversimplify complex realities by numerically representing multiple dimensions of the supply chain. As a result, important contextual nuances—such as cultural resistance, managerial practices, and sector-specific factors—may be overlooked.

In contrast, qualitative methods, including Delphi studies and case studies, provide rich contextual insights. They capture practitioners' perceptions, organizational barriers, and engagement processes, thus offering a deeper understanding of how digital technologies are implemented in different contexts. However, qualitative approaches face limitations regarding

scalability and generalizability, as findings are often context-specific and subject to interpretive biases.

Mixed methods present a promising solution by combining the breadth of quantitative analysis with the depth of qualitative insights. Such approaches allow triangulation of results, offering a more holistic perspective on digital supply chain adoption. Nevertheless, mixed methods require careful methodological integration and substantial resources, which may explain their under-utilization in current research.

Furthermore, the influence of sectoral, geographical, and cultural specificities must be acknowledged when interpreting these methodological patterns. For example, highly automated industries such as automotive or electronics often generate more consistent quantitative data, whereas service-oriented or traditional industries rely heavily on qualitative insights due to variability in processes. Similarly, firms operating in developed countries benefit from advanced digital infrastructures, enabling large-scale quantitative research, whereas organizations in emerging economies may face infrastructural and cultural constraints that necessitate adaptive and context-sensitive approaches. Cultural factors, such as openness to innovation, hierarchical decision-making, or risk tolerance, further shape both the implementation of digital technologies and the methodological approaches suitable for studying them.

Table 1: Comparison of methodologies applied to digital supply chain research

Approach	Strengths	Weaknesses	Example from corpus
Quantitative (SEM, surveys)	<ul style="list-style-type: none"> - Statistical robustness - Generalizable findings - Hypothesis testing 	<ul style="list-style-type: none"> - Oversimplification - Ignores contextual dynamics 	Al Tera et al. (2024); Andry (2023)
Qualitative (Delphi, case studies)	<ul style="list-style-type: none"> - Rich contextual insights - Captures barriers & perceptions - Explores new themes 	<ul style="list-style-type: none"> - Limited scalability - Subjective interpretation 	Kumar & Raut (2021); EcheGARAY et al. (2023)
Mixed Methods	<ul style="list-style-type: none"> - Combines depth & breadth - Triangulation enhances credibility - Contextualizes statistical findings 	<ul style="list-style-type: none"> - Requires expertise in both methods - Resource-intensive 	AbouROKBAH et al. (2023); KEHAYOVA et al. (2022)

Source: Developed by the author

4.2. Proposed Methodology

Building on the previously identified strengths and limitations of current research, this paper proposes a comprehensive three-phase hybrid methodology designed to address the challenges of studying digital technology adoption in supply chains. This methodology aims to combine the statistical rigor of quantitative approaches with the contextual depth of qualitative exploration, while explicitly accounting for sectoral, geographical, and cultural variations. Such an approach ensures that the research is not only methodologically robust but also sensitive to the real-world complexities of supply chain contexts.

Phase 1 – Qualitative Exploration: The first phase focuses on obtaining rich, contextual insights into how digital technologies are adopted and implemented across various supply chain environments. Semi-structured interviews are conducted with supply chain managers, digitalization experts, and frontline practitioners. This approach allows the researcher to capture nuances related to organizational culture, managerial practices, and sector-specific operational realities. The qualitative exploration also facilitates the identification of key variables and the generation of hypotheses that are grounded in the actual experiences and challenges faced by organizations. By emphasizing context, this phase ensures that the subsequent quantitative analysis addresses variables that are both relevant and reflective of real-world practices.

Phase 2 – Quantitative Validation: Building on the qualitative findings, the second phase employs large-scale surveys and Structural Equation Modeling (SEM) to test the hypotheses developed in Phase 1. This step provides statistical validation of the relationships between

digital technology adoption and supply chain performance indicators, such as efficiency, responsiveness, and cost reduction. The quantitative phase ensures generalizability of the results across different organizations and contexts. Importantly, the survey design incorporates considerations for industrial sector, geographical location, and cultural factors, allowing the analysis to identify potential variations in the impact of digital adoption across diverse environments. This careful integration of contextual factors enhances the robustness and applicability of the findings.

Phase 3 – Triangulation: The final phase focuses on integrating and comparing results from the qualitative and quantitative phases to enhance the reliability, credibility, and comprehensiveness of the study. Triangulation allows the identification of convergent and divergent findings, providing a holistic understanding of digital technology adoption. This phase also highlights how sectoral differences, regional infrastructures, and cultural contexts shape both the process of adoption and its observed outcomes. By systematically combining insights from both qualitative and quantitative sources, the methodology generates a practical, evidence-based framework that bridges theory and practice, guiding future research and informing managerial decision-making in diverse supply chain contexts.

Overall, this structured hybrid methodology strengthens the rigor of SEM while grounding the research in organizational and contextual realities. By addressing both methodological and contextual dimensions, it contributes to advancing theoretical understanding and provides practical guidance for practitioners seeking to implement digital technologies effectively across different supply chain environments. This approach ensures that research findings are not only statistically sound but also practically relevant and sensitive to the unique characteristics of each organizational and regional context.

5. Conclusion

This systematic review emphasizes the essential role of research methods in furthering our knowledge of digital technologies within supply chains. The findings emphasize that quantitative methods, specifically SEM, are predominating in the literature. These methods allow for strong causal analysis and testing of theoretical models, and they generate statistically significant and generalizable findings. However, being based on numerical data means they often ignore mired, contextualized complexities associated with technology adoption and organizational change. In comparison, while qualitative methods are less accepted, they provide rich and descriptive perspectives covering the multifaceted nature of digital transformation. Semi-structured interviews and thematic analysis, in particular, allow for the examination of organizational barriers to transformation, cultural influences on transformation, and stakeholder perceptions of digital technologies. Qualitative methods are particularly useful for identifying contextual factors that quantitative methods may overlook. To make the distinction clearer between methods, the authors proposed a complementary approach that combines qualitative and quantitative methods. The complementarity mentioned was justified in the context of educational research and has the potential in this situation to balance qualitative exploration influenced by context with quantitative measures that generate broader, statistically validated insights about the situation. The methodology of triangulation embraces diverse viewpoints which helps to increase the reliability and credibility of the findings. Moreover, a mixed-methods research design helps address both the global and local aspects of the issue (i.e., macro and micro levels) and offers an actionable recommendation that speaks directly to the real-world problem.

Future research can build on this hybrid method in empirical contexts to study the evolving interactions between digitalization and supply chain performance. It would be beneficial for researchers to explore the impact of contextual variables, such as different sectors and

organizational contexts, on the extent of digital technology adoption and how that technology influences supply chain performance. There is also a need to develop frameworks that combine conceptual and practical approaches, allowing organizations to navigate digital transformation more intelligently. Thus, we believe this hybrid method provides a step forward not only toward mitigating the shortcomings of existing methodologies but also a step toward deeper and more meaningful research on an evolving role of digital technologies in supply chains.

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