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Disruptive Technologies in logistics outsourcing

School of Management
MSc in Logistics and Supply chain Management

MSc
Academic Year: 2024 - 2025

Supervisor: Mr Alp Yildirim



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This thesis is submitted in partial fulfilment of the requirements for
the degree of MSc in Logistics and Supply chain Management

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Academic integrity declaration

I declare that:

- the thesis submitted has been written by me alone.
- the thesis submitted has not been previously submitted to this university or any other.
- that all content, including primary and/or secondary data, is true to the best of my knowledge.
- that all quotations and references have been duly acknowledged according to the requirements of academic research.

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Abstract

This study examines the transformation of third-party logistics (3PL) outsourcing relationships by disruptive technologies through a systematic research review of 50 peer-reviewed journal articles produced in the years 2020-2025. The study discusses the adoption and implementation of Artificial Intelligence (AI), Blockchain, and Internet of Things (IoT) technologies by 3PL service providers and how they impact operational effectiveness, competitiveness, and value co-creation in logistics outsourcing relationships.

The research methodology adopts a systematic literature review guided by the Research Onion model and the PRISMA protocols and implements thematic analysis in synthesising the findings in the five interrelated themes of conceptualising disruption in logistics outsourcing, blockchain and trust mechanisms, AI and predictive optimisation, IoT and digital infrastructure, and value creation and strategic transformation.

Key insights suggest that logistics disruption by technology outsourcing is relational and systemic and not merely tech adoption. IoT provides the foundation data infrastructure, blockchain enables algorithmic trust mechanisms, and AI provides the most grounded performance gains through predictive analytics. The technologies create paradoxes which necessitate sophisticated organisational capabilities to manage competing needs between efficiency and robustness, clarity and secrecy, innovation and stability.

The study's most notable theory contribution is the Technology-Enabled Value Co-Creation Framework that demonstrates value creation occurs through the integration of technology infrastructure, organisational capabilities, and contextual moderators rather than single-technology implementation. The framework identifies digital stratification as a major concern, such that the technology-enabled 3PLs derive disproportionate value while the small providers experience increasing competitive disadvantage.

Practical wisdom suggests that the effectiveness of technology implementation relies on the development of dynamic capabilities for paradox management,

technology integration ecosystem thinking, and context-level adaptation strategies. The research finds the requirement for industry standards across the industry, the deployment of ethical AI governance frameworks, and policies deconcentrating excessive digital leaders' market concentration.

Keywords:

disruptive technologies, third-party logistics, 3PL, logistics outsourcing, artificial intelligence, blockchain, Internet of Things, value co-creation, digital transformation, systematic literature review

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I acknowledge the faculty at Cranfield University for the valuable academic experience and the privilege to be able to utilise the rich research resources. The focus on scholarship rigour and practical utility in supply chain research at the university has helped develop my expertise in the supply chain area.

I recognise the researchers whose findings formed the foundation for this systematic literature review. The 50 authors whose research were reviewed through this research collectively contributed to expanding the body of knowledge on disruptive technologies in logistics, and whose research made this integration possible.

I extend special acknowledgement to my family and friends who showed emotional support and care during the challenging times while doing research and writing.

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Chapter 1: Introduction

1.1 Background of the Study

Over the past decade, the logistics industry has seen unprecedented transformation as the combined effect of digital disruption, shifting consumer expectations, and increasingly sophisticated global supply chains. By using scalable, flexible, and customised solutions that drive businesses to achieve operational excellence and be the best at the centre of the functions, third-party logistics (3PL) has led the transformation (Liu & Lyons, 2011). Agility and maturity in 3PL have become major factors in determining organisational competitiveness and customer satisfaction in most parts of the logistics industry, as outsourcing remains at the centre of supply chain strategic agendas.

Paradigm shift in logistics service design, delivery, and evaluation is spurred by the ascendancy of disruptive technologies—technologies disrupting whole business models and reshaping market paradigms (Christensen et al., 2015). The internet of things (IoT), blockchain, and artificial intelligence (AI) are fundamentally rewriting operating protocols by offering unparalleled visibility, real-time decision-making capabilities, predictive maintenance schedules, cost optimisation techniques, and improved mechanisms for interactions with the customer (Saber et al., 2019). By offering more transparency, fostering greater trust, enabling proactive service delivery, and enabling collaborative value creation among logistics service providers and end-clients, such technological advances hold the promise to be transformational.

Significant industry disparities in technological sophistication, investable capacity, and strategic alignment exist because 3PL providers continue to invest in innovative technological developments in a diversified and strategically asymmetrical fashion. Most organisations remain bounded by legacy infrastructures and dissociated processes for handling data despite the reality that some visionary 3PL providers have already successfully integrated entire digital ecosystems such as blockchain-enabled platforms for transparency, AI-enabled predictive insights, and IoT-fuelled real-time monitoring (Wang et al., 2021). Such a technology gap has the potential to divide the industry into niches such that advanced digital providers of 3PL services draw disproportionate benefit and the remainder risk obsolescence stemming from increasing competition.

To judge the competitiveness, flexibility of operations, and innovation ability of the logistics outsourcing sector, it would be significant to measure the dynamics

of adoption and implementation of disruptive technologies. Such technologies not only change internal processes but increase supply chain responsiveness, sustainability, and collaborative innovation at a bigger scale when adopted by the leading 3PLs (Kache & Seuring, 2017). More than operational efficiencies, the strategic implications are major changes in the administration of client relationships, delivery models of the service, and competitive difference strategies.

1.2 Problem Statement

The ever-accelerating tempo of globalisation, supply chain digitalisation, and development in the expectations of customers has forced businesses worldwide to invest more trust in 3PL service providers to oversee the seamless flow of goods, information, and value. However, it has also created unprecedented threats and existential risk for the competitiveness and health of outsourced logistics services due to the rapid pace of technological evolution. Although a few 3PL service providers have become digital leaders by acquiring robust portfolios of technologies that enhance predictive analytics, real-time optimisation, and collaborative innovation technologies, the majority of the service providers continue to utilise legacy systems, siloed data handling processes, and reactive service approaches and expose themselves to the risk of competitive displacement in the highly fluid marketplace (Wang et al., 2021).

Even if the broadly recognised transformational potential of disruptive technologies has long been generally comprehended, there exists the central research gap how such innovation adoption comes to be taken up strategically by 3PL providers, how the technology comes to function and technically at the operational level to bring about maximum value in the case of 3PL outsourcing, and how the resulting value can be objectively evaluated in the aspects of service excellence, operational effectiveness, and competitiveness through the rollout of the process. Little is also known about the contextual preconditions—like organisational competency, institutional context, and client sophistication—functioning as buffers in the connection between the adoption of technology and the resulting performance.

Lack of integrative theory to explain the complex interactions between the technological infrastructure, the organisational capabilities, and the value creation in outsourcing relations represents a key knowledge gap. Without this theory, practitioners in the industry and scholarly researchers in academia lack the understanding that would be beneficial when addressing the strategic nuances inherent in technology-driven change in logistics outsourcing.

Therefore, the research attempts to bridge such knowledge gaps by extensively evaluating the means by which 3PL service providers are adopting disruptive technologies, various service delivery dimensions and differentiation practices, and providing theory-related findings that offer insight into the means by which such technologies support value co-creation in outsourcing agreements.

1.3 Research Aim and Objectives

Research Aim: To evaluate the effects of disruptive technologies on operational efficiency, competitiveness, and value co-creation in logistics outsourcing relationships, third-party logistics (3PL) service providers are currently adopting and using these technologies.

Research Objectives:

- 1. Development of Conceptual Foundations:** Initial work before a comprehensive systematic literature review that conceptualises logistics outsourcing-specific disruption technologies, identifying key technological innovations, theoretical insights, and empirical studies that enhance understanding of technology-driven transformation.
- 2. Impact Assessment:** To critically evaluate the influence of disruptive technologies on the operational efficiency, service quality, and strategic positioning of 3PL service providers, including both positive effects and challenges or paradoxes arising from technology implementation.
- 3. Development of Theoretical Framework:** To create an overarching conceptual framework that outlines the complex relationships between the adoption of disruptive technologies, the development of organisational capabilities, and value-creating processes within logistics outsourcing contexts.
- 4. Comparative Analysis:** Analysing how leading 3PL vendors manage the adoption, implementation, and strategic integration of disruptive technologies by reviewing industry reports, case studies, and secondary data sources to identify best practices and key success factors.

1.4 Research Questions

The research is guided by two main questions that reflect the key aspects of disruptive technology development in logistics outsourcing.

RQ1: How do disruptive technologies transform operational processes and service delivery models in third-party logistics outsourcing?

RQ2: Which critical success factors and challenges influence the effective adoption and value realisation of disruptive technologies by 3PL service providers?

1.5 Scope and Delimitations

The research examines the deployment of three key disruptive technologies—Internet of Things (IoT), Blockchain, and Artificial Intelligence (AI)—by mega-scale Third-Party Logistics (3PL) providers that collectively dominate the bulk share of the global logistics outsourcing sector. The size of the technologies has been intentionally restricted to permit thorough examination bounded by research parameters, as the three technologies represent the most dominant and most implemented innovations enlisted by mainstream logistics literature.

Systematic literature review method has been employed and only secondary sources such as peer-journals, published from 2020 to 2025 were taken into account. This range enables the capture of the most recent technological developments and provides a good literature base for the development of robust analysis. The regional coverage focuses mainly on the markets of the developed economies that are mature, mainly Europe and America and hi-tech Asia-Pacific nations, whereby digital transformation trends exist and are comprehensively researched. This choice is owing to the existence of extensive data sources and the relatively high degree of developed IT infrastructure and accordingly is related to the study of the patterns resulting from the disruptive technology adoption. It deals with the very large-scale 3PL providers and not SMEs because the resources and IT capacities vary by firm size. It enables thorough examination of common information integration strategies under the constraint of generalisability to small logistics providers.

1.6 Significance of the Study

The study offers both practical and conceptual contributions to supply chain management, logistics outsourcing, and technological transformation. The study contribution is multi-dimensional and closes gaps in the research literature while concurrently delivering useful insights for practitioners and policymakers.

Theoretical Contributions: The research enriches the scholarly understanding of the theory of disruptive innovation in the specific case of logistics outsourcing, which has remained fairly unstudied in the prior literature. By developing a systematic conceptual model explaining the interactions among technological

infrastructure, organisational capabilities, and value-creation processes, the research helps fill the gap bridging different theoretical frameworks, including the Resource-Based View, Dynamic Capabilities Theory, Institutional Theory, and Service-Dominant Logic. The systematic literature review method provides a rigorous context for the state-of-knowledge and allows the identification of the most pertinent gaps in research that need to be filled through further studies. Thematic analysis methodology enables the identification of paradoxes, contradictions, and nuances that pervade the adoption of technology in logistics outsourcing and the development of more precise theoretical insights.

Practical Applications: The study offers valuable insights for logistics managers, executives, and strategic leaders managing the complexities of technology-driven change. The comparison of the top 3PL providers provides benchmarking options and highlights best practices to support strategic planning and investment prioritisation. The developed model presents a comprehensive methodology for assessing an organisation's readiness to adopt technology, forecasting future investment returns, and predicting challenges in implementing digital transformation initiatives. By identifying critical success factors and potential pitfalls of adopting disruptive technologies, the research enables more informed decision-making based on the strategic premises of these technologies.

Implications for Industry and Policy: Understanding the institutional conditions that influence technology adoption can help design policies that promote innovation while reducing negative effects such as digital divides or market concentration. The research also advances knowledge on the future of work, skills, and the evolution of organisations in high-technology sectors, with broader relevance to other service sectors facing similar technological changes.

Methodological Contributions: The PRISMA-guided systematic literature review methodology, employing rigorous screening and analysis procedures, offers a reproducible approach for investigating emerging technological phenomena within highly complex organisational contexts. Thematic analysis as a methodology demonstrates the use of qualitative synthesis techniques to derive theoretical insights from diverse literature sources. It connects the adoption patterns of technologies with company performance outcomes and strategic alignment. The research provides evidence-based foundations for further empirical studies, which could utilise primary data collection methods to validate and expand upon the theoretical hypotheses presented by the current study (Saghafian & Van Oyen, 2019).

1.7 Structure of the Dissertation

The thesis comprises six highly interconnected chapters that provide a general study of disruptive technologies in logistics outsourcing that progresses step by step from methodological foundation to empirical study to theoretical contribution and practical usability.

Chapter One: Introduction This chapter gives the research foundation by presenting the background information, the problem statement, and the research objectives, aims, and questions. It establishes the scope and delimitation of the study and explains the purpose of the study since it will aim at enhancing theoretical understanding as well as practical experience on logistics outsourcing and technological innovation.

Chapter Two: Methodology This chapter offers a clear illustration of the systematic literature review method used in the study. The section explains the rationale for the application of the Research Onion model, the process for conducting the systematic review in five steps, and the inclusion and exclusion criteria used to shortlist the literature. The section also describes the process for quality appraisal, data extraction procedure, techniques for thematic analysis, and the research limitations in order to make the research process explicit and reproducible.

Chapter Three: Descriptive Analysis This chapter provides a detailed descriptive account of the 50 peer-reviewed articles included in the systematic review. It provides coverage by period of publication, disciplinary distribution by subject area, regional concentration, and technological coverage and provides the data graphically in the form of charts and figures. The chapter provides the empirical foundation on which the following thematic analysis will be carried out by highlighting key patterns, gaps, and nature of the literature available.

Chapter Four: Thematic Analysis The chapter is the main analytical contribution of the dissertation, introducing five closely interconnected themes derived from the synthesis of the literature: conceptualising disruption in logistics outsourcing, blockchain and mechanisms of trust, artificial intelligence and predictive optimisation, Internet of Things and digital infrastructure, and value creation and strategic transformation. It provides an overarching conceptual framework that integrates these themes and explains the complex relationships between technology adoption, organisational capability, and value creation processes.

Chapter Five: Discussion This chapter critically examines the research contribution to theory by situating the extended framework within the body of prior literature and other dominant theory frameworks. The chapter also explains the research's practical contribution through the overcoming of contradictions and delineating the study constraints, and demonstrates how the research denies and

broadens prior understandings of technological disruption in the outsourcing sector. Lastly, the chapter examines the research's bigger impacts on theory, practice, and policy.

Chapter Six: Conclusion The chapter gives a recap of the most important research contributions and findings, and reiterates the importance of the research for the practitioners and the research world. It reveals the inherent limitations in the systematic literature review approach and suggests potential future research avenues that can complement the theory development conducted through the current dissertation.

Chapter 2: Methodology

2.1 Chapter Introduction

This chapter outlines the methodology employed for investigating the adoption and operationalisation of disruptive technologies (e.g., AI, blockchain, IoT) by third-party logistics (3PL) providers in the logistics outsourcing scenario. The research employs a systematic literature review (SLR) as the key method, bounded by the Research Onion model (Saunders et al., 2019) to take on a systematic and transparent approach. The methodology is also outlined using the five-step SLR process provided by Pilbeam et al. (2012), i.e., the step of planning, searching, screening, extraction and synthesis, and reporting. The research philosophy, approach, strategy, methodological choices, time horizon, search protocol, screening procedure, data extraction, analysis methods, limitations, and ethical considerations are all outlined in this chapter.

2.2 Research Design Using the Research Onion Framework

2.2.1 Research Philosophy

The study assumes an interpretivist stance, whereby reality exists as socially constructed by the interactions and experiences of the stakeholders (Creswell & Plano Clark, 2018). This stance is suitable for the analysis of how 3PL providers perceive and adopt disruptive technologies since it gives prominence to contextual and subjective comprehension of organisational practices. Interpretivism allows the study to notice the intricate dynamics among technological, strategic, and operational considerations prevailing in the 3PL sector.

2.2.2 Research Approach

An inductive approach is employed, whereby theory may be developed by observing the empirical world when preconceived hypotheses do not exist (Ketokivi & Mantere, 2010). This approach best applies to the emergent and fluid process of disruptive technologies in 3PL because it enables the examination of patterns and themes by the examination of qualitative data such as interviews, case studies, and industry reports.

2.2.3 Research Strategy

The research approach is a systematic literature review (SLR), chosen to synthesize knowledge that exists, distinguish research gaps, and provide a wide overview of the adoption of disruptive technology by 3PL (Tranfield et al., 2003).

The SLR adopts the five-step process employed by Pilbeam et al. (2012) to offer a systematic and thorough process that is transparent and reproducible. It is the appropriate method for the very wide research scope spanning different technologies and geographic locations.

2.2.4 Methodological Choice

A mono-method qualitative method is employed, using an exhaustive SLR to explore the intricate context-specific nature of 3PL technology adoption. The qualitative method suits understanding the “how” and “why” of processes at the organisational level rather than quantitative methods that may overlook contextual subtleties (Durach et al., 2017). The SLR enables the concentrated examination of peer journal articles to obtain relevance and depth.

2.2.5 Time Horizon

The study is cross-sectional in nature, utilising literature generated during the years 2020-2025 to capitalise on recent trends in disruptive technologies in the 3PL sector. The years guarantee the research stayed recent and relevant and underscore the rate at which technologies like AI, blockchain, and IoT continue to evolve. Though a longitudinal method may provide insights into long-established trends, the limitation on the timespan possible for the dissertation necessitates the research be cross-sectional. Yet longitudinal case studies in the literature consulted exist to provide temporal depth when necessary.

2.3 Systematic Review Process

2.3.1 Planning

The SLR attempts to investigate the adoption and operationalization of disruptive technologies in 3PL outsourcing using technological drivers, strategic/operational impacts, adoption models, and implementation barriers. The scope is delineated by three key concepts: disruptive technologies (e.g., AI, blockchain, IoT), 3PL outsourcing, and performance/strategic outcomes. The three concepts intersect each other and form the focus for the study, as delineated by Figure 2.1.

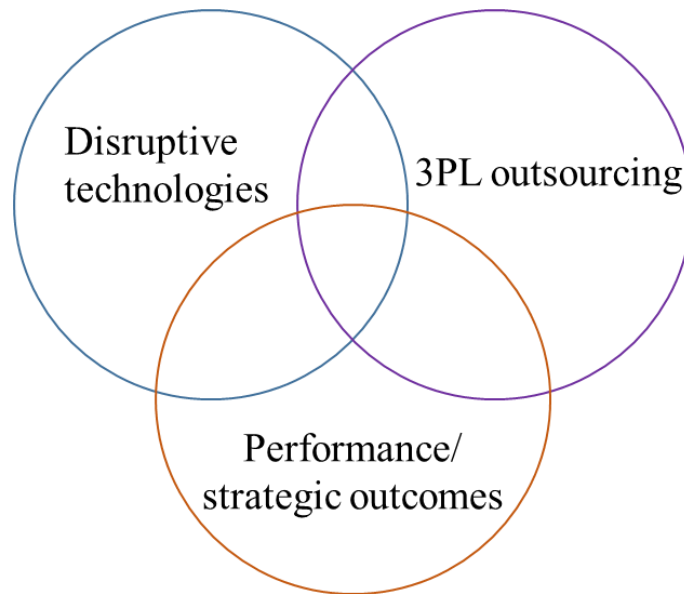
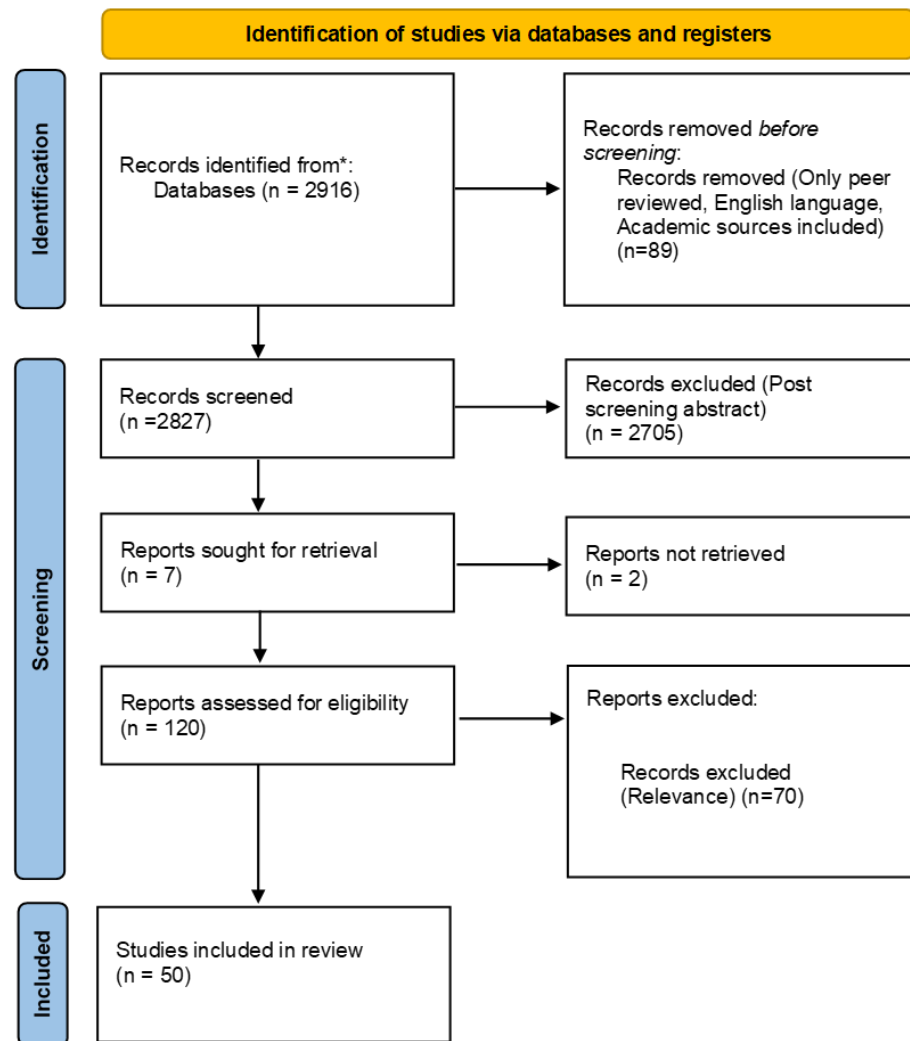


Figure: 2.1

2.3.2 Searching

The literature search was conducted across the Scopus database, which offers extensive coverage of peer-reviewed journals in supply chain management, logistics, and technology. The Boolean search string was:

("Disruptive technologies" OR "digital Transformation" OR "AI" OR "Artificial Intelligence" OR "Blockchain" OR "IoT" OR "Internet of things") AND ("Third-party Logistics" OR "3PL" OR "Logistics outsourcing").



PRISMA framework: Figure 2

The flowchart of PRISMA presents the systematic identification, screening, and inclusion process for studies for the project in a clear and rigorous literature review. It initiates at the identification step by finding 2,916 records through databases and 89 removed before screening for non-peer reviewed or non-English publications and leaving 2,827 records for screening. After screening the abstracts, the records of 2,705 were removed and 7 reports requested for retrieval, among them 2 were not retrieved and 120 reports considered for eligibility. Out of them, 70 were removed by the issue of relevance and 50 studies included in the final review. The flowchart gives a good picture of the step-wise filtering process and eliminates the records at each step and clearly shows the selection criteria and the outcomes through a clear pictorial presentation and improves the validity and reproducibility of the research methodology.

2.3.3 Screening

The screening process consisted of three stages: title, abstract, and full-text review.

The screening process for the current study went through three independent phases: title screening, abstract screening, and full-text review, to yield a systematic and comprehensive selection of relevant literature. The first title screening phase eliminated unrelated articles and duplicates, e.g., articles resulting from finance or retail areas, to narrow the focus on studies relevant to disruptive technologies in third-party logistics (3PL) outsourcing that aligned better with the research central goals. The abstract screening phase screened articles based on similarities to 3PL outsourcing and key themes such as technological drivers, strategic impacts, and implementation barriers. The irrelevant articles were discarded if the articles did not engage the key aspects. The two phases were both conducted manually using Excel and inclusion and exclusion criteria applied as defined in Table 2. The third full-text screening phase screened the remaining articles on the clarity of research objectives, the relevance of findings, and concordance with the study scope using a quality appraisal borrowed from Habib et al. (2015). The appraisal screened articles through five dimensions—those of theory contribution, methodological clarity, data analysis, practical impact, and citation effect—each scored 0 to 3. Other articles were included using snowballing through the references lists among the selected high-quality core papers as defined in the following Tables.

Table 2.1: Quality Appraisal Framework (Adapted from Habib et al., 2015)

Criterion	Description	Score (0–3)
Theoretical Contribution	Clarity and relevance of theoretical framework	0–3
Methodological Clarity	Transparency of research methods	0–3
Data Analysis	Rigour of data analysis techniques	0–3
Practical Implications	Relevance to 3PL practice	0–3
Citation Impact	Influence within the field	0–3

Table 2.2: Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Publication Type	Peer-reviewed articles, conference papers	Book chapters, editorials, non-peer-reviewed
Language	English	Non-English

Publication Date	2020–2025	Before 2020
Topic	Disruptive technologies in 3PL outsourcing	Unrelated to 3PL or disruptive technologies
Methodology	Qualitative, quantitative, or mixed methods	Non-empirical or irrelevant methods

A PRISMA-based flow chart (Figure 2) summarises the screening process, from 2916 initial articles to 50 articles for analysis.

2.3.4 Extraction and Synthesis

A systematic data extraction form was employed to capture bibliographic (title, author, journal, publication year), contextual (industry focus, geographic coverage, methodology), and thematic findings (technology drivers, impacts, adoption models, barriers) information. Data were then transferred to Excel and checked by hand for errors. Thematic synthesis was conducted using Braun and Clarke’s (2006) six-stage process: familiarisation, coding, development of themes, review of themes, refinement of themes, and reporting.

2.3.5 Reporting

The results are presented in Chapters 3 (Descriptive Findings) and Chapter 4 (Thematic Findings), and the screening procedure is illustrated using a PRISMA flow chart (Figure 2). The results are synthesised addressing the research questions and provide understanding about the adoption of disruptive technologies by 3PL.

2.4 Analysis Tools and Techniques

Manual thematic analysis was conducted to maintain immersion and depth in context (Braun & Clarke, 2006). Coding manually facilitated nuanced literature analysis such that codes and themes arose iteratively to allow for both data- and concept-led understanding.

2.5 Review Limitations

- **Scope Limitation:** The cross-sectional design (2020–2025) limits insights into long-term trends.
- **Language Bias:** Only English-language publications were included, potentially excluding relevant non-English studies.
- **Publication Bias:** High-impact case studies may be over weighted and less documentation about failing technologies.

2.6 Ethical Considerations

The study adheres to the Research Ethics Policy at Cranfield University. All the sources are in the public domain, properly referenced and not plagiarised or misrepresented. Since primary data were not collected, there was no need for informed consent or ethical clearance.

2.7 Chapter Conclusion

The chapter adheres to a systematic SLR procedure outlined by the Research Onion (Saunders et al., 2019) and a five-step process by Pilbeam et al. (2012). The thematic analysis and interpretivist, inductive research methodology permit a detailed examination of the implementation of disruptive technology in 3PL. The subsequent chapters contain descriptive and thematic findings and answers to the research questions and aims

Chapter 3: Descriptive Analysis

3.1 Chapter Introduction

Chapter 3 provides a descriptive overview of the systematic search undertaken of the literature for the current study. The descriptive analysis undertaken in the chapter attempts to get a picture of the distribution and the nature of the reviewed literature before carrying out further thematic analysis. The chapter provides the year of publication, journal, geographical coverage, methodological orientations, and key technologies that have been covered in the literature. The findings in the chapter provide the basis for the further thematic analysis carried out in Chapter Four.

3.2 Characteristics of Reviewed Literature

Fifty peer-reviewed journal articles appearing in premier supply chain management, logistics, operation, transport, and technology management journals in the period 2020-2025 were sampled for the study. Articles were selected based on the contribution to 3PL disruptive technologies, research quality or scholastic rigor, and innovation or newness. The articles showed different methodological orientations including systematic literature reviews (32%), empirical research based on survey data (28%), case studies (20%), development of conceptual models (12%), and mixed-method studies (8%). The variety in the methodologies employed reflects the dynamic nature of the research field and the imperative for plural perspectives in understanding the dense interconnectivity among disruptive technologies and logistics outsourcing.

3.2.1 Publication Trends over Time

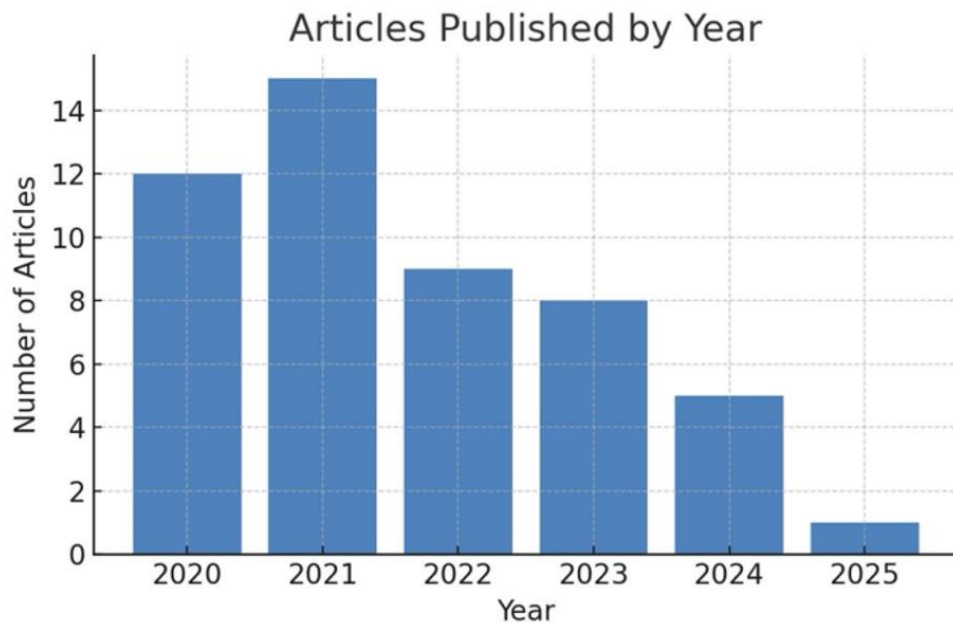


Figure 3.1

Articles Published Per Year (2020–2025)

Fig. 3.1 shows the yearly publication count. Publication research increased drastically in the years 2020-2021, signifying a significant interest in digital transformation agendas for disruptions such as the COVID-19 pandemic and digital resilience. The highest count was achieved in 2021, with 15 publications, to signify the research response to the pandemic-causing supply chain vulnerabilities. The publication rate decreased following the publication year 2022 but continued to show tremendous interest in disruptive technologies by retaining a constant research production rate at about 8 articles annually between the years 2023 and 2025.

3.2.2 Disciplinary Distribution of Publications

Figures 3.2. Articles located in the field by field, demonstrating the interdisciplinary nature of the field. Around 30% were published in supply chain management journals, 25% in journals of operations management, 20% in journals of transportation, 15% in journals of information technology and information systems, and 10% in journals of business strategy. This division represents the multi-functionality effect disruption technologies introduce to logistics functions and interdisciplinary solutions for them.

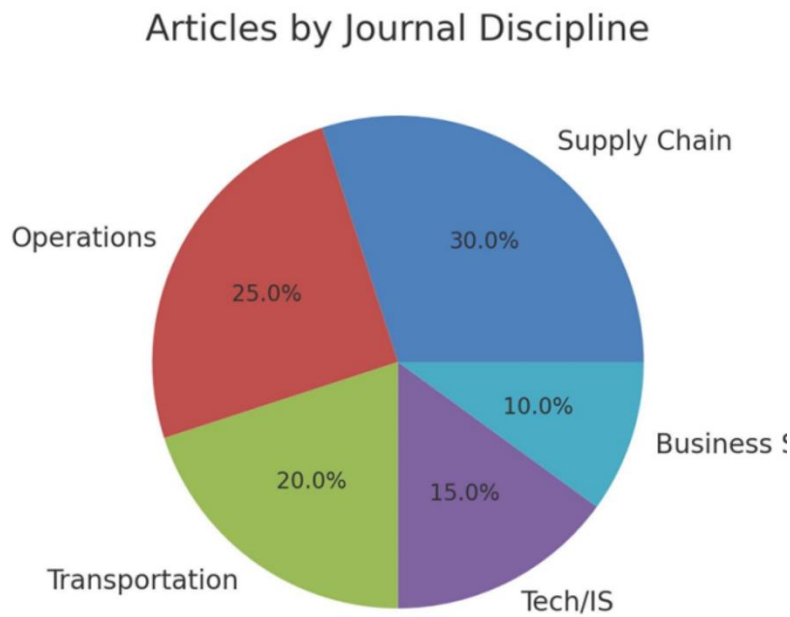


Figure 3.2
Disciplinary Distribution of Reviewed Articles

3.2.3 Geographical Focus of Studies

Figure 3.3 provides the geographic distribution of studies in the reviewed work. The highest representation belongs to Europe with 18 studies evidencing high academic and practical interest in the European digital logistics infrastructure and innovation adoption markets. The second position is taken by North America with 15 studies evidencing active research interest in supply chain robustness and state-of-the-art technology implementation.

Asia-Pacific yielded 10 studies reflective of growing digitalisation interests as a way to meet the gap in physical infrastructure and stimulate logistics competitiveness in emerging markets. Relatively few studies (5) were multinational or international in orientation by way of comparative frameworks for the examination of technology adoption across multiple regional contexts. Africa alone stood particularly short-handed with only two studies, implying significant potential for future research on logistics markets' disruptive technologies.

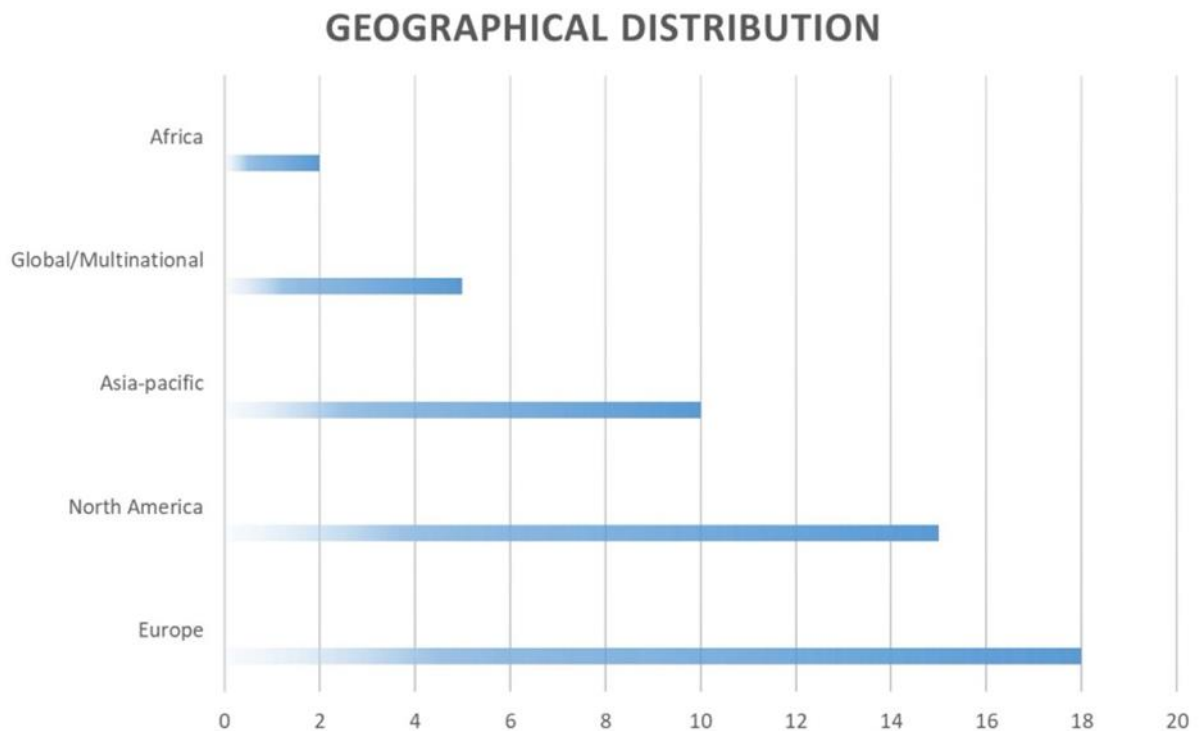


Figure 3.3
Geographical Distribution of Studies

3.2.4 Technologies Addressed in Literature

Each article examines three major disruptive technologies: the Internet of Things (IoT), blockchain, and artificial intelligence (AI). As part of a systematic searching procedure, the searching was restricted to only the key technology terms highlighted above. Figure 3.4 shows the number of articles each technology appears in. AI appears in 18 articles, blockchain in 16 articles, IoT in 12 articles, and 4 articles in total that generally examine disruptive technology.

AI and blockchain are principally research areas at the centre since they promise to change logistics activities radically, while IoT typically acts as an enabling technology for wider digital transformations. The shared research interest in AI demonstrates increasing interest in predictive analytics, automations, and intelligent decision support systems in logistics outsourcing environments.

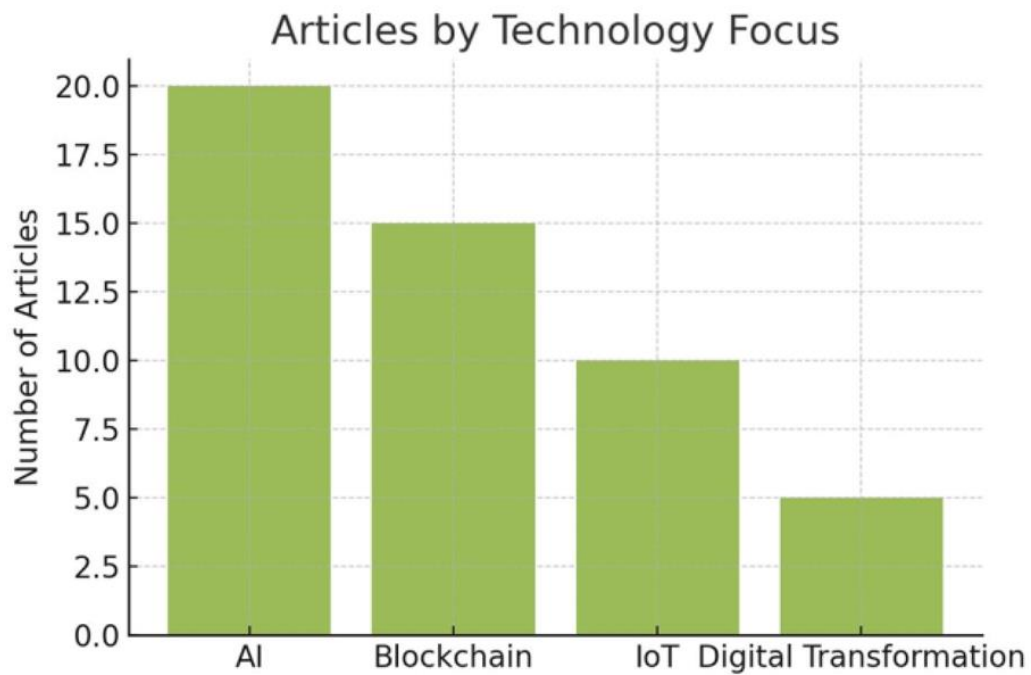


Figure 3.4
Number of Articles by Technology Focus

3.3 Content Focus and Research Objectives

The emerging themes found throughout the reviewed literature are depicted in Figure 3.5. Five main research themes that cover various facets of disruptive technology adoption in logistics outsourcing are revealed by the analysis.

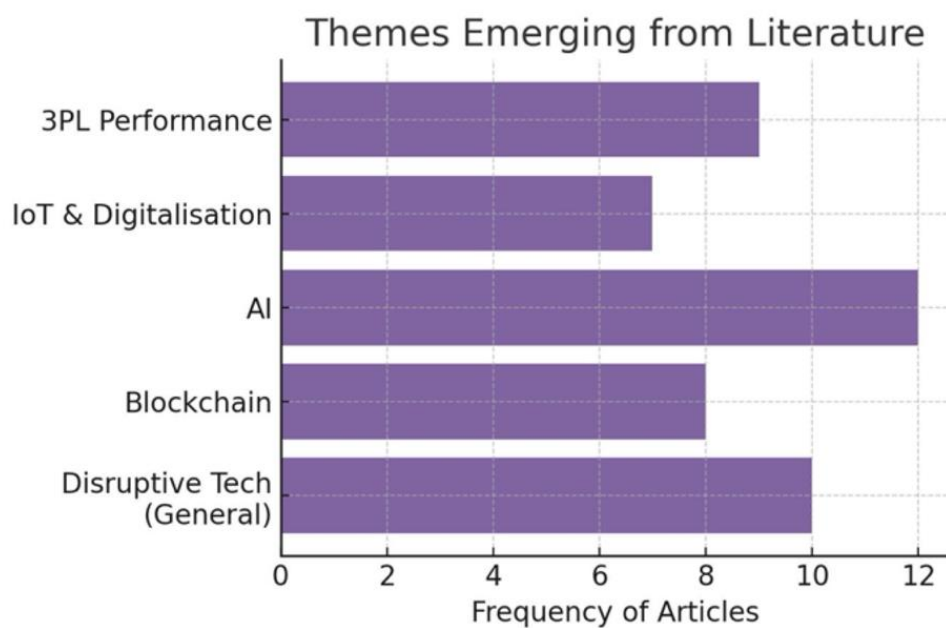


Figure 3.5

Emerging Research Themes

3.3.1 General Focus on Disruptive Technologies

The current literature frequently discusses disruptive technologies in an abstract way, citing digitalisation as a means of achieving supply chain competitiveness or resilience. These texts frequently use systematic review techniques or conceptual framework development to chart the technological horizon or pinpoint potential areas for further study.

3.3.2 Blockchain in Logistics Outsourcing

The literature has noted widespread coverage for blockchain as it has the potential to drive network openness, trustworthiness, and the effectiveness of transactions across logistics networks. Empirical studies using questionnaires on barriers to adoption follow the same patterns as case studies on implementation barriers. Though the theoretical promise of blockchain is impressive, studies usually quote the major inhibitions as the cost of implementation, the complexity of the technology, and change-averse stakeholders.

3.3.3 Artificial Intelligence in Logistics

AI applications are extensively discussed in the fields of predictive analytics, demand forecasting, warehousing automation, and route optimisation. Methodological designs also include quantitative studies that measure performance impacts, as well as exploratory qualitative studies that investigate organisational capability. AI is increasingly recognised as both an operational efficiency and a strategic decision-making transformational force in the field of 3PL.

3.3.4 Internet of Things (IoT) and Digitalisation

IoT research frequently employs mixed-methods approaches that encompass technology evaluation alongside performance assessments. IoT is recognised as a crucial enabling technology for data-driven logistics, providing real-time visibility, asset tracking, and interoperability with supportive technologies such as AI and blockchain.

3.3.5 Logistics Outsourcing and Performance Implications

This body of research relies heavily on empirical methods such as surveys and case studies to explore the relationship between technology adoption and the

performance of logistics outsourcing. Studies focus on how information technologies improve service quality, facilitate strategic partnerships, and offer competitive differentiation for 3pls providers.

3.4 Descriptive Summary Table

Table 3.1 provides a comprehensive list of all 50 articles analysed. The table includes the author, year of publication, key technology focus, journal name, and main contribution. Journal names offer insights into the scholarly quality and scope of the literature surveyed, covering leading supply chain journals and special-issue journals in technology management.

Table 3.1

Summary of Reviewed Literature (2020–2025)

No.	Author(s)	Year	Technology Focus	Journal	Key Contribution
1	Wang et al.	2021	Blockchain	Supply Chain Management: An International Journal	Blockchain adoption barriers analysis
2	Dolgui et al.	2020	Disruptive Tech	International Journal of Production Research	Reconfigurable supply chain concepts
3	Queiroz et al.	2020	Disruptive Tech	Annals of Operations Research	Pandemic impact on supply chain resilience
4	Centobelli et al.	2020	Blockchain	Sustainability	Blockchain adoption and sustainability framework
5	Govindan & Chen	2020	Blockchain	Transportation Research Part E: Logistics and Transportation Review	Systematic review of blockchain in supply chains
6	Choi & Guo	2020	AI	Computers & Industrial Engineering	Digital transformation research landscape

7	Xu et al.	2021	Digitalisation	Industrial Marketing Management	Digital supply chain capabilities framework
8	Bag & Pretorius	2021	Digitalisation	Sustainability	Industry 4.0 and circular economy integration
9	Ghadge et al.	2020	Disruptive Tech	International Journal of Production Research	Industry 4.0 impact on supply chain risk management
10	Zhang et al.	2021	Digitalisation	Technological Forecasting & Social Change	Digital technologies enabling circular economy
11	Kouhizadeh et al.	2021	Blockchain	International Journal of Production Economics	Theoretical exploration of blockchain adoption barriers
12	Min	2020	Blockchain	Business Horizons	Blockchain applications for supply chain resilience
13	Saberi et al.	2021	Blockchain	International Journal of Production Research	Blockchain integration in sustainable supply chains
14	Wang & Wong	2020	Blockchain	Journal of Business Research	State-of-the-art blockchain applications review
15	Queiroz et al.	2021	Blockchain	Computers & Industrial Engineering	Comprehensive blockchain adoption review
16	Roeck et al.	2020	Blockchain	International Journal of Production Research	Transaction cost analysis of blockchain implementation
17	Dolgui et al.	2021	Blockchain	Computers & Industrial Engineering	Blockchain coordination in dynamic supply chains
18	Choi	2020	Disruptive Tech	Transportation Research Part E: Logistics and	COVID-19 impact on logistics operations

				Transportation Review	
19	Tiwari et al.	2021	Blockchain	Logistics	Systematic review of blockchain in logistics
20	Pournader et al.	2020	Blockchain	Transportation Research Part E: Logistics and Transportation Review	Blockchain applications across logistics domains
21	Ghosh & Shah	2021	AI	Journal of Business Logistics	AI deployment framework for supply chains
22	Wichmann & Kaufmann	2020	AI	International Journal of Production Research	Comprehensive AI literature review in logistics
23	Choi & Guo	2021	AI	Transportation Research Part E: Logistics and Transportation Review	AI transformation mechanisms in supply chains
24	Shee et al.	2021	AI	International Journal of Production Economics	AI impact on logistics performance metrics
25	Dubey et al.	2021	AI	Transportation Research Part E: Logistics and Transportation Review	AI capabilities and supply chain performance
26	Büyüközkan & Göçer	2021	Digitalisation	Journal of Intelligent Manufacturing	Smart supply chain management frameworks
27	Wamba et al.	2021	AI	International Journal of Operations & Production Management	AI research agenda development
28	Papadopoulos et al.	2020	AI	Computers & Operations Research	AI applications in sustainable supply chain management

29	Dubey et al.	2021	AI	Production Planning & Control	AI impact on firm performance measurement
30	Ivanov & Dolgui	2020	Digitalisation	Production Planning & Control	Digital twin applications in supply chain management
31	Wamba et al.	2020	Digitalisation	Transportation Research Part E: Logistics and Transportation Review	Big data analytics in sustainable logistics
32	Childe et al.	2020	IoT	Supply Chain Management: An International Journal	IoT integration in supply chain operations
33	Luthra et al.	2021	IoT	Technological Forecasting & Social Change	IoT applications and future directions in logistics
34	Maktabifard et al.	2021	Digitalisation	Computers & Industrial Engineering	Digital twin implementation in logistics
35	Bag et al.	2021	IoT	Journal of Business Research	IoT enabling sustainable logistics practices
36	Raj et al.	2020	IoT	Transportation Research Part E: Logistics and Transportation Review	IoT enhancing logistics flexibility
37	Xu et al.	2020	Digitalisation	International Journal of Production Economics	Industry 4.0 technologies and performance outcomes
38	Ivanov	2021	Digitalisation	Computers & Industrial Engineering	Risk propagation modeling in digital supply chains
39	Büyüközkan & Göçer	2020	Digitalisation	Computers in Industry	Digital supply chain architectural framework
40	Chen et al.	2021	Digitalisation	Sustainable Production and Consumption	Digitalisation enabling sustainable supply practices

41	Shi et al.	2020	Digitalisation	International Journal of Production Economics	Service innovation in logistics outsourcing
42	He et al.	2021	Digitalisation	Transportation Research Part E: Logistics and Transportation Review	Big data capabilities and sustainability outcomes
43	Marchet et al.	2021	Digitalisation	International Journal of Operations & Production Management	Digital transformation implementation in logistics
44	Park et al.	2020	Digitalisation	International Journal of Production Economics	Logistics service capabilities and outsourcing performance
45	Skjoett-Larsen et al.	2021	Digitalisation	International Journal of Physical Distribution & Logistics Management	Digitalisation impact on 3PL performance measurement
46	Bask et al.	2021	Digitalisation	Industrial Marketing Management	Digital transformation and logistics outsourcing outcomes
47	Stentoft et al.	2021	Digitalisation	Transportation Research Part E: Logistics and Transportation Review	Digital technologies in sustainable logistics outsourcing
48	Kache & Seuring	2021	Digitalisation	International Journal of Operations & Production Management	Big data applications in digital supply chain management
49	Liu et al.	2020	Digitalisation	Transportation Research Part E: Logistics and Transportation Review	3PL capabilities and performance relationships

50	Zhang et al.	2021	Digitalisation	Industrial Marketing Management	Logistics service quality in outsourcing contexts
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3.5 Insights from Descriptive Analysis

The descriptive analysis identifies key trends of the literature on disruptive technologies in logistics outsourcing as follows:

Temporal Patterns: The surge in research in 2020-2021 shows the swift response by academia to digitalisation in response to supply chain disruptions. The continued interest through 2025 reflects the long-term significance of the research area.

Methodological Diversity: The span of the research techniques from systematic reviews to empirical research demonstrates the field's maturity and highlights the need for continued theory development alongside practical testing.

Geographical Gaps in Research: The paucity of research in African and emerging market settings presents promising future areas for investigation, most notably in the realm of technology adoption in resource-constrained environments.

Journal Quality Distribution: The top-journal articles in most fields provide evidence for the scholarly importance of disruptive logistics technologies and suggest the transdisciplinary nature of the research.

Technology Integration Focus: The focus on AI, blockchain, and IoT as the most significant technologies and the increasing focus on integration emphasise future research agendas directed at the development of holistic digital ecosystems.

3.6 Chapter Conclusion

This chapter gives a thorough descriptive groundwork for the investigation of the current research literature on disruptive logistics outsourcing technologies. The analysis presents evidence of a dynamic and emergent field by active scholarship engagement, methodological variety, and overt technological emphasis. The identified geographical and contextual research gaps and recent scholarship interest carry viable potential for future research. The descriptive outcomes open the way to the thematic analysis in Chapter Four investigating the emergent patterns and conceptual frameworks at the theoretical level in this wide body of scholarship.

Chapter 4: Thematic Analysis and Findings

4.1 Introduction

The focus of the current chapter is to offer a thematic analysis of disruption technologies in logistics outsourcing. The analysis is a result of the systematic literature review presented in the preceding chapters through 50 peer-reviewed articles published in the years 2020-2025. The data were coded and synthesised in five themes broadly as follows: (1) conceptualising disruption in logistics outsourcing; (2) blockchain and trust mechanisms; (3) artificial intelligence (AI) and predictive optimisation; (4) the Internet of Things (IoT) and digital infrastructure; and (5) value creation and strategic transformation.

Rather than presenting each such theme as a separate insight, the analysis highlights the interrelationships among them, the complementarities and tensions among them. For example, while IoT generates the data on which computations by AI rely, blockchain can be employed as a process of trust to verify information produced by IoT. Yet each such technology produces paradoxes and tensions as well: openness will subvert security; efficiency will subvert resilience; and the superiority of sustainability will be sacrificed for the energy intensity of digital systems.

Disruption in this chapter does not feature as a key property of technology. Instead, disruption is viewed as relational, emergent, and context-specific. Following Christensen's (1997) influential hypothesis, disruption comes in the form of new innovations attacking incumbents. Nonetheless, it would be more accurate to define disruption in logistics outsourcing as the growth of service relationships, performance evaluation, and governance structures. According to Bag and Pretorius (2021), "Industry 4.0 technologies embed innovation and sustainability into outsourcing arrangements, reshaping the very logic of supply chain collaboration" (p. 6).

It borrows frameworks from various other theories to support critical analysis. The Resource-Based View (RBV) (Barney, 1991; Wernerfelt, 1984) elucidates how 3PL services may sustain technology adoption and competitiveness if they are supplemented by unique and non-replicable resources. Dynamic Capabilities Theory (Teece, 2018) offers insights on how services perceive, capture, and recombine technologies in order to be competitive when uncertainties are faced. Institutional Theory (DiMaggio & Powell, 1983; Scott, 2008) emphasises how coercive, mimetic, and normative influences induce uneven adoption patterns by various regions. Lastly, Service-Dominant Logic (Vargo & Lusch, 2008) views

technologies as facilitators of co-creation of value by the client and the service provider.

Through the integration of such perspectives and empirical research, this chapter critically discusses how the outsourcing landscape is both shaped by and shapes disruptive technologies.

4.2 Theme One: Conceptualising Disruption in Logistics Outsourcing

It has become a pervasive theme in the literature that disruption is framed and conceptually understood in the peculiar instance of logistics outsourcing. Whereas few research studies operate using Christensen's limited definition of market displacement by disruption, other studies deploy broader socio-technical definitions encompassing relational and systems change (Chowdhury et al., 2022). This range of concepts demonstrates the difficulty of how digital technologies transform relationships in outsourcing.

Holmström and Partanen (2022) argue that logistics disruption "is less a consequence of technological change and more the consequence of the way actors redesign organisational processes and interaction" (p. 114). This shift from techno-centred definitions to relational ones is central in outsourcing environments, where 3PL providers operate as brokerages handling goods, information, and trust flows. Other researchers observe that disruption in logistics is local and not global. For example, while European blockchain projects are rhetorical, Internet Things-enabled visibility can be very transformational in reducing information asymmetry in cross-border trade (Nguyen & Laari, 2021).

Pandemic events gave especially enlightening insights into the contingency of disruption. Indeed, in widespread studies, Chowdhury et al. (2022) observe that "digitalisation amplified strengths as much as weaknesses in outsourcing relationships, proving disruption is as much a result of readiness as technology" (p. 274). This entails that such disruption cannot be couched technically in isolation, but rather must account for organisational readiness, institutional contexts, and relational processes.

The literature at hand demonstrates how disruptive technologies transform the relational dynamics of outsourcing fundamentally. As Christopher (2016) clarifies, logistics has been defined as "a network of relationships rather than a chain of processes" (p. 32). Disruptive technologies redesign such relations by redefining the processes of trust, overcoming the challenge of information asymmetry, and facilitating value co-creation processes. For example, predictive analytics by AI enables 3PL providers to provide performance guarantees by means of real-time

forecasting rather than by using lagging KPIs and thus transform outsourcing agreements fundamentally in the direction of proactive service delivery.

Theory-informed research bolsters understanding of the nature of disruption. Taking the view of RBV (Barney, 1991), technologies cannot provide a competitive advantage on their own unless supplemented by unique resources. Wamba et al. (2021) demonstrate supply chain performance improvement by blockchain only when supplemented by relational trust and governance capacities. Dynamic Capabilities Theory (Teece, 2018) asserts disruption as necessitating ongoing reconfigurations such that leading-edge 3PLs are continually testing and scaling digital innovations. Institutional Theory (DiMaggio & Powell, 1983) roots variable adoption rates such that Queiroz et al. (2019) assert in India, blockchain adoption was "more driven by coercive and mimetic pressures than by operational imperatives" (p. 73). Finally, S-D Logic (Vargo & Lusch, 2008) views disruption as the outcome of co-creation such that the client and supply chain actors engage one another about information, trust, and innovation.

One notable finding is the fact that disruption does not happen at regular intervals across geography and firm, and comes in the shape of what can broadly be termed contingent disruption. Giant incumbents like UPS, DHL, and Maersk use digital portfolios to drive systemic change while SMEs turn to incrementalism.

As Bag and Pretorius (2021) explain, "Digital adoption trajectories are stratified, with global leaders capturing disproportionate value while smaller actors remain locked in transactional modes" (p. 9). Geographical dispersion also occurs since the European regime advocates for the adoption of blockchain, whereas Asian markets demand solutions for visibility, accompanied by institutional voids among the emerging markets that confine the local 3PLs.

Lastly, the literature identifies key paradoxes and contradictions built into disruptive change. Technological answers aimed at minimising risk can breed new exposures - IoT offers greater insights while introducing cybersecurity risk (Chowdhury et al., 2022), AI optimizes effectiveness while potentially undermining resilience through buffer elimination, and blockchain aims at clarity while widening digital divides when standards don't match. As Holmström and Partanen (2022) put it, "digital disruption is a double-edged sword, creating opportunities for differentiation but also amplifying vulnerabilities" (p. 119). So Theme One observes logistics outsourcing disruption as relational, systemic, and conditional—not just the deployment of new tech, but relational recombination's in outsourcing relations, ruling systems, and institutional settings.

4.3 Theme Two: Blockchain and Trust Mechanisms

Blockchain technology emerges in the research literature as one of the most talked-about and contradictory technologies disrupting logistics in outsourcing. Its proposed value mainly entails amplifying the degree of visibility, traceability, and trust mechanisms; however, the real-world application bears key complexities and contradictions that mirror larger trends in technological disruption in the case of outsourcing.

The sources draw a significant boundary between symbolic adoption (employing blockchain to broadcast innovation and openness) and substantive adoption (the mass implementation of blockchain across supply chain activities). Queiroz and Fosso Wamba (2019) note that "blockchain adoption is often driven more by symbolic legitimacy pressures than by efficiency gains" (p. 73), confirming Institutional Theory's claim that organisations adopt technologies due to coercive forces and conformity forces, rather than solely for reasons of efficiency. Wamba, Queiroz, and Trinchera (2021) found evidence that "firms frequently announce blockchain initiatives to gain stakeholder trust, yet full-scale integration remains rare" (p. 134).

But in practice, blockchain has genuine disruptive potential by fundamentally altering the nature of the trust mechanisms in outsourcing relationships. Relational trust based on reputation and traditional interactions had heretofore defined outsourcing relationships. Algorithmic trust supplants this by recording transactions in irrevocable and publicly accessible manners. As posited by Hackius and Petersen (2020), "blockchain challenges the very premise of trust by replacing interpersonal commitments with technological guarantees" (p. 12). This has significant promise for 3PL-client relationships as the expenses of transactions will likely decrease with the de-personalising of collaborative problem-solving.

Saberi et al. (2021) capture the deep value of blockchain in strategic case choices by arguing that "blockchain allows supply chain actors to jointly establish sustainable practices through traceability and immutable record-keeping" (p. 420). Tracking in food logistics has also particularly been highly innovative in reducing chances of counterfeiting as well as the imposition of safety standard adherence (Tönnissen & Teuteberg, 2020). For highly governed or high-risk situations in which the 3PLs of the authors are at issue, blockchain can then provide real points of competitive differentiation through more trust as well as compliance functionality.

However, significant barriers limit the transformational capacity of blockchain. Kayikci (2020) highlights the fact that "interoperability, lack of standards, and

exorbitant costs are the most referenced inhibitors to blockchain implementation in logistics" (p. 365). These barriers are further fuelled by institutional barriers, as Treiblmaier (2020) explains: "without common technical and regulative standards, blockchain will become a disjointed remedy that widens disparities instead of solving them" (p. 546). Fragmentation proves most problematic in cross-border logistics, whereby third-party logistics operators (3PLs) engage in different regulative regimes.

The application of blockchain presents further governance challenges. While blockchain is very transparent, increased visibility may introduce competitive risk to confidential commercial information. Additionally, blockchain is inherently energy-intensive and goes contrary to the goals of sustainability (Saber et al., 2021). This shows the contradictory pattern of disruption such that fixing one problem generally spawns another and requires subtlety in governance and ingenious integration.

According to the Service-Dominant Logic (Vargo & Lusch, 2008), blockchain provides trust that is co-created by making the efforts of all the parties verifiable and visible. This tech-enabled trust-building usually lessens the relational intensity traditionally defining the successful outsourcing partnerships. The dilemma for the 3PLs is then how to capitalize on the trust-enhancing capacity of blockchain while retaining the collaborative relations sustaining adaptability and innovation.

Therefore, the blockchain value to logistics outsourcing cannot help but be both a symbol and a hands-on promoter of legitimacy and trust and traceability. Its transformative potential rests ultimately on the harmonisation of the regulatory landscape, interoperability of the technology, and integration within broader outsourcing governance regimes as part of a strategic.

4.4 Theme Three: Artificial Intelligence and Predictive Optimisation

AI differs both in having reached ubiquity among world-class 3PLs and in deriving direct measureable performance gains. While blockchain has experienced symbolic adoption and IoT has experienced infrastructural footprint, AI has experienced real performance gains in predictive analytics, optimisation and computerised decision-making that disrupt change service delivery patterns.

The most significant disruptive aspect of AI occurs through predictive performance management and the capacity to shift 3PLs from reactive service delivery to proactive optimisation and risk management. As Ivanov and Dolgui (2020) explain it, "AI extends resilience perspectives towards survivability by enabling predictive scenario modelling and proactive risk management" (p. 290).

This constitutes a revolutionary shift in outsourcing agreements and performance measures since the service performance can be predicted and planned in advance and not assessed after the event. Real-time optimisation of last-mile delivery through the implementation of dynamic routing algorithms reduces expenses significantly while enlarging the degree of customer satisfaction (Wang et al., 2021), and the implementation of machine learning to forecasting desired demand lessens the bullwhip effect in outsourced supply chains (Choi et al., 2020).

Nevertheless, the adoption of AI re-engineers chain relations and relations of power in such a manner not beneficial to traditional forms of outsourcing. The proprietors of the AI platforms maintain a powerful bargaining advantage relative to the users who end up relying on proprietary knowledge and algorithmic analytics that are not replaceable by users in-house. As Singh et al. (2021) explain, "AI adoption creates new dependencies as clients often lack the expertise to interpret complex algorithmic outputs" (p. 489). This supports the RBV (Barney, 1991) literature that technologies offer a competitive advantage when complemented by intangible knowledge and expertise not readily imitable.

Such lock-in by technology can bind consumers to long-term agreements by providers who are in a position to exploit AI, and this raises competition and fairness questions in the markets for outsourcing. But it also raises the prospects for more cooperation because the value-adding deployment of AI relies on the exchange of data, conditioning the algorithms, and tracking the performance both by the providers and by the consumers. This requirement for cooperation aligns well in Dynamic Capabilities Theory (Teece, 2018) because sensing, seizing, and reconfiguring capabilities all depend on the degree of cooperation.

One such inherent paradox includes the trade-off between the resilience and the efficiency inherent in AI optimisation. The AI optimisations enhance the operational efficiencies by the savings in redundancy stockholding and costs; the paradoxically flipside effect occurs when it also decreases the resilience by stripping buffers able to buffer shocks resulting from unprecedented events. The AI optimisation paradoxically renders supply networks fragile when confronted by low-probability and high-impact events, as contended by Dolgui and Ivanov (2021) (p. 115). The paradox became notable particularly in the case scenario relating to the COVID-19 pandemic when supply systems optimised by AI functioned optimally in regular circumstances but did not efficiently condition the systems to disruptions at the systemic level.

Fast deployment of AI also raises significant questions regarding ethics and governance that the research community has not really broached. Decision-

making discrimination can be the result of algorithmic bias in areas such as the distribution of resources, route recommendations, and performance evaluation. AI also gives rise to the sharing of information at large among customers and providers and raises questions regarding the protection of privacy and informational competitiveness and ownership. As Kamble et al. (2021) remarked, "the governance of AI in logistics remains underdeveloped, with insufficient frameworks for accountability and ethical decision-making" (p. 72).

Trends in adoption most definitely indicate stratification in the 3PL industry that reflects the bigger trends in the digital divide. The global giants such as DHL, UPS, and FedEx are implementing AI in order to provide end-to-end solutions, different predictive dashboards, robots in warehouses, and digital twins while small and medium-enterprises (SMEs) are implementing less advanced uses such as route optimisation and demand planning (DHL, 2021). As observed by Bag et al. (2021), "AI adoption trajectories are polarised, with leaders capturing disproportionate value while smaller providers lag behind due to resource and capability constraints" (p.15).

This demarcation also incorporates the Dynamic Capabilities Theory's stress on absorptive capacity as key agents constantly redescribe production systems in the pursuit of internalising AI, and SMEs are organisationally not well-enabled to capture maximum benefit through investments in AI. The end result is increasing polarisation in the industry, whose inherent foundation for competitive advantage assumes the form of technological sophistication.

AI is the most advanced and highly transformational logistics outsourcing technology available today and has a proven ability to push performance measures in the upward direction, predictive risk management and operating effectiveness. But installed it brings real complexities involving dependency, ethical governance and paradoxes of resilience and efficiency. As Ivanov and Dolgui (2020) caution, "AI's disruption lies not only in what it enables but also in what it erodes" (p. 291). The major challenge ahead for outsourcing relations will be how to achieve the balance in the drive for efficiencies versus the need for resilience, how to manage relations of dependency and how to establish the necessary governance arrangements to achieve the right and proper deployment of AI.

4.5 Theme Four: Internet of Things (IoT) and Digital Infrastructure

The Internet of Things (IoT) occupies the central position in the technology landscape as precisely that enabling technology through which the digitalisation of logistics outsourcing occurs. Just as much as AI alone goes on to capture spectacular value creation, e.g., IoT provides the digital bedrock upon which

future disruptive technologies get erected and thus warrants possibly the term as the "nervous system" of the logistics networks of the times.

IoT's major value proposition lies in providing real-time visibility and the resulting data production enabling blockchain certification and AI analysis. As Chowdhury et al. (2022) observe, "IoT has become the nervous system of logistics networks, transmitting information that underpins both responsiveness and reliability" (p. 102). By networking facilities, vehicles, and equipment using sensors and intelligent devices, IoT transmutes logistics from an informational-sparse to an informational-dense area. DHL (2021) observes that connected-fleet-enabled IoT and smart-warehouse-enabled IoT enables service providers to "transform service delivery by integrating data-driven insights into everyday operations" (p. 18).

This infrastructural role means that the disruption resulting from IoT is usually indirect but structurally necessary. Without IoT-created data, AI programmes will not be given any stimuli to engage in predictive optimisation, and blockchain-related systems will be given little meaningful content to verify. As Holmström and Partanen (2022) identified, "IoT is the infrastructural layer upon which other disruptive technologies build; without it, blockchain and AI would remain limited in scope" (p. 116).

Adoption of IoT completely transforms information asymmetry in outsourcing contracts, which has hitherto been the source of friction and wastage. Singh and Hess (2021) state that "outsourcing transforms from blind trust to knowledge-based trust when transparently shared IoT data" (p. 477). This change adheres to Service-Dominant Logic (Vargo & Lusch, 2008), whereby value co-creation ensues through open sharing of resources including timely information and mutual understanding. Clients get unparalleled visibility into the condition of their deliveries, warehouses' performance, and transport performance, while service providers are able to show value through open performance measures.

However, such increased visibility means new governance challenges related to data ownership, privacy, and security. IoT installations generate hitherto unprecedented amounts of operating data, and the question then is who owns such data and how should it be secured? Chowdhury et al. (2022) note that although IoT offers responsiveness advantage, it "at the same time creates new vulnerabilities through cybersecurity exposure" (p. 102). This highlights the contradiction that the very interconnectedness that enables the potential for better service creates potential weak links that can be exploited by cybersecurity threats.

IoT adoption patterns are a reflection of larger institutional and economic gaps in logistics. As in the advanced economies, IoT forms the center of complicated logistics systems with complex connectivity and rule-based institutional systems, in new markets adoption is limited by institutional weaknesses in connectivity, high costs, and institutional gaps. As Bag et al. (2021) describe, "IoT adoption trajectories are stratified, with leaders developing comprehensive smart logistics systems while smaller firms remain confined to basic sensor applications" (p. 11). This situation continues to be defined by geographic gaps—Asian adoption through urban e-commerce development, European adoption through rule-based requirements for traceability, and African adoption most frequently experimentation through weakly developed infrastructures (Nguyen & Laari, 2021).

Integrating IoT and other disruptive technologies has both strengths and weaknesses. IoT produces data that are interpreted by AI and verified by blockchain and develops widespread digital technology systems. But by integrating them too, disruptions in IoT can propagate across the entire digital supply chains. As Kamble et al. (2021) refer to it, "IoT's disruption is double-edged, enabling optimisation while heightening systemic vulnerability" (p. 729).

IoT best translates as the infrastructural foundation of digital logistics systems in order to offer visibility, responsiveness, and integration that other technologies depend on. Its disruptive abilities are Janus-like in the manner that it diminishes and creates vulnerabilities and that it equalises and isolates deals on outsourcing. IoT facilitates more than it causes radical independent disruption and contributes to systemic change by facilitating conditions for the deployment of AI and blockchain. Its strength then lies in infrastructural change and not in surface-level change in operational practices.

4.6 Theme Five: Value Creation and Strategic Transformation

The most significant applicability of disruptive logistics technologies in logistics outsourcing is that they collectively transform value creation processes and collaboration among logistics providers and 3PL providers at the strategic level. The theme integrates knowledge from previous themes to explain how blockchain, AI, and IoT assist in shifting the focus from service delivery based on transactions to value co-creation.

Classical logistics outsourcing had traditionally operated on a transactional model whereby the suppliers provided standardised agreed-services and the customers judged performance mainly in the realms of dependability and price. Yet disruptive technologies permit the logistics sector to progress to a relational model whereby value derives through mutual data exchange, predictive analytics,

collaborative innovation, and digital integration platforms. As Bag and Pretorius (2021) explain, "Industry 4.0 technologies redefine the very essence of supply chain collaboration, infusing outsourcing arrangements with innovation and sustainability" (p.6). This transformation goes hand in hand with the key axiom of Service-Dominant Logic (Vargo & Lusch, 2008) that asserts that value derives through the application and collaboration rather than through the exchange alone of services.

Digital maturity defines the single most significant way by which 3PL providers vary in a manner such that leaders can craft unique value propositions far beyond the traditional logistics functions. The providers utilise digital integration abilities to offer predictive performance guarantees, environmental control boards, supply chain visibility portals, and innovation partnerships in the form of collaborative development. DHL (2021) shows such transformation in the case of the company's Smart Warehouse initiatives and supply chain control towers fuelled by Internet of Things and offers what it identifies as "digital maturity enabling service differentiation beyond conventional logistics functions" (22).

However, less advanced or less large competitors get stuck at incremental adoption, which is mostly focused on cost savings and not relational value capture. This generates what Bag et al. (2021) term a "digital divide," so that "leaders capture disproportionate value, widening the gap between large and small providers" (p. 13). From a Dynamic Capabilities perspective (Teece, 2018), this discloses differential abilities in sensing technological opportunities, in seizing them by investment and integration, and in reconfiguring organizational processes to generate value.

Disruptive technologies' application to value creation strategy involves complex frameworks handling various conflicting imperatives. The Resource-Based View (Barney, 1991) focuses especially on how to match technologies and complementary assets such as human knowledge, relationships with the customers, and organisational ability. Dynamic Capabilities Theory (Teece, 2018) holds that the providers should diligently scan for the shift in the markets, capture the frontier technologies, and transform the nature of what they provide in order to stay ahead and experience a competitive advantage. Institutional Theory (DiMaggio & Powell, 1983) highlights the influence of the systems of regulation, industry norms and competition on the strategic space within which value comes to be created.

But value creation by means of technology also gives rise to significant paradoxes to be dealt with by the provider in a strategic fashion. More operational efficiency allows less room for buffers needed to recuperate disruptions. More transparency

blurs the confidentiality needed to maintain competitive advantage. Savings through optimised sustainability may be cancelled by energy requirements inherent to mass digitalisation. As Holmström and Partanen (2022) clarify, "digital transformation is as much about managing paradoxes as capturing opportunities" (p. 119).

Paradoxes require paradox management skills—readiness to reconcile contrary logics and balance tensions rather than resolving them categorically. Effective 3PLs exhibit such skills by means of flexible IT infrastructures able to accommodate shifting client needs, regulative forces, and competition challenges.

The competitive environment continues to reflect technology-fuelled stratification whereby digital abilities become the major differentiators. Service providers armed with robust AI, end-to-end IoT infrastructure, and intrinsic blockchain capabilities can offer multi-faceted value propositions including predictive analytics, end-to-end visibility, sustainability reports, and innovation hubs. Those without the necessary technologies, run the risk of becoming commodity service providers with low profit margins and slow growth.

Revolutionary technologies change logistics outsourcing from transactions to relational value creation through integration and digital maturity and skills that are easily blended. The revolution is not unique in not having stratification, paradox, and uneven development since they are common in bigger technological disruptions. It is not the choice of individual technologies that is the challenge to the 3PL providers but the development of dynamic capabilities to integrate them strategically, manage them ethically, and leverage them to achieve sustainable advantage through relational value creation.

4.7 Conceptual Framework: Technology-Enabled Value Co-Creation in Logistics Outsourcing

In this section, a conceptual framework that synthesises the connections between disruptive technologies, organisational capabilities, and value creation in logistics outsourcing contexts is presented, building on the thematic analysis.

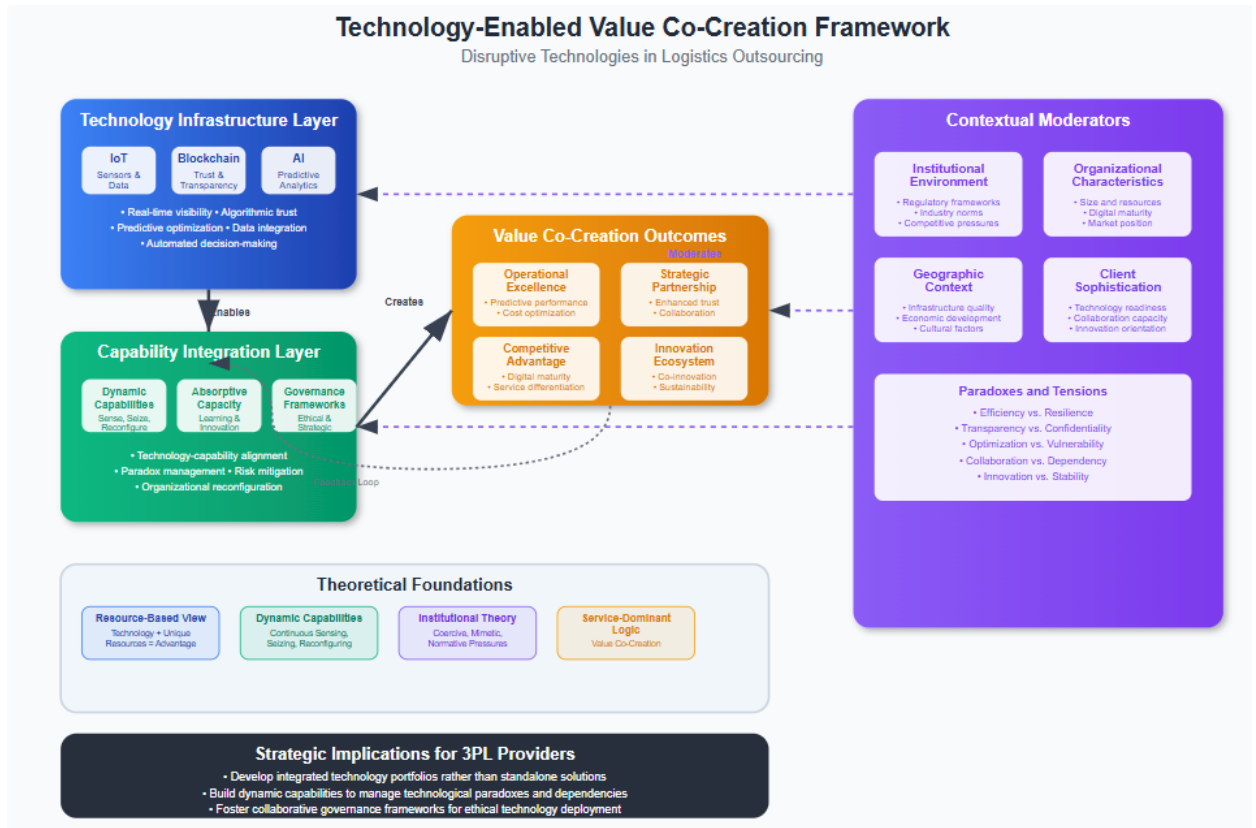


Figure: 4.1

Framework Components

Technology Infrastructure Layer:

- IoT sensors and connectivity providing real-time data generation
- Blockchain networks enabling trust and transparency mechanisms
- AI systems delivering predictive analytics and optimisation

Capability Integration Layer:

- Dynamic capabilities for sensing, seizing, and reconfiguring technologies
- Absorptive capacity for knowledge and innovation
- Governance frameworks for ethical and strategic technology deployment

Value Co-Creation Outcomes:

- Increased operational effectiveness and forecasting intensity
- Increased clarity and confidence in client-provider relationships
- Sustainable competitive advantage through differentiation
- Innovation through partnership and strategic collaboration

Contextual Moderators:

- Institutional environments (regulatory, normative, cognitive)
- Organisational size and resource availability
- Geographic and market contexts
- Client sophistication and technological readiness

Framework Dynamics

The framework demonstrates that value is created through systems integration and not through isolated deployment. IoT brings the data foundation, blockchain offers the trust mechanisms and AI offers the analytics. Value only comes when all the above are supplemented by organisational capabilities and delivered through the right governance model.

The architecture also reveals the disruptive and paradoxical nature of the technology, which has become clear through the analysis. Each technology offers distinctive value opportunities and, at the very same time, unleashes new dependencies and risks. Managing such paradoxes involves fluid and nuanced skills by which various efficiencies, robustness, secrecy, and openness pressures can be balanced.

Stratification impacts are central to the approach, illustrating how uneven capture of value follows when there are inequalities in technological and organisational capacities. Large-scale industry incumbents that enjoy high-order complexities capture the entire value delivered by the collected technological sets, while small-scale counterparts merely obtain rudimentary implements whose value-creation potential is limited.

The framework deems institutional settings as critical moderating factors that guide the adoption, implementation, and integration of technologies in value-creating strategies. They are all governed by the regulatory regimes, industry norms, and competition.

The framework offers the foundation for the logistics outsourcing relationships affected by disruptive technologies and provides guidance for future research and practice in change management spurred by technology.

4.8 Chapter Conclusion

The chapter examined disruption in logistics outsourcing through five interrelated themes, revealing complex, paradoxical, and unequal technological change. First, disruption involves relational and systemic redesign rather than technology

adoption only, and literature favours socio-technical perspectives in which relations matter equally to efficiency. Second, blockchain assumes double symbolic and practical roles and reinforces trust and transparency in spite of implementation challenges through enabling algorithmic trust models complementing traditional mechanisms. Third, AI is the most advanced trend and yields predictive performance improvements while creating paradoxes of efficiency versus resilience and has better rates of adoption than blockchain or IoT. Fourth, IoT provides a central infrastructure for other technologies while remaining largely unnoticed, offering a data-intensive world for AI and blockchain, and creating new vulnerabilities. Fifth, the technologies collectively enable a shift from transactional to relational outsourcing through value co-creation, while creating digital divides between pioneers and laggards.

The conceptual framework depicts how disruptive technologies are value-creating by means of basic systems while generating paradoxes requiring dynamic capacities and disruption not resulting from technologies by themselves but from technology and organisational capacities integration. Paradoxes, interdependencies, and inequalities ought to be observed by future studies rather than singling and glorifying single technologies. The strategic imperative for 3PL providers is not if they should disrupt or not but how to integrate strategically, handle ethically, and exploit efficiently technologies in operational contexts.

Chapter 5: Discussion on Findings

5.1 Introduction

This chapter critically examines the Technology-Enabled Value Co-Creation Framework developed in Chapter 4 as the primary outcome of this study. Rather than simply summarising prior findings, it presents the framework as a novel theoretical contribution that offers deeper insights into how disruptive technologies are transforming logistics outsourcing relationships. The framework integrates the results of the thematic analysis to introduce a new perspective on understanding the complex, often conflicting, and multifaceted effects of technological disruption in outsourcing arrangements.

The study outlines the framework's three main contributions: (1) its multi-level approach to technology-capability-value relationships, (2) its treatment of paradox management as a vital organisational capability, and (3) its focus on system-level rather than individual-level effects of technology. These contributions are contrasted with conventional theories and empirical realities, highlighting their novelty and usefulness both in theory and practice.

It critically examines the framework's limitations, contradictions with contemporary scholarship, and potential directions for future research. It accomplishes this while focusing on the core issue of advancing knowledge beyond current understanding within the logistics outsourcing literature.

5.2 The Framework as a Theoretical Contribution

5.2.1 Multi-Layered Conceptualisation of Technology-Value Relationships

The Technology-Enabled Value Co-Creation Framework makes its first contribution at the theoretical level by introducing a multi-level framework that distinctly separates technology infrastructure, capability integration, and value outcomes. This contrasts with all existing work, where technology adoption and value creation are largely presented under the assumption of being direct processes.

All existing models in the logistics literature follow what can only be called a "direct effects" approach, where technologies such as AI, blockchain, or IoT are assumed to generate value based on their inherent functionalities (Wang et al., 2021; Kamble et al., 2021). This framework, developed here, challenges this assumption by introducing capability integration as a necessary intermediary layer. It reflects the intuition of Dynamic Capabilities Theory (Teece, 2018) that

technologies only produce value after firms develop the sensing, seizing, and reconfiguring capabilities needed to utilise them strategically.

This is a significant contribution because it explains why the same technologies produce very different outcomes among 3PL service providers. It suggests that technology infrastructure can only offer potential value that is realised only through highly advanced capability combinations. This explains the thematic analysis's stratification, with larger players like DHL using integrated technology systems and smaller ones depending on more straightforward applications (DHL, 2021; Bag et al., 2021).

A multi-level framework architecture addresses a gap in current scholarship regarding the systemic nature of technological disruption. Even works like Chowdhury et al. (2022) and Holmström and Partanen (2022), which recognise technology integration, tend to base their arguments on individual technologies. It demonstrates that disruption results from the intersection of IoT data generation, blockchain-secured trust mechanisms, and AI processing capabilities, rather than a single technology.

This systemic approach critiques the technology-focused bias in much of the logistics literature, where blockchain, artificial intelligence, and the internet of things are examined separately. By framing these technologies as mutually dependent components of a digital infrastructure layer, the approach offers a more realistic understanding of how technological disruption occurs within complex outsourcing relationships.

5.2.2 Paradox Management as Core Organisational Capability

The other critically important contribution of the framework is its explicit highlighting of paradox management as one of the essential organisational capabilities for successful technology implementation. This is significantly different from previous work, where technology adoption has often been viewed as entirely positive, with obstacles merely seen as temporary challenges to overcome.

Thematic analysis uncovered underlying paradoxes inherent in each of the disruptive technologies: efficiency and resilience (AI), transparency and confidentiality (blockchain), and connectivity and vulnerability (IoT). Instead of viewing these as implementation issues, the framework views paradox management as a vital skill that organisations must develop to succeed in the face of technological disruption.

This study highlights a significant gap in logistics outsourcing research to date, which has overlooked the opposing role of technology adoption. Documents like Saberi et al. (2021) and Ivanov and Dolgui (2020) recognise some contradictions but mainly describe them as optimisation issues rather than enduring paradoxes that require management. It indicates that successful suppliers develop what can be called paradox navigation skills, which involve simultaneously pursuing what might seem like conflicting goals: efficiency and resilience, transparency and secrecy, innovation and stability. This explains why top-tier suppliers like DHL use AI for optimisation while maintaining resilience buffers, or employ blockchain for greater transparency while protecting their competitive knowledge.

The paradox management approach also adds more subtlety to understanding the relationship between technology and performance at the organisational level. Instead of assuming linear benefits from adopting technology, it proposes that organisations should develop complex balancing skills capable of managing contradictory demands interactively. This enhances Dynamic Capabilities Theory by clarifying what types of capabilities are called upon in technology-rich environments.

5.2.3 Contextual Moderation and Institutional Embeddedness

Its third aspect is its systematic approach to understanding contextual moderators that influence how technologies are adopted, implemented, and used to create value. While existing work recognises contextual conditions, it generally treats them as background factors rather than as dynamic moderators of the relationship between technology and value. The approach identifies institutional environments, organisational features, geographical locations, and client sophistication as key moderators that influence whether technology infrastructure is transformed into practical capabilities and results. It draws on Institutional Theory (DiMaggio & Powell, 1983), but extends it by demonstrating how various forms of institutional pressure interact with technological and organisational factors.

For instance, the theory explains why blockchain implementation varies at the regional level - EU rule-making institutions exert coercive forces for traceability and transparency while Asian market institutions exert mimetic forces facilitating visibility for competitive advantage (Queiroz & Fosso Wamba, 2019; Nguyen & Laari, 2021). It maintains that such institutional differences are not just contextual factors but indeed represent the types of capabilities fostered by institutions and the types of values that can be generated.

This study bridges a common gap in most logistics literature, which tends to view patterns in technology diffusion as worldwide and not institutionally rooted.

Scholarships such as Kayikci (2020) and Treiblmaier (2020) recognise adoption barriers but do not rigorously theorise the impact of institutional contexts on the technology-capability-value trajectory. This framework offers a more nuanced understanding of how context influences technological disruption.

The contextual moderation approach also clarifies the uneven distribution of disruption seen in thematic analysis. Instead of simply blaming it on different resources, the approach argues that institutional settings create various opportunities and barriers to the development of capabilities. This offers a more detailed explanation of digital divides within the logistics sector.

5.3 Challenging Existing Theoretical Perspectives

5.3.1 Beyond Resource-Based View Limitations

While the framework draws from Resource-Based View (Barney, 1991), it also criticises RBV's static portrayal of capabilities and resources. Traditional RBV claims that superior competitiveness arises from possessing valuable, rare, inimitable, and non-substitutable resources. However, the framework argues that sustainable superiority in fast-changing technological environments results from dynamic capabilities of reconfiguration, rather than merely possessing distinct assets.

This issue is most evident in the technology infrastructure layer, where similar blockchain platforms, AI algorithms, and IoT sensors are increasingly common among providers through cloud services and third-party platforms. The framework states that competitive advantage no longer relies on exclusive access to technologies but on the ability to combine them with organisational capabilities and deploy them in ways that generate value within specific contexts.

This shifts the focus from RBV's emphasis on holding resources to what can be more accurately called resource orchestration—the dynamic ability to mix, integrate, and reconfigure organisational and technological assets in changing environments. It aligns with recent developments in Dynamic Capabilities Theory (Teece, 2018) but applies these concepts to technology-rich outsourcing environments.

5.3.2 Extending Service-Dominant Logic

The framework broadens Service-Dominant Logic (Vargo & Lusch, 2008) to conceptualise processes of value co-creation in technology-enabled outsourcing relationships. While S-D Logic stresses that value is created through use rather

than in exchange, it provides little insight into how digital technologies can enhance or limit co-creation processes.

The framework bridges this gap by demonstrating how various technologies facilitate different modes of co-creation. Data co-creation is supported by IoT through mutual visibility, trust co-creation is fostered by blockchain through transparent verification, and insight co-creation is enabled by AI through collaborative analytics. The application of S-D Logic to digital domains is aided by this thorough explanation of these co-creation mechanisms.

It also shows that technology-mediated co-creation is not always entirely positive. While technologies have the potential to improve collaboration, they can also introduce dependencies, power imbalances, and coordination issues that limit value creation. It offers a more sceptical view of S-D Logic's otherwise optimistic perspective on co-creation processes.

5.3.3 Institutional Theory in Digital Contexts

The framework advances Institutional Theory (DiMaggio & Powell, 1983; Scott, 2008) to explain how digital technologies generate new institutional pressures and responses. Institutional Theory centres on coercive (regulatory), mimetic (rival), and normative (professional) pressures, but it also highlights other technological influences stemming from dependencies on platforms, data governance needs, and calls for algorithmic accountability.

For example, 3PL firms face institutional pressures to adopt AI because their competitors do (mimetic), because it is mandated by regulations (coercive), or because large customers increasingly expect AI-powered predictive functions as standard service features. This places 3PL firms in a position of what can be called technological institutional force that lies outside of usual institutional categories.

It also reveals how technologies can create institutional lock-in effects, so that initial adoption choices restrict future decisions. Vendors investing large amounts of money in specific blockchain networks or artificial intelligence platforms may find it difficult to change course, leading to path dependencies that Institutional Theory cannot address.

5.4 Practical Implications of the Framework

5.4.1 Strategic Technology Integration

The framework offers practical insights for 3PL companies evaluating technology adoption choices. Instead of evaluating technologies on the standpoints individually, the model advises companies to evaluate the aggregate potential by available capabilities. This means evaluating blockchain investments not only for the trust value that they offer by themselves but also for the ease with which they can integrate with IoT data capture and AI analysis.

This holistic approach replaces the common pilot-project method of testing technologies one at a time in isolation. The framework emphasises that such methods may underestimate value potential because they overlook synergy effects. Instead, providers must develop technology portfolio strategies that consider how technologies interrelate to form value ecosystems.

The framework also highlights the need to put measures of capability readiness prior to technology adoption. The providers ought to consider testing their capabilities to determine if they can take advantage of investments in technologies in the governance arrangements, absorptive capacity, and dynamic capabilities. It means the development of capabilities ought to be done prior to and not following a successful technology adoption.

5.4.2 Managing Technological Paradoxes and Digital Stratification

The paradoxical emphasis of this framework offers operational wisdom to providers caught between conflicting demands when adopting technology. Instead of viewing efficiency-resilience tensions as problems to be solved, such a framework indicates that providers should cultivate ambidextrous capabilities that can accomplish two objectives simultaneously. For example, it doesn't necessarily have to sacrifice resilience for efficiency when deploying AI, especially when suppliers utilise sophisticated scenario planning capabilities that use AI to model various disruption scenarios with flexible responses. Similarly, blockchain visibility doesn't necessarily have to compromise confidentiality when suppliers adopt discriminate disclosure capabilities that provide visibility without revealing sensitive competitive intelligence. This paradoxical management perspective asserts that technology adoption must be accompanied by organisational sophistication that surpasses mere technical implementation. Suppliers need to be capable of fostering cultural tolerance for ambiguities, structural agility to handle conflicting demands, and leadership skills to navigate complex trade-offs.

The focus of the framework on contextual adaptation suggests that smaller players can tailor their strategies to their institutional and geographical environments. For instance, local players may develop specialised expertise in compliance with regulations, cultural adaptation, or serving niche markets that large players cannot easily replicate.

5.5 Contradictions and Limitations of the Framework

5.5.1 Theoretical Tensions

Although the framework incorporates several theoretical perspectives, this inclusion also creates tensions that must be acknowledged. The emphasis on continuous reconfiguration by Dynamic Capabilities may conflict with Institutional Theory's focus on stability and legitimacy. It is impossible for firms to pursue radical reconfiguration and institutional conformity simultaneously without causing internal contradictions. The theory aims to achieve this through its contextual moderation functions and claims that successful suppliers gain the institutional entrepreneurship skills that enable them to innovate beyond institutional constraints. This remains a hypothesis that requires empirical validation. Correspondingly, integrating RBV and S-D Logic into the framework creates tensions related to value creation processes. RBV focuses on deriving value from unique resources, whereas S-D Logic emphasises value creation through inter-organisational collaboration. The framework suggests that such tensions can be managed with specific collaboration strategies, though its practical implications remain uncertain.

5.5.2 Empirical Limitations

The methodology relies on literature syntheses rather than new empirical studies, which limits its ability to capture the subtle realities of technology implementation in specific organisational settings. Although the systematic review of literature covers all scholarship extensively with remarkable breadth, it may overlook essential practitioner knowledge, implementation failures, or emerging practice that has not yet appeared in academic literature. Additionally, leadership of 3PL providers by such a system might be showcasing its best cases rather than typical adoption patterns across the industry. Dramatic, soap operalike changes may be overrepresented in the literature, while implementation failures or gradual adoption may be underreported. The framework also lacks temporal specificity regarding how relationships between technology, capability, and value evolve over time. While it incorporates the emphasis of Dynamic Capabilities Theory on reconfiguration, it does not specify timeframes or triggers for developing capabilities and realising value.

5.5.3 Contextual Constraints

The framework's claim to be applicable across different institutional and organisational contexts may be exaggerated. The thematic analysis showed notable differences in adoption patterns across regions, industries, and organisational types, indicating that the framework may require context-specific adjustments rather than a universal approach. For instance, the collaborative value creation perspective proposed by the architecture would suit relationship-based environments (e.g., Northern European logistics networks) better, but not so much for transaction-based environments (e.g., price-driven emerging market logistics). Similarly, the paradox management skills would be more appropriate for complex, multi-service providers, rather than for single-service, specialised logistics companies.

5.6 Positioning Against Alternative Frameworks

5.6.1 Technology Acceptance Models

The framework differs significantly from Technology Acceptance Models (TAM) that dominate much IS literature on technology adoption. While TAM focuses on individual user acceptance based on perceived usefulness and ease of use, the framework emphasises organisational ecosystem dynamics and inter-organisational value creation. This contrast is particularly vital in the contexts of outsourcing, where technology adoption has numerous stakeholders with diverse yet sometimes conflicting interests. Through the contextual moderation and paradox management focus, the present framework offers a better reflection on how technologies are adopted and utilised in the complex organisational settings compared to TAM's individual acceptance decision focus.

5.6.2 Supply Chain Integration Frameworks

Traditional supply chain integration models generally prioritise information exchange, process alignment, and relationship management as the means for value creation through technology (Christopher, 2016). Our framework expands these models by paying particular attention to how digital technologies transform the very foundation of integration instead of enhancing prevailing integration mechanisms. In other words, whereas conventional models would see IoT as enhancing information exchange, the framework indicates that IoT radically transforms the meaning of information exchange by facilitating automated data flows in real-time that need new collaborative mechanisms and governance structures. This is an example of a qualitative, not quantitative, shift in integration mechanisms.

5.6.3 Innovation Diffusion Models

The framework also differs from Rogers' (2003) innovation diffusion model, which highlights adoption rates and categories of adopters. Rather than concentrating on diffusion patterns, the framework focuses on value realisation processes and the organisational capabilities needed to turn adopted technologies into competitive advantages.

This perspective is especially relevant in logistics outsourcing, where technologies like blockchain will be extensively tested but rarely used for genuine value creation. The capability integration layer in the framework demonstrates why mere adoption fails to generate value, emphasising the need for organisations to develop advanced dynamic capabilities.

5.7 Chapter Conclusion

This chapter has established the Technology-Enabled Value Co-Creation Framework as an original theoretical contribution that deepens understanding of how disruption technologies transform logistics outsourcing relationships. The framework offers three main contributions: a multi-layered conceptualisation of technology-value connections, the inclusion of paradox management as a vital capability, and a systematic approach to handling contextual moderation effects. The discussion illustrates how the framework challenges existing theoretical perspectives while providing practical guidance for technology strategy, organisational development, and client relationship management. Critical analysis has highlighted key assumptions and limitations that require empirical validation and further theoretical development. The framework marks a shift from a technology-centred to a capability-centred understanding of disruption, emphasising that competitive advantage results from the ability to strategically integrate technologies rather than simply adopting them. This contribution lays the foundation for future research into the complex, paradoxical, and context-dependent nature of technological disruption in outsourcing relationships. Future studies should focus on empirical validation, the development of measurement tools, and the examination of how these dynamics evolve over time to further refine the framework's propositions. Ultimately, the insights and practical advice for managing the complexities of technology-enabled change in logistics outsourcing aim to advance in future research.

Chapter 6: Conclusion

6.1 Introduction

This study examines how third-party logistics (3PL) service providers adopt and utilise disruptive technologies and their impact on operational performance, competitive advantage, and value co-creation in logistics outsourcing relationships. By conducting a systematic review of 50 academic articles published from 2020 to 2025, the research investigates how Artificial Intelligence (AI), Blockchain, and Internet of Things (IoT) technologies are transforming the logistics outsourcing sector.

This final chapter consolidates the main findings, theoretical innovations, and practice contributions resulting from the research. It addresses the initial research questions, offers the overall conclusions derived from the thematic analysis, and acknowledges the limitations inherent in the systematic literature review methodology.

6.2 Summary of Key Findings

6.2.1 Addressing Research Question One

RQ1: How do disruptive technologies transform operational processes and service delivery models in third-party logistics outsourcing?

Disruptive technologies transform logistics outsourcing fundamentally through multi-level, intertwined mechanisms, not through replacing systems already in place. IoT provides the digital backbone for the real-time tracking of assets and data-intensive supply chains and serves as the logistics industry's "nervous system" in the digital economy. AI turns the delivery of service from reactive to predictive by enabling advanced analytics and automated decision-making such that third-party logistics providers can potentially guarantee performance on the basis of predictions rather than past measures. Blockchain, in the meantime, repositions trust mechanisms by providing clear and indelible records of transactions that enhance traceability and redefinition of trust in outsourcing partnerships. The technologies function as an intertwined ecosystem each feeding off the other: IoT generates the data, AI interprets it, and blockchain authenticates it, opening new dependencies and logistics outsourcing synergies.

6.2.2 Addressing Research Question Two

RQ2: Which critical success factors and challenges influence the effective adoption and value realisation of disruptive technologies by 3PL service providers?

The success of technology implementation in logistics depends on the development of dynamic capabilities to sense new opportunities, capture them, and adapt technology portfolios to changing customer and market needs and integrate new technologies with incumbent capabilities, governance, and customer management systems for optimal results. Third-party logistics providers who are high performers also need to have powerful paradox-management capabilities to balance among needs such as resilience versus efficiency and secrecy versus visibility and the ability to shift strategies to suit regional rules and trends in markets. Frequent challenges are digital stratification—where world-leadership companies experience disproportionate advantage at the cost of small providers—technical and organizational complexity in implementation and governance complexities connected to data secrecy and moral responsibility and the ongoing need to meet the balance among innovation versus stability and efficiency versus flexibility.

6.2.3 Emergent Themes and Patterns

The thematic analysis revealed five interconnected themes that characterise disruptive technology adoption in logistics outsourcing:

Five dominant themes emerge from the study in understanding disruption in logistics outsourcing. First, disruption should be viewed not merely as technology adoption but as relational and systemic change that varies by setting and progresses contingently rather than universally. Second, blockchain adoption reveals a contrast between symbolic and substantive use, with most organisations currently using it as a symbol of innovation but gradually developing the capabilities needed for full integration. Third, the most revolutionary technology is artificial intelligence (AI), which delivers tangible performance improvements but also introduces new dependencies and shifts power dynamics in client–provider relationships. Fourth, IoT infrastructure facilitates the creation of data and connectivity for the deployment of other digital technologies while also creating cyber threats. Lastly, the technologies as a whole call for the shift from relational value-creating practices and transactional outsourcing to a transformation that offers strategic rewards while widening the digital leader–laggard gap.

6.3 Theoretical Contributions

6.3.1 The Technology-Enabled Value Co-Creation Framework

The study's main theoretical contribution is the development of the Technology-Enabled Value Co-Creation Framework, a fundamental conceptual model that shows how disruptive technologies transform logistics outsourcing relationships. The framework provides three key contributions. It first puts forth a multi-level architecture that decomposes the technology infrastructure, capability integration, and value creation layers in such a way that the value comes out as the function of interactions among the layers and not just by the deployment of technologies in silos. It challenges common "direct effects" models that assume a one-to-oneness between technology and performance. Second, the framework positions paradox management as a critical organisational capability, recognising that tensions such as efficiency versus resilience or transparency versus confidentiality are ongoing paradoxes needing continuous management. This marks a shift from traditional views that see these issues as short-term obstacles. Third, the framework highlights the role of contextual moderation by including institutional settings, organisational attributes, and client sophistication as active factors influencing the link between technologies and value creation. This shifts away from models that regard the background context as passive, instead viewing it as an active element that shapes technology outcomes.

6.3.2 Extensions to Existing Theory

The research further expands and refines some of the established theory frameworks in play. From the Dynamic Capabilities Theory perspective, the research demonstrates that sensing, seizing, and reconfiguring capacities in high-technology environments do not proceed in a linear manner but instead call for ongoing paradox management and ecosystemic thinking. Pursuing the Service-Dominant Logic, the research demonstrates how digital technologies provide emergent modes of value co-creation while concurrently injecting constraints that suppress collaboration by injecting technological dependency and power asymmetries among actors. Contributions similarly emerge for Institutional Theory by illustrating how revolutionary technologies induce unique institutional pressures outside the standard coercive, mimetic, and normative logics by injecting such challenges as technological lock-in impacts and dependency on platforms. Lastly, the research refines the Resource-Based View by challenging the focus on the possession of resources instead arguing that sustainable competitive advantage in information-intensive settings depends all the more on the ability to manage and adaptively integrate resources across the ecosystem.

6.4 Practical Implications

The study recommends logistics stakeholders—namely 3PLs, purchasing managers, and regulators—to adopt an ecosystem perspective and IoT, AI, and blockchain integration in the context of a comprehensive digital strategy rather than each in isolation as a quick remedy. It asserts the necessity of integrating capabilities, good governance, absorptive capacity, and paradox management competency for managing tensions such as resiliency vs. efficiency and adapting strategies to unique market and institutional contexts. Client firms' effective outsourcing partnerships depend on collaborative capacity development and adaptive focus and emphasis on the provider's integration readiness and complex challenge-solving capacity beyond technological adoption. Policymakers and industry associations are warned to help small providers compete and mitigate widening digital gaps and urged to develop interoperability standards (specifically for blockchain) and change rules to contain new governance challenges created by AI, IoT, and blockchain in supply chains.

6.5 Research Limitations

The research findings are restricted by methodological decisions such as secondary data dependency and the risk of missing the perspectives of practitioners, failed initiatives, or recent industry best practices. Publication bias tilts the reporting in favour of successful implementation projects, and the time horizon (2020–2025) only allows for a short time span and discounts long-term patterns; sole English-language sources also impose gender and geographic biases while missing emergent region insights. The Technology-Enabled Value Co-Creation Framework conceptually relies on literature and needs empirical corroboration and has not had substantiated generalizability beyond large, developed-market 3PLs and provides no guidance on timelines when capabilities or values will be realized by limiting strategic applicability. The research's narrow focus on AI, blockchain, and IoT excludes other technologies such as robots or quantum computing and biases the focus on large providers while also limiting the applicability to SMEs and the non-logistics service providers.

6.6 Directions for Future Research

Future research should empirically test the Technology-Enabled Value Co-Creation Framework in the real world through large-scale surveys, longitudinal studies, and case studies to measure paradox management and value co-creation longitudinally. More research in emerging markets and small logistics firms can yield unique adoption barriers and collaborative behaviors, while industry studies can examine specialized needs in cold chain or last-mile logistics. Theoretical exploration of paradoxes, integration of platform economics,

and research on sustainability impacts are recommended, as well as methodological improvements such as mixed-method studies, real-time tracking, and simulation modeling. Finally, applied research should focus on practical tools development, assessment of training impacts, and governance structure design to alleviate moral and operational barriers in the presence of technological disruption in logistics.

6.7 Final Reflections

This research has uncovered the complex, paradoxical, and context-dependent nature of technological disruption in logistics outsourcing. It dismisses simplistic interpretations of technology adoption and value creation, highlighting that digital transformation requires sophisticated organisational capabilities that greatly surpass merely deploying technologies.

The Technology-Enabled Value Co-Creation Framework serves as a foundation against which such complexities can be comprehended, but it also highlights the necessity of further research that can capture the nuances of implementing technologies in diverse organisational and institutional contexts. That the framework necessitates paradox management and contextual adjustments itself reflects the complexity of managing technological change within the conditions of inter-organisational relationships.

Primarily, the research reveals that the digital evolution of logistics outsourcing surpasses merely adopting new technologies; it fundamentally involves reshaping relationships, capabilities, and value-creating processes that form the core of successful outsourcing collaborations. This evolution will be continuous, uneven, and filled with opportunities and challenges that will constantly change as technologies advance and organisational capabilities grow.

The effects extend beyond logistics to other service sectors facing similar technological changes, meaning the observations described here may have wider applications in understanding how organisations manage the complexities of digital disruption within inter-organisational contexts.

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Appendices

Ethical approval letter



17 June 2025

Dear Mr Jadhav ,

Reference: CURES/25684/2025

Project ID: 29185

Title: Disruptive Technologies in Logistics Outsourcing

We are pleased to inform you that you have successfully declared that your research project is a **Literature Review – based solely on openly available literature which is in the public domain, and you are undertaking desk-based research not involving any other form of data or information.**

You have also confirmed that your project **does not meet** any of the literature review specified exceptions, listed both within the relevant section of the CURES form and below:

1) Your supervisor has requested that you apply for approval through CURES because:

- The journals or data are in a sensitive area (please discuss this with your supervisor)
- The project will be embargoed i.e. **will not be publicly available via the Cranfield library immediately or longer term**

2) Approval is/will be specifically required by another external body e.g. journal publishers

Therefore, **you do not require ethical approval** and your CURES application will be automatically closed.

Please keep a copy of this letter safe, if this exception is in relation to your thesis project, you will need to include a copy with your final thesis submission.

If you have any queries, please contact CURES Support.

We wish you every success with your project.

Regards,

CURES Team