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From Micro to Meso-Level Blockchain Adoption: Redefining Supply Network Dynamics and Collaboration

Thesis Summery

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1. Introduction

In recent years, blockchain technology has garnered widespread recognition for its transformative potential across various industries. Within the domain of supply chain management, blockchain presents an unparalleled opportunity to revolutionize traditional practices by addressing critical issues such as lack of transparency, limited traceability, and inefficiencies in data sharing. By leveraging blockchain's decentralized and immutable ledger, supply chains can enhance trust among stakeholders, reduce the risk of fraud, and optimize operations across complex networks. These features are particularly relevant in industries where accountability and real-time data are paramount, such as food safety, pharmaceuticals, and automotive manufacturing.

Despite its evident promise, the adoption of blockchain technology in supply chains is neither uniform nor straightforward. Organizations face a diverse array of challenges and considerations when deciding whether to implement blockchain-based solutions. These decisions are influenced by a constellation of factors, including individual perceptions of utility, organizational readiness, regulatory environments, and sector-specific demands. The intricate nature of these factors often leads to significant variations in adoption rates across industries and geographic regions.

This research seeks to unravel the complexities underlying blockchain adoption in supply chains, providing a nuanced understanding of the motivations, barriers, and decision-making processes involved. It aims to investigate how individual actors, organizational entities, and sectoral dynamics converge to shape blockchain implementation. By adopting a mixed-methods approach, the study will explore the interplay between Micro-level motivations of individual actors, Meso 1-level organizational strategies, and Meso 2 power dynamics at a broader institutional level. Through this comprehensive examination, the research aspires to generate actionable insights and theoretical frameworks that advance both academic and practical understanding of blockchain adoption.

The scope of the study extends beyond a singular lens, exploring blockchain adoption from multiple perspectives to provide a holistic view. At the individual level, the research delves into personal attitudes, perceptions, and behavioral drivers that influence decisions regarding blockchain. At the organizational level, it examines how internal policies, resource availability, and strategic priorities affect the decision-making process. At the sectoral level, the study investigates external pressures such as market trends, regulatory frameworks, and competitive dynamics that drive or hinder adoption.

The findings of this research will not only enrich the scholarly discourse on blockchain technology in supply chains but also offer practical value for businesses navigating the challenges of digital transformation. By identifying the critical factors that influence blockchain adoption and understanding their interdependencies, the study will provide organizations with a clearer roadmap for implementation. Additionally, the development of a comprehensive adoption framework applicable across diverse industries will contribute to bridging the gap between theory and practice, enabling more informed decision-making in the era of supply chain digitization.

1.1. Research Plan

The complexity of blockchain adoption in supply chains necessitates a systematic and multi-layered research approach. This study adopts a mixed-methods methodology to explore the factors influencing adoption decisions, examine the interplay between key stakeholders, and identify the strategic considerations at various levels of the supply chain ecosystem. The research plan is designed to ensure a thorough analysis by integrating qualitative and quantitative data, enabling a comprehensive understanding of the multifaceted adoption process through the introduction of a conceptual model.

1.1.1. Research Objectives

The primary objectives of this research are to

Identify and analyze the critical factors influencing blockchain adoption in supply chains: This includes both enablers and barriers at individual, organizational, and sectoral levels. Examine the differences in adoption motivations between upstream and downstream actors: For example, suppliers and manufacturers may prioritize operational efficiency, whereas retailers and consumers might focus on transparency and trust. Investigate decision-making processes across different levels of analysis: This involves exploring how decisions are made by individuals, organizations, and sectoral stakeholders within the broader supply chain context. Explore the roles of trust, transparency, and consumer behavior in driving adoption: These elements are particularly crucial in industries where authenticity and accountability are key drivers of competitiveness.

Develop a comprehensive framework: The framework will synthesize insights across sectors such as food, fashion, and automotive, providing practical guidance for blockchain implementation.

1.1.2. Research Methodology

To achieve the research objectives, the study is structured into three levels of analysis: Micro-level, Meso1-level, and Meso2-level. A mixed-methods approach, integrating both qualitative and quantitative techniques, ensures a comprehensive understanding while maintaining generalizability.

Phase 1: Micro-Level Analysis (Individual Actors)

Objective: To investigate personal attitudes, perceptions, and behavioral factors influencing blockchain adoption within supply chain management. This phase will focus on understanding the human dimensions of adoption, such as motivations, concerns, and potential barriers, across different industry sectors (e.g., food, fashion, IT).

Data Collection: Semi-structured, open-ended interviews will be conducted with supply chain managers, IT professionals, end users, and other relevant stakeholders from industries such as food, fashion, and IT. This diverse range of participants ensures a comprehensive understanding of the adoption process across different sectors.

Methodology: A grounded theory approach will be employed to facilitate qualitative analysis. This approach will allow for the identification of key themes, including motivations for adopting blockchain, perceived benefits, and barriers to adoption. The research will leverage both qualitative and quantitative analysis techniques to provide a more nuanced view of the data.

Data Analysis: Thematic analysis will be conducted using Atlas.ti for coding. The iterative coding process will follow these stages:

1.Open Coding: Identifying initial concepts and themes in interview responses (e.g., trust, transparency, technological challenges).

2.Axial Coding: Establishing relationships between identified codes to form broader categories (e.g., transparency categorized as a driver of trust).

3.Selective Coding: Refining these categories into key themes most relevant to blockchain adoption, which will be statistically validated.

To measure the prominence and relative importance of each theme across different stakeholder groups, code frequency analysis and weighted scoring will be applied.

Ensuring Validity:

•Triangulation: Interview data will be triangulated with secondary sources and relevant literature to ensure robust findings.

•Member Checking: Participants will be asked to review the interpretations of their responses to validate accuracy and reduce researcher bias.

•Thematic Saturation: Interviews will continue until thematic saturation is reached, ensuring that all relevant themes and variations are captured.

Phase 2: Meso 1-Level Analysis (Organizational Dynamics)

Objective: To quantitatively assess organizational factors affecting blockchain adoption and analyze decision-making frameworks employed by companies.

Data Collection: A large-scale survey will be conducted among organizations across Europe, the USA, Canada, Turkey, and Dubai. The sample will include diverse sectors to allow for comparative analysis.

Survey Design: Insights from Phase 1 inform the survey, ensuring the inclusion of key organizational dynamics. A 3-point scale will be used for rating factors such as organizational readiness, strategic alignment, and cost considerations. The scale allows for clear comparative insights while reducing emotional biases.

Methodology: The Analytic Hierarchy Process (AHP) will be employed for structured pairwise comparisons of organizational factors. This method minimizes socially desirable response biases by focusing on relative factor importance.

Analysis Approach:

Step 1 – Data Preparation in Excel: Construction of pairwise comparison matrices and calculation of consistency ratios to assess response reliability.

Step 2 – Statistical Validation in R-Studio: Replication of calculations in R-Studio for cross-validation. Additional statistical tests, including regression and correlation analyses, will be performed to confirm relationships between organizational factors and blockchain adoption.

Validity Considerations:

•AHP's consistency ratio ensures logical response coherence.

•Cronbach's alpha will assess internal consistency reliability.

•Convergent and discriminant validity will be evaluated through factor analysis.

Phase 3: Meso 2-Level Analysis (Sectoral Power Influences)

Objective: To explore strategic and external influences shaping blockchain adoption at the sectoral level.

Data Collection: Semi-structured interviews and focus groups with decision-makers from large enterprises and SMEs across various sectors.

Focus Groups: Four groups (4–6 participants each) will discuss critical themes such as regulatory challenges, market pressures, competitive dynamics, and decision-making power hierarchies.

Triangulation: Findings from interviews and focus groups will be cross-referenced with Phase 2 survey data to enhance validity.

Analysis Tools: Atlas.ti will be used for qualitative data analysis, employing thematic coding techniques, while triangulation strategies will validate sectoral insights.

Validity Considerations:

•Data triangulation across interviews, focus groups, and survey findings ensures consistency.

•Thematic saturation will be monitored to confirm comprehensive data coverage.

•Member validation will be employed to verify sectoral insights with participants.

1.1.3. Data Collection Strategy

Objective: The objective of Phase 3 is to explore the strategic and external influences that shape blockchain adoption at the sectoral level, with particular focus on sector-specific challenges, power dynamics, and external forces that drive or hinder adoption.

Data Collection: Data collection will be carried out through semi-structured interviews and focus groups involving decision-makers from both large enterprises and small-to-medium enterprises (SMEs) across multiple sectors. This will ensure a comprehensive perspective on sectoral power dynamics and external influences within the blockchain adoption process.

Focus Groups: Four groups, each consisting of 4–6 participants, will be conducted. The discussions will center around key themes such as:

Regulatory challenges in blockchain implementation.

Market pressures and competitive dynamics influencing blockchain adoption.

Power hierarchies and decision-making structures within various sectors, particularly between larger corporations and SMEs.

Triangulation: To enhance the validity of the findings, triangulation will be employed across multiple data sources:

The findings from these interviews and focus groups will be cross-referenced and validated with the quantitative data collected in Phase 2. This will ensure that the sectoral insights are identified through the qualitative data align with trends identified through the survey and regression analysis.

Analysis Tools: Qualitative data will be coded and analyzed using Atlas.ti, facilitating the identification of key themes across interviews and focus groups and the qualitative insights derived from Atlas.ti will be supported by regression modeling from Phase 2 to assess the statistical significance of sectoral differences, decision-making power, and external influences.

Validity Considerations:

To ensure the validity and reliability of the study, several strategies will be employed:

1.Data Triangulation: Triangulating findings from the interviews, focus groups, and survey data ensures consistency and enhances the robustness of sectoral insights.

2.Thematic Saturation: Monitoring for thematic saturation will ensure that all relevant themes are explored comprehensively, providing a rich dataset for analysis.

3.Member Validation: Member validation will be used to cross-check the findings with participants, ensuring that the interpretations of the sectoral dynamics and blockchain adoption drives align with their lived experiences and perspectives.

2. Research Background

2.1. Blockchain Technology Role in Sustainable Supply Chains

Blockchain is revolutionizing industries like food and fashion by improving supply chain transparency, sustainability, and efficiency (Cui et al., 2023). Initially tied to cryptocurrency, it now addresses issues like fraud, waste, and inefficiency. In food, blockchain reduces waste by tracking products precisely, as seen in Walmart's partnership with IBM, cutting trace times from days to seconds (Liu et al., 2023). In fashion, it combats counterfeiting and promotes ethical sourcing, with brands like Stella McCartney using it to track sustainable materials (Patil & Bhosale, 2023).

While adoption presents challenges like high costs and integration complexity (Smith & Jones, 2020), blockchain's benefits—such as driving transparency and promoting circular economies—outweigh these issues. In agriculture, it optimizes resource use and reduces waste (Saberi et al., 2018). As consumer demand for sustainability grows, blockchain is poised to transform global supply chains, fostering greater responsibility and transparency.

Blockchain as a Solution for Supply Chain Challenges

Blockchain enhances transparency, reduces fraud, improves efficiency, and ensures ethical practices. It creates a decentralized, tamper-proof ledger that helps verify product authenticity, allowing consumers to trace items like tuna or confirm the sustainability of raw materials in fashion (Rowan, 2023; Ye et al., 2023). By ensuring immutable product information, blockchain reduces fraud in both fashion and food sectors, confirming the authenticity of luxury goods and tracking ingredient origins (Bhatia & Albarrak, 2023; Patil & Bhosale, 2023). It also boosts efficiency by automating processes through smart contracts and reducing intermediaries, improving inventory management (Zheng et al., 2018). Additionally, blockchain supports ethical practices by tracking sustainable sourcing and monitoring social and environmental conditions, such as fair wages and responsible agricultural practices (Papamichael et al., 2023; Nowicki & Kafel, 2021).

Examples: Blockchain in Food and Fashion Supply Chains

Blockchain technology is transforming both industries by addressing fraud, inefficiency, and sustainability challenges. In food, it enhances transparency, traceability, and security, enabling better management and optimization (Zheng et al., 2017). Walmart’s collaboration with IBM reduced trace times for leafy greens from days to seconds, while Carrefour and Nestlé use blockchain to prevent fraud and improve sustainability (Latha et al., 2023; Li et al., 2023). In fashion, blockchain promotes transparency and combats counterfeiting, as seen with VeChain’s partnerships with luxury brands like Louis Vuitton (She, 2022). It ensures ethical practices and sustainability, as Provenance tracks labor conditions and Stella McCartney traces sustainable material sourcing (Ding et al., 2023; Kadnikova et al., 2019). Both industries benefit from blockchain's ability to reduce intermediaries, optimize supply chains, and promote environmental and social responsibility, driving them toward more resilient and ethical futures (Hu, 2023; Kshetri, 2022).

2.2. Advancements and Impact of Technology in Modern Supply Chains

Overview of Modern Supply Chains: From Linear to Complex Networks

Supply chains have evolved from linear to complex networks due to globalization and technological advancements, necessitating improved collaboration and real-time information sharing to enhance transparency and reduce inefficiencies (Adebayo & Kırıkkaleli, 2021; Adomako & Nguyen, 2023). This transformation is particularly crucial in industries like agri-food, which faces food safety and traceability issues, and luxury goods, where counterfeiting is a concern (Li et al., 2022). Technologies like IoT, AI, and blockchain optimize supply chains by enabling real-time tracking, improving decision-making, and ensuring transparency and accountability (Cobbe et al., 2023; Zheng et al., 2017). Blockchain, for instance, offers a decentralized ledger that enhances trust and traceability in industries such as food safety and luxury goods authentication (Musamih et al., 2023).

These technologies are already making a significant impact. IoT monitors food conditions during transport, and blockchain verifies product origins in luxury goods (Palanisamy et al., 2023). They not only enhance operational efficiency but also strengthen brand reputation and sustainability (Crouzet, Gupta, & Mezzanotti, 2023). Carrefour, for example, uses blockchain to trace the environmental impact of products (Osman et al., 2022). As adoption grows, companies must overcome integration challenges to fully leverage these innovations for greater supply chain efficiency and sustainability (Qin et al., 2023; Martínez-García & Hernández-Lemus, 2022).

2.3. Actors in the Sustainable Supply Chain: Roles, Trust, and Decision-Making

Sustainable supply chains (SSCs) involve a dynamic network of actors—ranging from upstream suppliers to downstream distributors—who play key roles in advancing environmental, social, and economic sustainability goals. Blockchain enhances transparency, traceability, and fraud prevention, especially in industries like food and fashion. Trust, both at organizational and individual levels, is crucial for blockchain's success. Companies like Nestlé and Unilever use blockchain to verify ethical sourcing and sustainability, thereby strengthening trust across their supply chains (Kshetri, 2022). However, smaller actors may resist adoption due to concerns over complexity and operational disruption, emphasizing the need for gradual integration (Zheng et al., 2018).

At the organizational level, large companies prioritize long-term benefits such as scalability and risk management, while smaller suppliers focus on immediate cost-effectiveness (Zheng et al., 2017). Industry norms, experiences, and cultural contexts shape decision-making around blockchain adoption. While some organizations view blockchain as essential for regulatory compliance and consumer demand for transparency, others resist due to established trust-based practices. The "shadow of the past" (existing relationships and practices) and the "shadow of the future" (anticipated market changes and risks) influence adoption decisions (Kunzelmann, 2019). Power dynamics between large organizations and smaller suppliers further complicate adoption, necessitating support mechanisms for seamless integration (Ouyang et al., 2022). Effective blockchain use drives operational efficiency, improves traceability, and enhances consumer trust, leading to more sustainable and resilient supply chains (Sharma et al., 2023).

3.Problem statement

Blockchain technology promises increased transparency, traceability, security, and efficiency in supply chains, especially in industries like food, fashion, and pharmaceuticals. However, its adoption remains slow and uneven due to challenges such as technological readiness, organizational culture, and regulatory complexities. Existing studies focus on isolated aspects of adoption without considering the broader, interconnected factors. This research aims to fill this gap by proposing an integrated framework that explores the dynamics of blockchain adoption across sectors, considering both technological and non-technical factors at multiple decision-making levels.

3.1. Research Gap

The research gap in blockchain adoption in supply chains includes several key areas. First, existing studies lack comprehensive, multi-level adoption models that consider the interrelationships between Micro-level factors (individual behaviors) and Meso-level factors (organizational dynamics). Most current frameworks overlook the holistic nature of adoption, which requires an integrated approach that accounts for actors at different levels. Second, industry-specific challenges, particularly in sectors like food, fashion, and automotive, are underexplored, with limited insight into sector-specific barriers and drivers. Third, there is insufficient investigation into the interactions between individual behaviors and organizational factors, which play a crucial role in adoption. Additionally, many studies focus primarily on technological aspects, neglecting non-technical factors such as trust, regulatory pressures, and consumer behavior. Lastly, there is a lack of practical implementation frameworks to guide organizations through the adoption process. Addressing these gaps, this research will propose a multi-level model that incorporates both technological and non-technical factors, explores cross-level dynamics, and offers actionable frameworks to support effective blockchain adoption.

4.Conceptual Model for Blockchain Adoption in Supply Chain

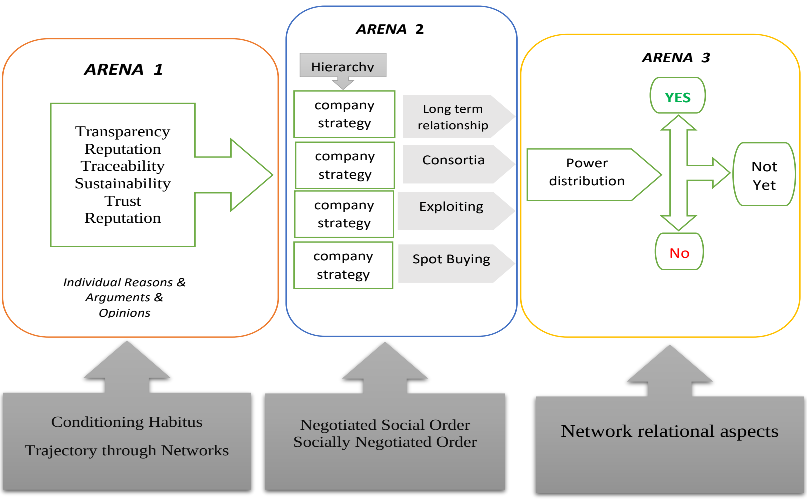
The conceptual model for blockchain adoption in supply chains outlines a three-arena framework. Arena 1 focuses on individual decision-making, examining how personal perceptions, trust, and behavior affect adoption. Arena 2 looks at organizational factors like internal processes, culture, and leadership in adoption decisions. Arena 3 explores network-level dynamics, including power, interorganizational relationships, and external pressures influencing blockchain integration. The model's validity is supported by qualitative and quantitative research methods, such as interviews, surveys, case studies, and social network analysis, offering a comprehensive view of adoption barriers and enablers across supply chain levels.

Model 01. The 3 Arenas Model

5.Theorical framework

Isomorphism Theory

Institutional isomorphism significantly influences decision-making in supply chain



management. Organizations operate within three primary arenas of influence: the technological arena, the regulatory arena, and the professional arena. Each of these arenas exerts distinct pressures, leading to convergence in practices and behaviors across industries (Phin, Zámborský, & Kruesi, 2023).

1. The Technological Arena: Innovation Through Mimetic Isomorphism

The technological arena is primarily shaped by mimetic isomorphism, wherein firms adopt new technologies by imitating industry leaders or peers. This often occurs when companies face uncertainty regarding the benefits of emerging innovations such as blockchain, artificial intelligence (AI), and automation (Zheng et al., 2017). Rather than conducting independent evaluations, firms tend to follow competitors to avoid being left behind, creating a bandwagon effect (Gaol & Wahyudi, 2023).

2. The Regulatory Arena: Compliance Through Coercive Isomorphism

The regulatory arena is driven by coercive isomorphism, where firms conform due to government regulations, legal requirements, and industry standards. Unlike mimetic isomorphism, which is voluntary, coercive pressures mandate compliance to ensure operational legitimacy (Chughtai et al., 2021). Businesses must adapt their supply chain strategies to meet sustainability laws, labor standards, and compliance protocols enforced by regulatory bodies (Roxani et al., 2023).

3. The Professional Arena: Ethical Legitimacy Through Normative Isomorphism

The professional arena is influenced by normative isomorphism, which emerges from shared industry values, ethical expectations, and professional standards. Unlike the other two forms, which stem from competition or legal mandates, normative isomorphism is shaped by industry norms, professional networks, and institutional training (Kashem & Haque, 2014). Companies integrate sustainability initiatives and corporate social responsibility (CSR) strategies to align with professional expectations and maintain legitimacy in the industry (Javaid et al., 2022).

6.Research Questions

RQ1:	**Given the blockchain capabilities, what is the motivation for actors to adopt the technology within supply networks?**
RQ1a:	What motivates upstream actors to adopt blockchain technology?
RQ1b:	What motivates downstream actors to adopt blockchain technology?
RQ1c:	How do differences in supply chain roles and responsibilities influence the adoption of blockchain technology?
RQ1d:	What external pressures (e.g., regulations, market competition) drive blockchain adoption in upstream and downstream supply chain actors?
RQ2:	**What goes on in the mind of the individual decision maker?**
RQ2a:	What factors (external / internal) affect the individual decision-maker's choice to adopt blockchain?
RQ2b:	What are the key arguments for and against adopting blockchain technology in the supply chain?
RQ3:	**Which factors are persuasive for participants to insert the required strategic information?**
RQ3a	How do economic and reputational factors influence the sharing of strategic information?
RQ3b	How does competitive pressure affect the willingness to share information?
RQ4:	**How does blockchain adoption contribute to sustainability goals in supply chains?**
RQ4a:	How does blockchain improve transparency and traceability of sustainable practices in supply chains?
RQ4b:	To what extent do stakeholders view blockchain as a tool for meeting sustainability requirements, such as ethical sourcing and energy consumption reduction?

Table 1. Research Questions

7.Empirical research

This chapter presents the empirical analysis of the study, utilizing a mixed-method approach to explore the factors influencing blockchain adoption in supply chains. The research was conducted in three phases: a qualitative phase involving interviews with blockchain and supply chain experts to identify key adoption factors; a quantitative phase where a survey validated and quantified these findings across a broader sample;

and focus group discussions to triangulate and further explore the dynamics shaping blockchain adoption. The study follows *Model 01* , with three arenas: Arena 1 (Micro-level), focusing on individual actors' perceptions and decision-making; Arena 2 (Meso-level), examining organizational interactions and structures; and Arena 3 (Meso-level), investigating higher-level strategic decision-makers and external market forces. This layered approach ensures comprehensive, validated findings at both individual and organizational levels, contributing to a richer understanding of blockchain adoption across diverse supply chains. Despite the challenges of data collection and analysis, the mixed-method approach offers a more holistic perspective, combining numerical data with qualitative insights to enhance reliability, generalizability, and contribution to the field.

7.1 Arena 1: Micro Level (Individual actors)

The Genesis of Decision Makers' Mental Maps: Human decision-making is shaped by subjective mental maps, influenced by personal experiences and social conditioning. These mental maps prioritize information based on its relevance, with each individual's worldview guided by a unique reference model—shaped by their social environment or "habitus" (Bourdieu, 1972, 1977). The habits, a "structured structuring structure" (Bourdieu, 1977), determines how individuals approach familiar problems and how they address new, complex challenges. The behaviors and decisions made by individuals are rooted in these structured experiences, which can be influenced by educational institutions, organizational cultures, and broader societal norms (Bakker & Kamann, 2007).

Methodology: This qualitative research focuses on the human dimensions of blockchain adoption at the Micro-level, collecting data through a variety of sources. In-depth interviews were conducted with 23 upstream actors (producers, manufacturers, distributors) and 11 downstream actors (consumers, retailers, end-users) from sectors like food and fashion. Experts in blockchain technology, sustainable supply chains, and various industries provided further insights. Collaborative dialogue through focus group discussions and peer-to-peer interviews allowed for deep exchanges, and semi-structured, open-ended interviews provided a platform for participants to express their motivations and beliefs beyond technical factors.

*Results (Data Analysis and Key Themes):*The interviews highlighted key factors for blockchain adoption, with analysis conducted using Atlas.ti to identify recurring patterns. Major themes emerged around transparency, traceability, and sustainability for managers; technical challenges and advantages for IT managers; and trust and reputation for consumers. Four distinct sets of perspectives were identified:

sustainability experts emphasized ecological and social sustainability; blockchain experts highlighted transparency, traceability, and technological integration; end-users prioritized trust and reputation; and organizational experts considered operational efficiency and cost-effectiveness.

Fuzzy Cognitive Mapping: Fuzzy Cognitive Mapping (FCM) was used to visualize relationships and interdependence among adoption factors. Using the Mental Modeler software, the FCM model revealed that upstream actors prioritize transparency and traceability, while downstream actors focus on trust and reputation. The FCM model illustrated the "push-and-pull dynamics" in blockchain adoption, showing that technological benefits such as transparency attract upstream stakeholders, while ethical practices, sustainability, and reputation drive downstream adoption.

Analysis of Key Motivations

Different sets of actors emphasized different factors:

Set 1 (Sustainable Supply Chain Experts): Transparency (20.2%), traceability (14.8%), and sustainability (21.4%) were key drivers.

Set 2 (Blockchain Experts): Transparency (21.5%) and traceability (26.6%) were central, with a focus on technological capabilities and future sustainability.

Set 3 (End-user Customers): Trust (34.9%) and reputation (25.8%) were top priorities, followed by a lesser emphasis on transparency (2.8%) and traceability (3.6%).

Set 4 (Organizational Experts): Transparency (36.5%) and traceability (14.8%) were significant, alongside operational efficiency and cost-effectiveness.

Key Conclusions from the FCM Model

The FCM model confirmed that upstream actors are primarily driven by transparency, while downstream actors are motivated by trust and reputation. The "push-and-pull" dynamics identified in the model show how the emphasis on transparency in upstream actor’s contrasts with the downstream focus on ethical practices and brand reliability.

	Hypotheses
	Hypotheses Related to Upstream Actors:
H1:	Upstream actors prioritize transparency and traceability as key drivers for blockchain adoption.
	Hypotheses Related to Downstream Actors:
H2:	Downstream actors prioritize trust and reputation in blockchain adoption.
H3:	Downstream actors' decision-making regarding blockchain adoption are significantly influenced by perceived reputation of the platform's providers.
H4:	Downstream actors are more likely to adopt blockchain technology when trust and reputation are effectively communicated and reinforced.
	Hypotheses Related to the Fuzzy Cognitive Map (FCM):
H5:	The FCM will demonstrate significant differences in the hierarchical importance of factors influencing decision-making between upstream and downstream actors.

Table 2. Research Hypotheses

Validation of the Research Hypotheses: The FCM model visually reinforced the research hypotheses, highlighting the distinct motivations of upstream and downstream actors. Upstream actors prioritize technical advantages like transparency, while downstream actors focus on consumer trust and ethical practices, underscoring the need for blockchain strategies that align with stakeholder expectations.

Linear Structural Equation Modeling: LISREL was used to complement the FCM model and further analyze complex relationships between observed and latent variables. This method helped refine the theoretical framework by offering a quantitative perspective on how key factors interact and influence blockchain adoption, balancing the qualitative depth with statistical rigor.

Discussion of Significance and Practical Implications: The findings underscore the importance of trust, transparency, and sustainability in blockchain adoption, aligning with existing research. The study highlights the need for blockchain strategies that accommodate the diverse priorities of upstream and downstream actors, emphasizing the role of consumer trust in driving adoption. The research suggests that addressing these varied motivations is critical for successful blockchain implementation.

Micro-Level Revolution: This research reveals the "Micro-level revolution" behind blockchain adoption, focusing on the motivations, perceptions, and cognitive shifts of individual decision-makers. The FCM model and hypotheses validation provide insights into how personal mental maps and social conditioning shape blockchain adoption at the Micro-level within supply chains, offering a deeper understanding of the human aspects involved.

7.2 Arena 2: Meso-1, Company Level

The Battle of the Egos: Hierarchy in decision-making: The adoption of technologies, such as blockchain, within companies is influenced by power structures across different functions like Finance, Marketing, HRM, Purchasing, and Production. These power dynamics are shaped by organizational hierarchy, where Finance and Marketing tend to hold the most influence, while Purchasing is often seen as the least influential.

Methodology: Research tools: The study used a mix of survey questionnaires (SQ), scenario-based evaluations, the Analytic Hierarchy Process (AHP), and advanced data analysis tools (Excel and R-Studio).

Sample: 156 respondents from various industries and countries participated, offering a diverse range of insights into the impact of departmental influence on blockchain adoption.

Scenario-based evaluations: Respondents were asked to assess the relative power of different departments in the context of blockchain adoption using a three-point scale.

AHP: This method helped quantify subjective judgments, converting them into a ranked list of departmental influences, ensuring internal consistency and rigorous analysis.

Quantitative Data Collection and Analysis: Hierarchical analysis: The results of the AHP analysis showed that Finance (30.3%) and Marketing (26.6%) were the dominant departments in decision-making. HRM (17.6%) and Production (21.1%) held moderate influence, while Purchasing (13.9%) was the least influential. By analyzing the data using R software, we obtained the following results: the Finance department achieved the highest total score (186), followed by Marketing (161). The HRM (133) and Production (129) departments showed moderate scores, while Purchasing had the lowest score (100), indicating potential areas for improvement.

Comparing Functional Arenas: Findings: Finance was confirmed as the most influential department, with Marketing coming second. HRM, Production, and

Purchasing were ranked lower, with Purchasing having the least power in decision-making. Validation with statistical analysis (R-Studio): Statistical methods like ANOVA, correlation analysis, and regression helped confirm the hierarchical structure of departmental influence.

Contextual Factors: Industry and geography: The hierarchical dynamics of departments vary based on industry, geography, and contextual factors like experience and gender. For example, the Netherlands showed a strong influence from Finance and Marketing, while Turkey had a more equal distribution between Finance, Marketing, and HRM.

Relationship Between Functional Areas and Geographic Locations: Geographical and industry contexts influenced the hierarchical power distribution across departments. For example, Belgium had a stronger emphasis on Marketing and Purchasing, while Dubai and Canada showed a more balanced distribution of power.

Insights and Implications: Influence of Finance and Marketing: The dominance of Finance and Marketing reflects the centrality of financial control and market strategy in the adoption of new technologies like blockchain.Role of underrepresented functions: The relatively low influence of Purchasing highlights the potential for organizations to improve decision-making by integrating the expertise of departments like Purchasing, which are often overlooked in technology adoption processes.

Discussion of Significance and Practical Implications: Strategic decision-making: Finance and Marketing's influence on technology adoption decisions reinforces the need for strategic arguments that resonate with these departments. Implications for HRM and Purchasing: The relatively low influence of HRM and Purchasing suggests that their ideas may require the backing of more powerful departments, like Finance, to be successful.

Conclusion: The "Battle of the Egos": The study emphasizes the importance of understanding internal power dynamics when adopting new technologies like blockchain. A more inclusive decision-making process, which considers the underrepresented functions, can help ensure a more balanced and effective implementation strategy.

7.3 Arena 3: Meso-2, the Network Level

Typology of Networks: Once a company establishes its external strategies (procurement, marketing, operations), it becomes part of a larger network. Companies often interact with different types of networks simultaneously, including:

Long-term relational networks: Stable, trust-based partnerships.

Consortia with short-term relations: Temporary alliances for specific projects.

Exploitative networks: One-sided relationships for unilateral gain.

Volatile spot-buying networks: Short-term transactions driven by immediate needs.

These varied relationships create a complex web that influences how blockchain adoption is approached within supply chains.

Power and Uniqueness: Power dynamics play a significant role in blockchain adoption. Factors such as company size, market share, product uniqueness, and strategic positioning determine a company's ability to influence decisions within a network. Larger companies often push for blockchain adoption, while smaller players may face resistance or limited ability to drive change.

Methodology: The study used focus group discussions to explore network dynamics and decision-making processes. Five diverse groups from various sectors, regions, company sizes, and genders provided insights into how power imbalances and network position affect blockchain adoption.

Focus Group Findings

Compelled Acceptance of Terms: Companies often feel forced to accept unfavorable terms due to financial dependency or market power imbalances, straining relationships and trust.

Manifestations of Arrogance: Unilateral decision-making or unrealistic demands by powerful actors can damage relationships.

Power Dynamics: Power imbalances can drive efficiency but may also lead to resentment and disengagement from weaker actors

Key Findings on Blockchain Adoption

Power Asymmetry: Larger corporations resist blockchain due to a preference for stability, while smaller firms are more flexible but lack negotiation power.

Company Size: Larger firms have resources for blockchain but may resist, while smaller firms struggle with resources and negotiating power.

Strategic Network Positions: Key players (suppliers or distributors) can drive adoption, while weaker players face significant barriers.

Individual Characteristics: Leadership traits like risk tolerance and openness to innovation influence blockchain adoption.

Relevance for Blockchain Adoption: The study highlights that the success of blockchain adoption is highly dependent on navigating power dynamics and fostering clear, symmetrical communication. Larger players' power can either enable or hinder adoption, and a deeper understanding of network dynamics is essential for overcoming barriers.

Practical Implications: The study suggests that blockchain adoption requires collaborative frameworks to address power imbalances. By promoting mutual respect, transparent communication, and aligning leadership priorities with broader network goals, companies can enhance blockchain adoption and overcome systemic challenges.

Conclusion: The study emphasizes the importance of understanding organizational, cultural, and individual factors in network dynamics. Power asymmetries can either accelerate or hinder blockchain adoption, so fostering collaboration and equitable partnerships is critical. The findings contribute valuable insights into overcoming barriers to blockchain implementation and provide actionable recommendations for firms to leverage blockchain's transformative potential across interconnected supply chains.

8.Research findings

This research explores blockchain technology adoption in supply chains through a Mixed methods approach across three arenas. It uses institutional isomorphism to understand how firms align their strategies due to external pressures, with a focus on how past practices and future expectations shape adoption decisions. Arena 1 (Qualitative) focuses on in-depth interviews and case studies, revealing factors such as industry norms and competition pressures (mimetic isomorphism) that influence blockchain adoption. Arena 2 (Quantitative) offers a statistical analysis across sectors to measure how different isomorphic pressures (coercive, mimetic, and normative) drive blockchain adoption. This arena highlights sector-specific influences, with finance and marketing more influenced by coercive and mimetic forces, while HRM and purchasing are driven by normative isomorphism. Arena 3 (Qualitative) further investigates power dynamics within supply chain hierarchies via focus groups, showing how powerful actors exert influence over adoption decisions. The triangulation of findings across these three arenas enhances understanding of blockchain adoption, providing insights for both theoretical development and practical implementation in supply chains.

8.1. Novelty of the Research Summary:

This research brings several innovative contributions to the study of blockchain adoption in supply chains. First, it integrates institutional isomorphism with a temporal framework that considers both the "shadow of the past" (legacy systems, organizational culture) and the "shadow of the future" (competitive pressures, anticipated benefits), offering a dynamic perspective on adoption. Second, it conducts a multi-sector comparative analysis using a mixed-methods approach, enhancing the generalizability of findings across diverse industries and countries. The research also incorporates power dynamics within the supply chain hierarchy, addressing how key stakeholders influence adoption decisions, which has been underexplored in previous studies. Additionally, the study refines the measurement of isomorphic pressures, making it more context-specific and tailored to blockchain adoption in supply chains. Lastly, the cross-national data collection approach adds complexity and depth to the analysis, accounting for how different national and cultural contexts affect blockchain adoption patterns. These innovations collectively enhance theoretical development and offer valuable practical insights for businesses and policymakers.

8.2. Limitations and Challenges Summary:

While the research is innovative, it faces several challenges. Methodologically, integrating qualitative and quantitative data from diverse contexts is complex, requiring careful interpretation to avoid inconsistencies. Data collection across multiple countries introduces challenges related to language, culture, and regulatory differences, which may impact comparability and bias. Accurately measuring isomorphism also presents difficulties, as it requires valid and reliable proxies for abstract concepts like industry norms and competitive pressures. The study's focus on power dynamics requires careful handling of potential biases in data collection and analysis. Data limitations, such as access to reliable blockchain adoption statistics, sampling bias, and ensuring the quality of qualitative data across different cultural settings, pose additional challenges. The complexity of applying institutional theory to blockchain adoption in a dynamic context also requires careful consideration of its limitations. Practical challenges include resource and time constraints, as well as ethical considerations when conducting research in diverse cultural settings. Despite these challenges, addressing them through robust research design and careful data analysis will strengthen the research's credibility and contribution to the field.

9.Future of study

I. Extending the Theoretical Framework:

Resource Dependence Theory: Integrating this theory could provide insights into how reliance on specific technologies or suppliers influences blockchain adoption.

Institutional Logics: Future studies could explore how different institutional logics (e.g., market, regulatory, social responsibility) interact in shaping adoption decisions.

Institutional Entrepreneurship: Investigating the role of key actors promoting blockchain adoption could enhance understanding of the diffusion process.

Dynamic Model of Isomorphism: Developing a dynamic model that incorporates feedback loops and the evolution of institutional pressures over time would better capture adoption processes.

II. Deepening the Empirical Investigation:

Longitudinal Study: Tracking blockchain adoption over time would reveal how isomorphic pressures evolve and their long-term impact on supply chain performance.

Comparative Case Studies: In-depth studies of organizations within the same sector but with varying blockchain adoption levels could provide insights into decision-making processes.

Expanding Geographic Scope: Including regions with diverse levels of technological development and regulatory frameworks would enhance understanding of context-specific factors.

Examining Blockchain Implementations: Investigating different types of blockchain implementations (public, private, permissioned) could shed light on their impact on supply chain efficiency.

III. Exploring Practical Implications and Policy Recommendations:

Developing Best Practices: Creating guidelines for overcoming challenges in blockchain adoption across sectors could improve implementation outcomes.

Policy Recommendations: Proposing regulatory frameworks and investment strategies to support blockchain adoption could accelerate its integration in supply chains.

Sustainability and Ethics: Examining blockchain's environmental impact and its potential to enhance ethical sourcing and transparency could promote responsible adoption.

SMEs Impact: Assessing the unique challenges and opportunities for small and medium-sized enterprises (SMEs) could help design policies to facilitate their blockchain adoption.

By building on the study's strengths and addressing these future directions, the research could significantly impact both theory and practice in the field of blockchain technology adoption in supply chains.

10.Discussion and Conclusion

This dissertation explored the adoption of blockchain technology in global supply chains, examining the interplay of institutional isomorphism, the "shadows of the past and future," and power dynamics. Using a Mixed methods approach across three interconnected arenas, it revealed a nuanced understanding of the factors shaping blockchain adoption. Arena 1 employed qualitative methods to uncover the motivations and challenges behind adoption, highlighting how past infrastructure and future expectations influenced decision-making. Arena 2 quantitatively assessed institutional isomorphism's impact across sectors, revealing sector-specific variations in adoption patterns. Arena 3 analyzed power dynamics within the supply chain, showing how stakeholders with greater market control influenced adoption processes. The integration of these findings across arenas offered a comprehensive understanding of blockchain adoption, emphasizing the importance of considering global and local contextual factors in shaping technological change within complex supply chains.

This dissertation makes significant contributions to the literature on technological adoption in complex organizational networks by offering a nuanced, multi-faceted perspective that integrates institutional theory with a temporal framework and power dynamics analysis. It challenges simplistic views of technological adoption by revealing the intricate interplay of individual motivations, institutional pressures, and power relations in blockchain integration decisions. The research's multi-national, multi-sector approach strengthens the generalizability of its findings while recognizing the contextual diversity across geographical and cultural settings. Despite certain limitations, the study provides valuable insights for both academics and practitioners, particularly in helping organizations navigate blockchain integration complexities. It also guides policymakers in fostering responsible adoption of blockchain technologies in global supply chains and contributes to the broader body of knowledge on technological innovation's impact on the global economy.

11.List of Publications

1.Behavioural and Organisational Factors Determining Blockchain Adoption , **Journal**: Current Journal of Applied Science and Technology. Published ,**2022. DOI**: 10.9734/cjast/2023/v42i74077

2.Blockchain adoption: the decision flows through three arenas,**Journal**: Journal of Economics, Management and Trade (JEMT). Published, **2023.DOI**: 10.9734/jemt/2024/v30i71221

3.The impact of blockchain on transparency & trust in sustainable agri-food supply chains. **Book**: Springer: Web 3.0 and Metaverse. Published ,**2024.**

4. *3 Arenas Models*. **Magazine**: Deal. Business and Economy ,**2024.**

5.Micro-Level Perspective on Blockchain Adoption: A Fuzzy Cognitive Map Analysis of Motivations. **Journal** : Journal of Business Research (JOBR-D-25-00966). Submitted , **2025.**

6. How Finance stages and shapes strategic Blockchain technology adoption decisions. **Journal**: Frontiers. Submitted ,**2025**.

7.The role of power in market control in supplier-buyer relations. **Journal**: Edelweiss Applied Science and Technology- Published, **2024**.**DOI**: 10.55214/25768484.v8i6.3858

8.How Isomorphism Forces Shape Blockchain Adoption for Sustainability in Supply Chains: A Multi-Level Analysis. **Journal**: Society and Economy -Submitted ,**2025.**

12.Cofrencess Participations

1. IPSERA International Conference

•Year: 2022

•Conference Date: 2nd – 5th April 2022

•Location: Jönköping, Sweden

•Mode: In-person

•Participation: Participated and presented

2. IKSAD INSTITUTE International Conference

•Year: 2022

•Conference Date: 9th October 2022

•Location: Izmir, Turkey

•Mode: Online

•Participation: Participated and presente

3. Pannon National Conference

•Year: 2022

•Conference Date: 9th November 2022

•Location: National Conference (in-person)

•Mode: In-person

•Participation: Participated and presented

4. IKSAD INSTITUTE International Conference

•Year: 2022

•Conference Date: September 2022

•Location: Online

•Mode: Online

•Participation: Participated and presented

5. IPSERA International Conference

•Year: 2023

•Conference Date: 2nd – 5th April 2023

•Location: Barcelona, Spain

•Mode: In-person

•Participation: Participated and presented

6. MDI International Conference

•Year: 2023

•Conference Date: 5th – 7th January 2023

•Location: Online

•Mode: Online

•Participation: Participated and presented

7. IKSAD INSTITUTE International Conference

•Year: 2023

•Conference Date: 13th – 15th December 2023

•Location: Mardin, Turkey

•Mode: Online

•Participation: Participated and presented

8. UNeECC International Conference

•Year: 2024

•Conference Date: 9th – 11th October 2024

•Location: Timișoara, Romania

•Mode: In-person

•Participation: Participated and presented

9. BBU 1857 National Conference

•Year: 2024

•Conference Date: 14th November 2024

•Location: Budapest, Hungary

•Mode: In-person

•Participation: Participated and presented

10. IPSERA International Conference

•Year: 2024

•Conference Date: 5th – 9th April 2024

•Location: Rio de Janeiro, Brazil

•Mode: Online

•Participation: Participated and presented

11. IKSAD INSTITUTE International Conference

•Year: 2024

•Conference Date: 11th – 13th November 2024

•Location: Antalya, Turkey

•Mode: Online

•Participation: Participated and presented

12. AI-Hungary International Conference

•Year: 2024

•Conference Date: 11th – 13th September 2024

•Location: Berlin Germany

•Mode: In-person

•Participation: Participated and present

13. IPSERA International Conference

•Year: 2025

•Conference Date: 30th March – 4th April 2025

•Location: Eindhoven, Netherlands

•Mode: In-person

•Participation: Participated and present

13. References

Adebayo, T., & Kırıkkaleli, D. (2021). Impact of renewable energy consumption, globalization, and technological innovation on environmental degradation in Japan: application of wavelet tools. Environment, Development and Sustainability, 23, 16057-16082.

Adomako, S., & Nguyen, N. P. (2023). Digitalization, inter-organizational collaboration, and technology transfer. Journal of Technology Transfer, The Journal of Technology Transfer.

Ayala, V., Caldwell, J. I., Garcia-Silva, B., Shah, D., García, V., & Kuo, T. (2022). Increasing Surplus Food Redistribution to Improve Food Access Through a Partnership Between Public Health and a Technology-Based Company. Journal of Health Care for the Poor and Underserved, 33, 24-7.

Bakker, E. F., & Kamann, D. J. F. (2007). Perception and social factors as influencing supply management: A research agenda. Journal of Purchasing and Supply Management, 13(4), 304-316. https://doi.org/10.1016/j.pursup.2007.10.001

Bhatia, S., & Albarrak, A. (2023). A Blockchain-Driven Food Supply Chain Management Using QR Code and XAI-Faster RCNN Architecture. Sustainability.

Biggs, E. E., Bumble, J., & Hacker, R. E. (2022). Professional Networks of Special Educators and Speech-Language Pathologists Working With Students Who Use Augmentative and Alternative Communication. Remedial and Special Education, 44, 351-364.

Bourdieu, P. (1972, 1977). Outline of a Theory of Practice. Cambridge University Press.

Butt, H. M. M., Khan, I., & Xia, E. (2023). How do energy supply and energy use link to environmental degradation in China? Environmental Science and Pollution Research, 30, 92891-92902.

Campos-Alba, C., Chica-Olmo, J., Pérez-López, G., & Zafra-Gómez, J. (2023). Modeling political mimetic isomorphism versus economic and quality factors in local government privatizations. Public Administration.

Chandan, A., John, M., & Potdar, V. (2023). Achieving UN SDGs in Food Supply Chain Using Blockchain Technology. Sustainability.

Chitimira, H., & Ncube, M. (2020). The Role of Regulatory Bodies and Other Role-Players in the Promotion of Financial Inclusion in South Africa. Acta Universitatis Danubius: Juridica, 16.

Cobbe, J., Veale, M., & Singh, J. (2023). Understanding accountability in algorithmic supply chains. Proceedings of the 2023 ACM Conference on Fairness, Accountability, and Transparency.

Crouzet, N., Gupta, A., & Mezzanotti, F. (2023). Shocks and Technology Adoption: Evidence from Electronic Payment Systems. Journal of Political Economy, 131, 3003-3065.

Cui, Y., Hu, M., & Liu, J. (2023). Value and Design of Traceability-Driven Blockchains. Manufacturing & Service Operations Management, 25, 1099-1116.

DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. American Sociological Review, 48(2), 147-160.

Ding, M., Li, Y., Fan, T., Lash, G., Wei, X., & Zhang, T. (2023). Geochemistry of the Lower Silurian black shales from the Upper Yangtze Platform, South China: Implications for paleoclimate, provenance, and tectonic setting. Journal of Asian Earth Sciences.

Esmaeilzadeh, H., Zheng, K., Barry, C., Mead, J., Charmchi, M., & Sun, H. (2021). Evaluating Superhydrophobic Surfaces under External Pressures using Quartz Crystal Microbalance. Langmuir: The ACS Journal of Surfaces and Colloids.

Evans, M., Irizarry, J. L., & Freeman, J. (2022). Disciplines, Demographics, & Expertise: Foundations for Transferring Professional Norms in Nonprofit Graduate Education. Public Integrity, 25.

Guidi, C., & Berti, F. (2023). Labor exploitation in the Italian agricultural sector: The case of vulnerable migrants in Tuscany.

Hu, Q. (2023). Unilever's practice on AI-based recruitment. Highlights in Business, Economics and Management.

Joshi, A. (2023). Detecting Ponzi schemes on Ethereum: Towards healthier blockchain technology.

Kadnikova, O., Altynbayeva, G., Kuzmin, S., Aidarkhanov, A., Toretayev, M., & Khabdullina, Z. (2019). Ecological feasibility of applying technology in recycling garment and knitwear production. Environmental and Climate Technologies.

Kshetri, N. (2022). Blockchain systems and ethical sourcing in the mineral and metal industry: A multiple case study. International Journal of Logistics Management.

Kolcava, D., Smith, E. K., & Bernauer, T. (2022). Cross-national public acceptance of sustainable global supply chain policy instruments. Nature Sustainability, 6, 69-80.

Kunzelmann, H. (2019). The long shadow of the past: contemporary Austrian literature, film and culture. Journal of Contemporary European Studies, 27, 546-548.

Li, Y., Man, S., Ye, S., Liu, G., & Ma, L. (2022). CRISPR-Cas-based detection for food safety problems: Current status, challenges, and opportunities. Comprehensive Reviews in Food Science and Food Safety.

Liu, Z., de Souza, T. D., Holland, B., Dunshea, F., Barrow, C., & Suleria, H. (2023). Valorization of Food Waste to Produce Value-Added Products Based on Its Bioactive Compounds.

Latha, S. B., Asif, S., Dastagiraiah, C., Elangovan, D., Kiran, A., Chandra, P., & Reddy, S. (2023). An Adaptive Machine Learning model for Walmart sales prediction. In International Conference on Circuit, Power and Computing Technologies (pp. 988-992). 2023 International Conference on Circuit Power and Computing Technologies (ICCPCT).

Liu, Z., de Souza, T. D., Holland, B., Dunshea, F., Barrow, C., & Suleria, H. (2023). Valorization of Food Waste to Produce Value-Added Products Based on Its Bioactive Compounds.

Martínez-García, M., & Hernández-Lemus, E. (2022). Data integration challenges for machine learning in precision medicine. Frontiers in Medicine.

Musamih, A., Salah, K., Jayaraman, R., Arshad, J., Debe, M. S., Al-Hammadi, Y., & Ellahham, S. (2023). A blockchain-based approach for drug traceability in healthcare supply chain. IEEE Access, 9, 9728-9743.

Nowicki, P., & Kafel, P. (2021). Remote certification processes during global pandemic times. SHS Web of Conferences.

Osman, A., Chen, L., Yang, M., Msigwa, G., Farghali, M., Fawzy, S., Rooney, D. W., & Yap, P. (2022). Cost, environmental impact, and resilience of renewable energy under a changing climate: A review. Environmental Chemistry Letters, 21, 741-764.

Ouyang, Y., Zhang, J., & Li, Y. (2022). The interplay of manufacturer encroachment and blockchain adoption to combat counterfeits in a platform supply chain. International Journal of Production Research, 62, 1382-1398.

Papamichael, I., Chatziparaskeva, G., Voukkali, I., Navarro Pedreño, J., Jeguirim, M., & Zorpas, A. (2023). The perception of circular economy in the framework of the fashion industry. Waste Management & Research.

Palanisamy, P., Padmanabhan, A., Ramasamy, A., & Subramaniam, S. (2023). Remote patient activity monitoring system by integrating IoT sensors and artificial intelligence techniques. Sensors (Basel, Switzerland), 23.

Patil, M. D., & Bhosale, V. (2023). An overview of blockchain technology: Architecture, consensus, and future trends. International Journal of Advanced Research in Science, Communication and Technology.

Qin, M., Su, C., Wang, Y., & Doran, N. M. (2023). Could “digital gold” resist global supply chain pressure? Technological and Economic Development of Economy.

Rowan, N. (2023). Current decontamination challenges and potentially complementary solutions to safeguard the vulnerable seafood industry from recalcitrant human norovirus in live shellfish: Quo Vadis? Science of the Total Environment.

Saberi, S., Kouhizadeh, M., Sarkis, J., & Shen, L. (2018). Blockchain technology and its relationships to sustainable supply chain management. International Journal of Production Research, 57(7), 2117-2135.

Sharma, A., Sharma, A., Singh, R., & Bhatia, T. (2023). Blockchain adoption in agri-food supply chain management: An empirical study of the main drivers using extended UTAUT. Business Process Management Journal, 29, 737-756.

She, Z. (2022). VeChain: A Renovation of Supply Chain Management -- A Look into its Organisation, Current Activity, and Prospect.

Smith, A., & Jones, B. (2020). The impact of blockchain technology on supply chain management. Journal of Supply Chain Management, 15(2), 45-58.

Wade, J. (2022). Ethical sourcing. The Fairchild Books Dictionary of Fashion.

Ye, X.-Y., Chen, Y., Yang, J., Yang, H., Wang, D., Xu, B., ... Shi, Z. (2023). Sustainable wearable infrared shielding bamboo fiber fabrics loaded with antimony doped tin oxide/silver binary nanoparticles. Advanced Composites and Hybrid Materials, 6, 1-13.

Yudha, E. D., Santoso, B., & Setiono, J. (2023). Legal Protection for the Public Against the Circulation of Counterfeit Goods.

Zheng, Z., Xie, S., Dai, H., Chen, X., & Wang, H. (2017). An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends. 2017 IEEE International Congress on Big Data (BigData Congress), 557-564.

Zheng, Z., Xie, S., Dai, H., Chen, X., & Wang, H. (2018). Blockchain challenges and opportunities: A survey. International Journal of Web and Grid Services, 14, 352-375.

Wüstner, M., Radzina, M., Calliada, F., Cantisani, V., Havre, R., Jenderka, K., ... Jenssen, C. (2022). Professional Standards in Medical Ultrasound - EFSUMB Position Paper (Long Version) - General Aspects. Ultraschall in der Medizin.