Whoosh
Vol. 1, No. 2, (2026), pp. 157-177
ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

The Role of Financial Technology (FinTech) in Enhancing Financial Efficiency, Transparency, and Sustainability in Transportation and Logistics Systems

Sameullah Samim*, and Abdul Kabir Azizi

Department of Banking and Finance, Faculty of Economics, Balkh University, Balkh, Afghanistan
*Corresponding author: samiullahsamim2017@gmail.com

Abstract. Transportation and logistics systems move goods across many organizations, currencies, and legal regimes, while the related financial flows often lag behind physical delivery. This paper examines how financial technology (FinTech) may narrow that gap. It is a structured narrative review of 35 peer-reviewed and institutional sources on digital finance, blockchain, supply chain finance, and sustainable supply chain management, interpreted against three outcomes: financial efficiency, transparency, and sustainability. The synthesis distinguishes three FinTech layers (digital payments and settlement, data-based financing, and shared ledgers with smart contracts) and identifies four recurring mechanisms: lower transaction and reconciliation costs, faster information exchange, improved verification of shipment events, and financing terms conditional on verified information. Evidence is strongest for financing efficiency, whereas direct evidence on delivery-to-payment intervals in logistics remains limited, and the transfer of general small and medium-sized enterprise financing findings to logistics firms is uncertain. Literature published through 2025 broadens the evidence base but does not remove the shortage of causal, logistics-specific comparisons. The review also shows that ledger immutability does not guarantee the truth of source data: trusted capture, identity assurance, provenance, audit, and dispute procedures are necessary antecedents. Five propositions are derived as hypotheses for future testing, not as established effects. The paper concludes that FinTech is best understood through a conditional framework in which gains depend on readiness, governance, and data assurance, and it sets out a research agenda for testing these conditions with logistics-specific samples.

Keywords: Blockchain, Financial Technology, Supply Chain Finance, Sustainability, Transportation.

1 Introduction

A container that leaves a factory in one country and reaches a retailer in another passes through a long chain of firms. Each of them issues, checks or forwards a document, and each expects to be paid. Studies of logistics digitalization describe many of these steps

This work is licensed under a Creative Commons Attribution 4.0 International License (CC BY 4.0)

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

as document-heavy and dependent on bilateral trust between firms [1], [2]. The physical movement of goods has become faster and easier to track. The movement of money, and of the evidence that justifies a payment, has changed more slowly.

Financial technology, or FinTech, is the term now used for digital innovation in financial services, including payments, lending, investment and insurance [3], [4]. Arner and colleagues trace FinTech through three eras and place the current one after the 2008 financial crisis [5]. Lee and Shin describe an ecosystem made up of start-ups, technology developers, governments, customers and established financial institutions [6]. Thakor reviews what is known about FinTech and banking [7], and Philippon argues that technology can lower the cost of financial intermediation, which has barely fallen in the United States over more than a century [8]. If that argument holds, sectors with long, multi-party payment chains, such as transportation and logistics, are natural places to look for gains.

Two bodies of work touch this question but rarely meet. One studies blockchain in supply chains, transport and logistics, and it is large enough to have produced several reviews [9]–[12]. The other studies FinTech in banking and financial intermediation [13]. Supply chain finance sits between them, because it ties financing decisions to the flow of goods [14]. Among the sources reviewed here, few ask how the financial layer as a whole changes what logistics systems can achieve, and fewer still read that question against efficiency, transparency and sustainability together.

This paper makes three contributions. First, it synthesizes a focused set of 35 sources and distinguishes logistics-specific evidence from evidence transferred from general finance or supply-chain settings. Second, it develops a conditional conceptual framework and five propositions that are explicitly framed as hypotheses requiring empirical validation. Third, it identifies evidence gaps, especially for payment settlement in freight operations, the transferability of small and medium-sized enterprise (SME) finance findings, and the governance of source data. Section 2 gives the background, Section 3 describes the review approach and coding rules, Sections 4 and 5 present the synthesis, and Section 6 develops the framework. Sections 7 to 9 cover barriers, implications and limitations, and Section 10 concludes.

2 Background

2.1 FinTech: Scope and Layers

The label FinTech covers more than one thing. Gomber and colleagues interpret it as a force of innovation, disruption and transformation in financial services [4], and their earlier review sorts the research into digital finance areas and sets out directions for future work [3]. For this paper the useful split is functional. We group FinTech instruments into three layers: digital payments and settlement, data-based financing, and shared ledgers with programmable contracts.

Payments are the oldest layer. Mobile money in Kenya shows how far a payment system can reach: Suri and Jack estimate that the spread of the M-Pesa agent network raised consumption and lifted about 2 percent of Kenyan households out of poverty

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

[15]. Goldstein and colleagues survey the research questions that FinTech raises for finance more broadly [13].

2.2 Financial Efficiency in Logistics

We use financial efficiency to mean how little time, cost and capital it takes to move a payment, secure financing and settle a transaction in a logistics system. Supply chain finance is the clearest meeting point. Gelsomino and colleagues review the field and describe it as linking the financing of inter-company transactions with the physical and information flows behind them [14].

Information problems drive much of the cost. Chod and colleagues show in a theoretical model that when lenders can verify a firm's inventory transactions cheaply, the firm can obtain better financing terms with smaller operational distortions, and they argue that blockchain can supply that verification [16]. In a sample of 757 listed small and medium-sized firms in China, Guan and colleagues find that supply chain finance raises financing efficiency and that regional FinTech development strengthens the effect [17]. Transaction cost theory gives a further lens. Schmidt and Wagner apply it to blockchain and discuss how the technology may change the governance of supplier relations, depending on asset specificity and uncertainty [18].

2.3 Transparency and Trust

Transparency here means that partners, financiers and authorities can see reliable information about a shipment and its payment status when they need it. Kshetri links blockchain to several supply chain objectives, including cost, speed, dependability, risk reduction and sustainability [19]. Wang and colleagues review the technology for future supply chains and discuss how it might improve visibility and traceability [20]. Min argues that these properties can support resilience, for example by helping firms trace products and detect counterfeit goods [21]. Treiblmaier proposes a research framework built on four theories (principal-agent, transaction cost, resource-based and network theory) and calls for empirical tests of it [22].

2.4 Sustainability

Sustainable supply chain management is usually defined through the triple bottom line of economic, environmental and social performance. Seuring and Müller build a conceptual framework from a literature review and separate strategies centered on supplier risk and performance from those centered on sustainable products [23]. Carter and Rogers add four supporting facets to the triple bottom line: risk management, transparency, strategy and culture [24]. Transparency therefore appears in the sustainability literature as a condition for managing the other dimensions, and not only as a financial matter.

FinTech reaches sustainability through at least two doors. Green finance directs capital to environmental projects, and Taghizadeh-Hesary and Yoshino argue that distributed ledger technology can raise transparency in green finance and propose credit

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

guarantee schemes to draw in private investors [25]. Muganyi and colleagues find in Chinese data that FinTech development is associated with lower sulfur dioxide emissions and with more investment in environmental protection [26]. Saberi and colleagues examine blockchain in sustainable supply chain management and sort the barriers to its adoption into four groups: inter-organizational, intra-organizational, technical and external [27].

3 Review Approach

The paper is a structured narrative review, not a systematic review, and it should not be read as an exhaustive census of the field. A complete search log, database export, or screening record of the original searches was not retained; consequently, the exact search dates, the number of records retrieved, and record-level exclusion counts cannot be reconstructed, and no Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow or claim of comprehensive database coverage is made. To keep the selection logic auditable, the thematic search concepts and eligibility rules are stated explicitly (Table 1). The concepts covered combinations of (i) FinTech, digital finance, digital payment, e-payment, mobile money, digital settlement, and supply chain finance; (ii) transport, logistics, freight, carrier, port, maritime, shipping, and supply chain; and (iii) blockchain, distributed ledger, smart contract, electronic trade document, Internet of Things, traceability, transparency, and sustainability. Sources were eligible when they addressed at least one financial-technology construct and at least one transport, logistics, or supply-chain function, or supplied a clearly relevant theoretical mechanism. Peer-reviewed journal articles and identifiable scholarly working papers were retained; duplicate records, non-scholarly promotional material, and items without sufficient bibliographic information were excluded. General FinTech studies were retained only when used to explain a financial mechanism and are not treated as direct evidence about logistics operators. A supplementary bibliographic check for recent and logistics-specific work, completed on 19 November 2026 using publisher and scholarly-indexing records, added five sources to the 30-source core set [28]–[32]. Because the original search log is unavailable, this description improves transparency but does not make the study a reproducible systematic review.

For a future systematic update, the following replication search string is proposed; it is not a verbatim log of the original search: ("FinTech" OR "financial technology" OR "digital finance" OR "digital payment*" OR "e-payment" OR "mobile money" OR "digital settlement" OR "supply chain finance") AND (transport* OR logistic* OR freight OR carrier* OR port* OR maritime OR shipping OR "supply chain") AND (blockchain OR "distributed ledger" OR "smart contract*" OR IoT OR "electronic trade document*" OR traceab* OR transparen* OR sustainab*). A complementary contextual query is ("FinTech" OR "financial technology" OR "digital finance") AND ("supply chain finance" OR logistics OR transport OR freight). In a reproducible update, these strings should be run separately in Scopus, Web of Science, IEEE Xplore, and Google Scholar, and the date, platform, filters, and export files should be retained.

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

The retained set was assembled by topical relevance and bibliographic verification. The screening sequence was (1) removal of duplicates; (2) title and abstract screening against the finance-technology and transport or supply-chain concepts; (3) full-text inspection for an identifiable mechanism or outcome; and (4) verification of bibliographic metadata and follow-up of relevant references. Counts at each stage and itemized reasons for exclusion were not recorded; they are acknowledged as missing and are not replaced with estimated PRISMA numbers.

Table 1. Summary of the review protocol

Element	**Specification**
Review type	Structured narrative review; not a systematic review; no PRISMA flow is reported
Search concepts	(i) FinTech, digital finance and payments, supply chain finance; (ii) transport, logistics, freight, ports, shipping, supply chain; (iii) blockchain, distributed ledger, smart contract, IoT, traceability, transparency, sustainability
Inclusion	At least one financial-technology construct and one transport, logistics, or supply-chain function, or a clearly relevant theoretical mechanism; peer-reviewed articles and identifiable scholarly working papers
Exclusion	Duplicates; non-scholarly promotional material; items without sufficient bibliographic information
Supplementary check	Publisher and scholarly-indexing records, 19 November 2026; five recent sources added [28]–[32]
Coding dimensions	FinTech layer; logistics relevance; outcome; evidence design; unit or population; evidential strength (Appendix A)
Coding procedure	Single coder from the author team; no inter-rater statistic
Corpus	35 sources published 2008–2025 (Fig. 1)

Each source was coded using a common codebook for (a) FinTech layer, (b) logistics relevance, (c) outcome, (d) evidence design, (e) unit or population, and (f) evidential strength. Coding was performed by one member of the author team; no independent second coder or inter-rater statistic was available, and this is treated as a limitation. The operational rules are as follows. A source is coded as logistics-specific only when its sample, case, or application explicitly concerns transport, freight, ports, shipping, or logistics firms; supply-chain studies without an identified transport sample are coded as adjacent supply-chain evidence; and general banking, mobile-money, or SME studies are coded as contextual finance evidence. Evidence design is coded as empirical only when original observations, survey responses, administrative data, or experiments are analyzed; conceptual models and proposed architectures are coded as conceptual or analytical; and syntheses of prior studies are coded as reviews. Strength is rated high only for directly relevant empirical evidence with a clearly identified logistics population and outcome measure; moderate for empirical evidence in an adjacent supply-chain population or for convergent analytical and review evidence; and limited

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

for conceptual claims or general-finance findings transferred by analogy. On this basis, the 35-source corpus comprises 13 conceptual or analytical sources, 14 reviews, and 8 empirical studies (Fig. 1). The five sources added in the supplementary check comprise three reviews, one logistics-sector empirical study, and one conceptual smart-contract study [28]–[32]. Publication years extend through 2025. The coding matrix and the source-level application of these rules are provided in Appendix A (Table A1).

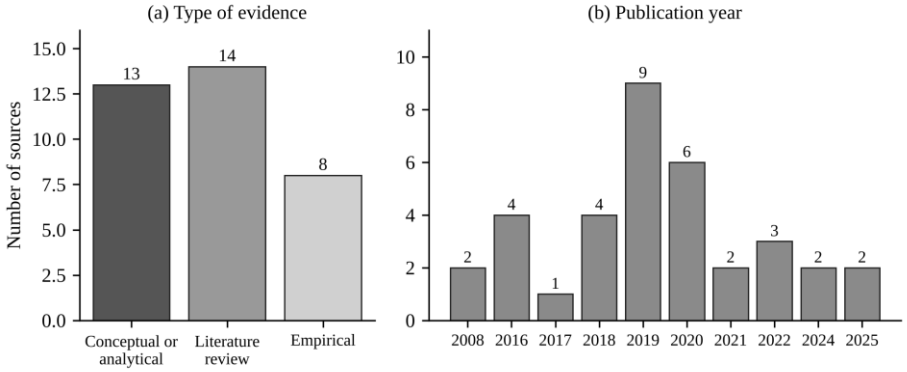


Fig. 1. Distribution of the 35 reviewed sources by type of evidence (a) and publication year (b). Evidence type is a single-coder classification by one author.

The framework was developed through a two-stage synthesis. First, mechanisms explicitly discussed in the sources were extracted and grouped by their functional role (payment execution, information exchange, event verification and financing decisions). Second, each candidate mechanism was checked against the three outcomes and against countervailing explanations, including implementation and coordination costs, platform governance, data-quality failures, legal uncertainty and exclusion of small operators. The four mechanisms retained are therefore recurring analytical categories, not a claim that all competing mechanisms were exhaustively tested or statistically ranked. The framework is partly deductive, drawing on transaction-cost and information-asymmetry arguments, and partly inductive, reflecting recurring themes in the reviewed logistics and supply-chain literature. Its boundaries and conditional assumptions are stated in Section 6.

4 FinTech Layers in Logistics Operations

Table 2 maps the three layers to logistics functions. The mapping is a synthesis of what the sources describe or test, and not every row has the same level of support.

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

Table 2. Mapping of FinTech layers to logistics functions

FinTech layer	Logistics functions affected	Main mechanism	Sources
Digital payments and settlement	Carrier and freight payment; payment of drivers and small operators; cross-border settlement	Lower transaction cost; wider access to payment services	[6], [8], [15]
Data-based financing and supply chain finance	Invoice and inventory financing; working capital for carriers and forwarders	Cheaper verification of goods and performance; conditional pricing of credit	[7], [14], [16], [17]
Shared ledgers and smart contracts	Transport documents; shipment tracking; automated release of payment; sustainability claims	Single record of events; rule-based execution; less reconciliation	[1], [2], [10]–[12], [18], [19], [33]

4.1 Digital Payments and Settlement

Payments sit at the base. A faster and cheaper payment shortens the time between delivery and cash, which matters most to small carriers and forwarders with thin working capital. The sources reviewed here do not isolate payment effects inside logistics firms, so the evidence for this layer comes mostly by analogy. The Kenyan case suggests that a payment network can extend to users who were outside the formal financial system [15], and Philippon's account of intermediation cost suggests why cheaper digital rails matter [8]. In Lee and Shin's ecosystem view, payment start-ups, technology developers and banks each hold part of the rail [6]. For logistics, the practical question is whether those rails connect to freight documents and delivery events. That connection is the job of the next two layers.

4.2 Data-Based Financing and Supply Chain Finance

Supply chain finance advances cash against receivables, orders or inventory, and its binding constraint is information: lenders need to know that goods exist, moved and were accepted [14]. FinTech helps where it makes that information cheaper to verify. Chod and colleagues model this for inventory-based financing and show that low-cost verification lets a firm signal its quality and obtain better terms [16]. The empirical sign is consistent. In Chinese listed SMEs, supply chain finance is associated with higher financing efficiency, and regional FinTech development raises that association [17]. Thakor's review discusses how FinTech lenders use alternative data in credit decisions [7], which is the same logic applied to lending in general.

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

4.3 Shared Ledgers and Smart Contracts

Shared ledgers give the parties to a shipment one record of events that none of them can alter alone. Reviews of blockchain in supply chains, transport and logistics describe use cases in documentation, tracking and payment [10], [11]. Tijan and colleagues discuss implementation in logistics, including the handling of transport documents [1]. Yang surveys blockchain applications in maritime shipping and tests intention to use with a technology acceptance model [2].

Smart contracts add execution. A payment or a financing advance can be released when a recorded event meets a condition agreed in advance, as Fig. 2 illustrates. Kshetri relates blockchain to supply chain objectives such as cost and speed [19], and automated release is one way those objectives could be reached in settlement. The best-documented large-scale attempt is TradeLens, a shipping platform built by a carrier and a technology firm. Jovanovic and colleagues study how it sought industry-wide adoption and find that both platform value and platform governance shaped whether actors joined [33]. Wamba and Queiroz set out the benefits, challenges and research opportunities of blockchain in operations and supply chain management [12]. Most items on this layer are conceptual or review-based, and only a few measure outcomes.

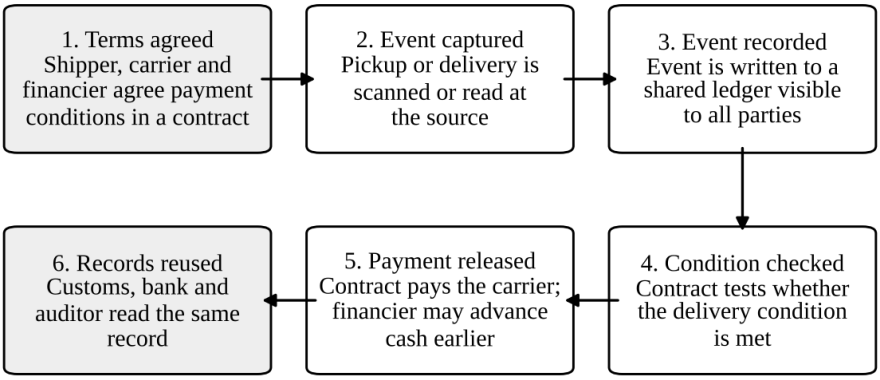


Fig. 2. Event-triggered settlement of a freight payment with a shared ledger and a smart contract (illustrative sequence, not an implemented system).

5 Effects on Efficiency, Transparency, and Sustainability

Table 3 summarizes what the sources support for each outcome and how strong that support is. Strength is assessed separately for directness and design: a well-designed study of general SMEs is not treated as direct logistics evidence. The ratings are qualitative judgments made by one member of the author team, not inter-rater-validated scores. The assessment therefore distinguishes the strength of a proposed mechanism from the directness of evidence for transport and logistics operators.

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

Table 3. Evidence by outcome (strength ratings are the authors' qualitative judgment)

Outcome	Proposed mechanism	Evidence in the set	Strength and main caveat
Financial efficiency	Lower transaction cost; shorter working-capital cycle; cheaper verification for lenders	Analytical model [16]; listed-firm data [17]; theory [18]; reviews [10], [11]	Moderate for financing efficiency; weak for operating-cost savings, which are argued more than measured
Transparency	Shared record of shipment events; traceability of goods and documents	Reviews [10], [20]; conceptual work [19], [21]; case study [33]	Moderate in concept, limited in the field; depends on data captured at source
Sustainability	Verification of environmental claims; green finance channels; conditional pricing	Regional panel data [26]; conceptual work [25], [27], [34]	Weak to moderate; indirect, with no logistics-level emission measure in the set

5.1 Financial Efficiency

Three channels recur in the sources: lower transaction and reconciliation cost, shorter working-capital cycles, and cheaper or more available financing. The financing channel has the firmest support, because an analytical model [16] and firm-level data [17] point the same way. The transaction-cost channel is less certain. A transaction cost reading does not predict savings everywhere, since shared ledgers lower some costs of monitoring but add costs of implementation and coordination, and the balance depends on the relationship [18]. Quantified savings in freight settings are scarce among the sources, and the reviews describe the gains mostly as expected and not measured [10], [11].

5.2 Transparency

Transparency is often presented as a benefit of shared ledgers [19]–[21], [28], [30], [32]. A ledger can make a record tamper-evident after it has been entered; it cannot, by itself, establish that the original observation was accurate, complete or honestly reported. The framework therefore treats data integrity as a chain of antecedent controls: (1) trusted data capture through authenticated human entry or calibrated Internet of Things (IoT), Global Positioning System (GPS), or radio-frequency identification (RFID) sensors; (2) oracle validation and exception handling before external events are written to the ledger; (3) identity and role assurance for carriers, shippers, drivers, inspectors and financiers; (4) provenance metadata recording source, time, device, method and subsequent transformations; (5) independent audit trails and periodic control testing; and (6) accessible dispute-resolution procedures for erroneous, incomplete or contested events. These controls do not eliminate fraud or sensor error,

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

but they make responsibility and correction pathways explicit. The TradeLens case also indicates that platform value depends on digitized workflows, governance and participation [33]. Field evidence remains limited; transparency gains should therefore be understood as conditional on trusted input and effective governance, not as an automatic property of blockchain.

5.3 Sustainability

The link from FinTech to sustainability is the least direct. Through the lens of Carter and Rogers, transparency and risk management support the environmental dimension [24], and a shared record of shipment events could in principle carry environmental data as well. Two mechanisms appear in the sources. One is verification of environmental claims, which Saberi and colleagues and Kouhizadeh and colleagues discuss when they study blockchain and sustainable supply chains [27], [34]. The other is the direction of capital, through green finance and credit guarantees [25]. Muganyi and colleagues provide the only quantitative evidence in the set, and it concerns regional emissions and environmental investment in China, not logistics firms [26]. Among the sources reviewed here, none measures how FinTech changes emissions in a logistics system.

6 Conceptual Framework and Propositions

Fig. 3 presents the conditional framework. The three FinTech layers—digital payments and settlement, data-based financing, and shared ledgers with smart contracts—may influence logistics outcomes through four recurring mechanisms: lower transaction and reconciliation costs, faster information exchange, improved verification of shipment events, and financing terms conditional on verified information. These mechanisms are not assumed to be universally dominant; they are the four most consistently identifiable pathways in this focused corpus. Their effects are conditional on (i) organizational and network readiness, (ii) interoperability and platform governance, and (iii) trusted data assurance. Trusted data assurance comprises source authentication, sensor/oracle validation, identity management, provenance, audit and dispute resolution. It is an antecedent to reliable transparency and event-triggered finance, rather than an outcome produced by the ledger itself. The framework also distinguishes direct logistics evidence from adjacent supply-chain and general-finance evidence.

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

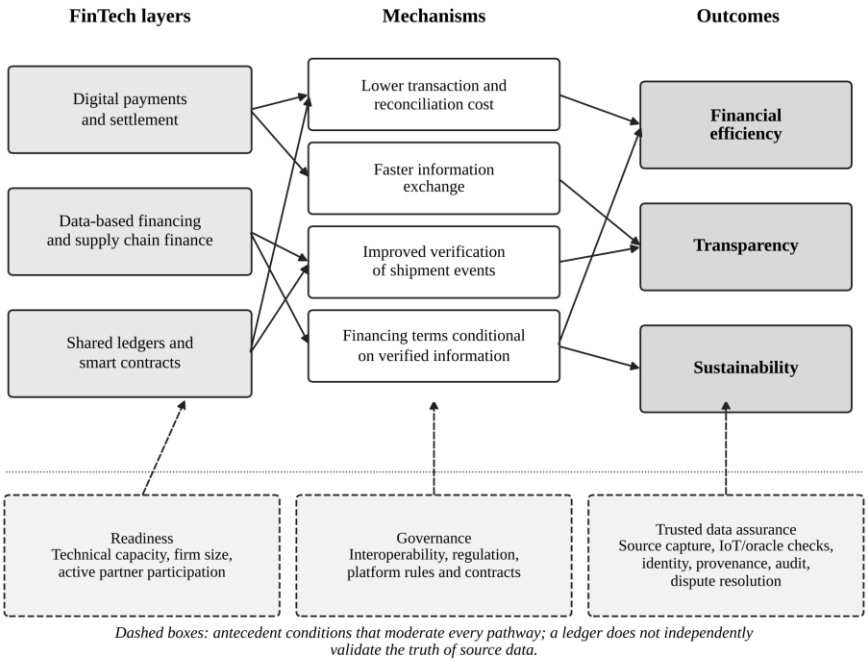


Fig. 3. Conditional conceptual framework linking FinTech layers, mechanisms, and logistics outcomes, with readiness, governance, and trusted data assurance as antecedent conditions.

The framework yields five propositions. Table 4 lists them with suggested indicators and research designs.

P1 (logistics-specific hypothesis requiring empirical validation). Where digital settlement is technically and contractually linked to independently verified delivery or acceptance events, the delivery-to-payment interval for carriers and freight forwarders is expected to shorten. The direction and magnitude of this effect have not been established by the general mobile-money and FinTech sources cited here [8], [15]; those sources provide contextual rationale, not direct carrier-level proof. The effect may be larger for small providers facing working-capital constraints, but this subgroup claim also requires testing.

P2 (transferability-qualified hypothesis). Among logistics firms, verifiable shipment, inventory and acceptance records may improve the availability or pricing of supply chain finance. The Chinese study of 757 listed SMEs [17] does not establish that its firms were transport or logistics companies; it is therefore adjacent SME evidence and cannot, by itself, validate a logistics-specific effect. Logistics firms differ in asset intensity, receivable cycles, subcontracting structures, freight-document requirements and exposure to delay or damage claims. P2 is consequently a hypothesis for logistics SMEs and should be tested with a clearly identified transport/logistics sample, controlling for firm size, asset structure, customer concentration and payment terms.

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

P3 (conditional transaction-cost hypothesis). The net cost effect of a shared ledger is expected to become more favorable as the number of active participating partners increases, because a common record may reduce duplicated reconciliation across more bilateral interfaces; however, the effect is expected to weaken as relationship-specific investments, bespoke data formats or tailored governance requirements increase. The reviewed sources support the relevance of network participation and relationship-specificity arguments [18], [33], but do not directly establish this interaction as a measured causal effect. Partner number should be operationalized as the count of distinct active organizations exchanging validated events on the platform during a defined period (with network density or active-partner share as robustness measures). Relationship specificity should be measured through the value of dedicated assets, switching costs, customized interfaces/processes, and the proportion of transactions tied to a particular partner. The interaction can be tested using panel or multi-case models with implementation cost, reconciliation hours, dispute frequency and total cost per shipment as outcomes.

P4. Transparency gains from shared ledgers are expected to rise with the proportion of shipment events captured automatically or independently verified at source and with the number of participating actors, provided that identity, provenance, audit and dispute controls are in place. The ledger alone does not verify the truth of an input [28], [29].

P5. Financing terms linked to independently verified environmental performance may raise investment in lower-emission logistics assets and practices, particularly where measurement and verification costs are low. This remains a conditional proposition because the reviewed environmental evidence is not specific to logistics-firm emissions [25]–[27].

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

Table 4. Propositions, suggested indicators, and research designs

Proposition	Basis	Suggested indicators	Suggested design
P1. Digital settlement linked to independently verified delivery events shortens the delivery-to-payment interval (logistics-specific hypothesis)	[8], [15], [19]; contextual evidence only; no direct carrier-level test in corpus	Days from delivery/acceptance to cleared payment; digital-settlement share; carrier/forwarder size	Phased rollout or difference-in-differences among identified carriers/forwarders
P2. Verifiable shipment and inventory records may improve supply chain finance terms for logistics firms (transferability to be tested)	[14], [16], [17]; Chinese listed-SME study is not established as logistics-sector evidence	Approval rate; interest spread; credit limit; receivable days; asset intensity	Difference-in-differences or matched panel of logistics SMEs
P3. Net ledger cost effects may improve with active partner count and weaken with relationship specificity	[18], [33]; interaction is theory-informed and not directly tested in reviewed studies	Active participating organizations; network density; dedicated-asset value; switching costs; customized-interface share; reconciliation cost/shipment	Panel or comparative multi-case study testing partner-count × specificity interaction
P4. Transparency rises with trusted automatic capture and participating actors, conditional on data assurance controls	[19], [28], [29], [33]; ledger immutability alone does not validate source truth	Automatic capture share; source-authentication rate; provenance completeness; error/dispute rate	Field study at ports, terminals or freight corridors with sensor/oracle audit
P5. Finance linked to independently verified environmental data may raise low-emission logistics investment	[25]–[27]; no direct logistics-emissions effect established in corpus	Emissions per tonne-kilometer; fleet renewal; verified data coverage; loan pricing	Panel of logistics firms with and without performance-linked finance

7 Barriers, Risks, and Governance

The sources agree that adoption is the main constraint. Saberi and colleagues group the barriers into inter-organizational, intra-organizational, technical and external categories [27]. Kouhizadeh and colleagues use the technology-organization-environment framework to rank barriers in the sustainable supply chain case and to show how they

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

relate to one another [34]. Kamble and colleagues examine the determinants of blockchain adoption in Indian supply chains, an emerging-economy setting [35].

Platform governance is a second constraint. Jovanovic and colleagues find that the sponsor of a shipping platform had to manage the value offered to participants together with governance rules covering strategy, technology and interoperability [33]. Regulation is a third. Arner and colleagues describe the current era of FinTech as one shaped by the post-crisis regulatory setting [5]. Cross-border logistics adds a further complication, because financial regulation, data protection and the legal status of electronic transport documents differ by jurisdiction.

Fit with small firms is a fourth. Many carriers and forwarders are small, and a platform designed for large shippers may leave them out. That would undercut the inclusion argument that the mobile money evidence supports [15]. Cyber risk and data protection also grow when more records and payments move onto shared infrastructure.

8 Implications

For logistics firms, the first step is to find where payment delay and documentation cost are largest, because the framework suggests that gains are uneven. Firms with long receivable cycles and many counterparties have the most to gain from linked settlement and verified records. Firms with few, stable partners have less reason to adopt on transaction-cost grounds [18]. Pilot projects should fix their indicators in advance, such as those in Table 4.

For financial providers, supply chain finance products can rest on verified delivery events and not on invoices alone, which is the logic of the model in [16]. Providers that tie pricing to environmental performance need verification that is cheap enough to be worth the effort [25].

For regulators and policymakers, the priorities are interoperability standards, legal recognition of electronic transport documents, and data protection rules that allow sharing between firms and financiers. In emerging economies, including landlocked countries such as Afghanistan that depend on cross-border corridors, the same mechanisms apply in principle. Whether the preconditions hold there, including digital payment coverage and reliable event data, is an empirical question that this review cannot answer.

9 Limitations and Research Agenda

This review has important limitations. It is a structured narrative review rather than a systematic review; the original search log and record-level screening data were not retained, so exact search dates, retrieval counts and exclusion flows cannot be reconstructed. The 35-source corpus is focused rather than exhaustive. Coding and evidence-strength ratings were completed by one author and were not independently double-coded; no inter-rater reliability statistic can therefore be reported. The corpus includes conceptual, review and empirical work, but only a subset is directly logistics-specific. The Chinese listed-SME study [17], for example, is not identified as a

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

transport-sector sample, and general mobile-money findings [15] are contextual rather than direct freight evidence. Recent sources through 2025 improve currency, but cannot compensate for the limited number of causal field studies. The propositions remain untested, and qualitative evidence ratings should not be interpreted as pooled effect estimates.

Future research should use a preregistered systematic search with dated database exports, full search strings, duplicate removal, two independent screeners and a published source-level coding sheet. Empirical studies should recruit identifiable carriers, freight forwarders, ports, shipping lines and logistics SMEs rather than infer sector effects from general SME samples. P1 can be tested through phased adoption of digital settlement linked to verified proof-of-delivery events, measuring days from delivery/acceptance to cleared payment. P2 requires logistics-specific financing data and controls for asset intensity, receivable duration, collateral, customer concentration and claims risk. P3 should test the interaction between active network size and relationship specificity using clearly defined measures. Transparency studies should assess source authentication, IoT/oracle validation, identity assurance, provenance completeness, audit findings and dispute-resolution performance alongside ledger adoption. Sustainability studies should measure logistics-level emissions (for example, emissions per tonne-kilometer) and verify the environmental data used in loan pricing.

10 Conclusion

FinTech may alter how money and evidence move through logistics systems, but the effects should not be overstated. The strongest support in the reviewed literature concerns financing efficiency in broader SME and supply-chain settings; the direct logistics-specific evidence remains more limited. The claims about faster delivery-to-payment and the transfer of financing benefits to logistics SMEs are hypotheses requiring field validation. Shared ledgers can make records tamper-evident, but transparency depends on trusted capture, identity, provenance, audit and dispute controls. Sustainability effects remain indirect and require logistics-level measurement. The framework is therefore a conditional research model, not a claim that FinTech automatically improves all dimensions of logistics performance.

11 Appendix A. Coding Rules and Source-Level Coding Matrix

Codebook. FinTech layer: PAY = digital payment/settlement; FIN = data-based finance/supply chain finance; LED = distributed ledger/smart contract; MULTI = more than one layer; CONTEXT = general FinTech without a logistics application. Logistics relevance: D = direct transport/logistics sample or application; A = adjacent supply-chain evidence without a clearly identified transport sample; G = general finance/SME evidence used only for contextual mechanism. Outcome: EFF = financial/operational efficiency; TRA = transparency/traceability; SUS = sustainability; GOV = adoption/governance; MULTI = multiple outcomes. Evidence design: EMP = original empirical data; REV = literature review; CON = conceptual/analytical. Strength: M =

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

moderate for the stated mechanism (including adjacent populations); L = limited/contextual or conceptual; no rating is labeled high unless a directly relevant logistics sample and outcome measure are both present. These are codes assigned by one member of the author team and have not been independently validated.

Table A1. Source-level coding matrix (single coder)

Source	FinTech layer	Logistics relevance	Outcome	Design	Strength
Tijan et al. (2019) [1]	LED	D	TRA/GOV	REV/CON	L
Yang (2019) [2]	LED	D	GOV/adoption intention	EMP	L
Gomber et al. (2017) [3]	CONTEXT	G	EFF/GOV	REV	L
Gomber et al. (2018) [4]	CONTEXT	G	EFF/GOV	CON	L
Arner et al. (2016) [5]	CONTEXT	G	GOV	CON	L
Lee & Shin (2018) [6]	PAY/MULTI	G	EFF/GOV	CON	L
Thakor (2020) [7]	FIN/CONTEXT	G	EFF/GOV	REV	L
Philippon (2016) [8]	PAY/CONTEXT	G	EFF	CON	L
Queiroz et al. (2020) [9]	LED	A	TRA/GOV	REV	L
Pournader et al. (2020) [10]	LED	D	TRA/EFF	REV	M
Dutta et al. (2020) [11]	LED	A	TRA/EFF/GOV	REV	L
Wamba & Queiroz (2020) [12]	LED	A	EFF/GOV	REV	L
Goldstein et al. (2019) [13]	CONTEXT	G	EFF/GOV	REV	L
Gelsomino et al. (2016) [14]	FIN	A	EFF	REV	M

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

Suri & Jack (2016) [15]	PAY	G	EFF/inclusion	EMP	L
Chod et al. (2020) [16]	FIN/LED	A	EFF/TRA	CON/analytical	M
Guan et al. (2025) [17]	FIN	G	EFF	EMP	L
Schmidt & Wagner (2019) [18]	LED	A	EFF/governance	CON/analytical	L
Kshetri (2018) [19]	LED	A	TRA/EFF/SUS	CON	L
Wang et al. (2019) [20]	LED	A	TRA/GOV	REV	L
Min (2019) [21]	LED	A	TRA/resilience	CON	L
Treiblmaier (2018) [22]	LED	A	TRA/GOV	CON	L
Seuring & Müller (2008) [23]	CONTEXT	A	SUS	REV/CON	L
Carter & Rogers (2008) [24]	CONTEXT	A	SUS/GOV	CON	L
Taghizadeh-Hesary & Yoshino (2019) [25]	FIN	G	SUS/green finance	CON	L
Muganyi et al. (2021) [26]	FIN	G	SUS/environmental investment	EMP	L
Saberi et al. (2019) [27]	LED	A	SUS/GOV	CON/REV	L
Ioannou & Demirel (2022) [28]	FIN/LED	A	EFF/TRA/GOV	REV	M
Ruangtip et al. (2024) [29]	PAY/LED	D	EFF/TRA/capabilities	EMP	M
Surucu-Balci et al. (2024) [30]	LED/MULTI	D	TRA/EFF/GOV	REV	M
Raj et al. (2022) [31]	PAY/LED/FIN	A	EFF/TRA	CON/analytical	L

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

Rachana Harish et al. (2025) [32]	LED	D	TRA/EFF/GOV	REV	M
Jovanovic et al. (2022) [33]	LED	D	TRA/GOV/adoption	EMP/case study	M
Kouhizadeh et al. (2021) [34]	LED	A	SUS/GOV	CON/analytical	L
Kamble et al. (2019) [35]	LED	A	GOV/adoption	EMP	L

Interpretive note. The matrix records the principal role each source plays in this manuscript; a source may address additional themes not listed in the compact code. D does not mean that the study establishes a causal effect: it indicates only that the empirical sample or application is explicitly in transport/logistics. For example, the 2024 Thailand study is direct sector evidence on e-payment, blockchain, trust and logistics capabilities, but it does not directly test the delivery-to-payment interval in P1. The 757 listed SMEs in [17] remain coded G because the manuscript does not establish that they are logistics firms.

DECLARATIONS

Author Contributions

Conceptualization, S.S.; literature review and coding, S.S.; framework development, S.S. and A.K.A.; writing—original draft, S.S.; writing—review and editing, A.K.A. Both authors have read and approved the final manuscript.

Funding

The authors received no specific funding for this research.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

Data Availability Statement

No new datasets were generated or analyzed in this study. All information supporting the findings is included in the article, its appendix, and the cited sources.

Artificial Intelligence (AI) Disclosure

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) for drafting assistance and language editing. The authors reviewed and revised all generated content and take full responsibility for the final manuscript, including the accuracy of the cited references.

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

Research Ethics
Ethical review and approval were not required for this study because it is a literature-based review that involved no human participants, animals, or personal data.

Informed Consent Statement
Not applicable.

Acknowledgments
The authors have no acknowledgments to declare.

References

[1] E. Tijan, S. Aksentijević, K. Ivanić, and M. Jardas, "Blockchain technology implementation in logistics," *Sustainability*, vol. 11, no. 4, Art. no. 1185, 2019, doi: 10.3390/su11041185.

[2] C.-S. Yang, "Maritime shipping digitalization: Blockchain-based technology applications, future improvements, and intention to use," *Transp. Res. Part E: Logist. Transp. Rev.*, vol. 131, pp. 108–117, 2019, doi: 10.1016/j.tre.2019.09.020.

[3] P. Gomber, J.-A. Koch, and M. Siering, "Digital finance and FinTech: Current research and future research directions," *J. Bus. Econ.*, vol. 87, no. 5, pp. 537–580, 2017, doi: 10.1007/s11573-017-0852-x.

[4] P. Gomber, R. J. Kauffman, C. Parker, and B. W. Weber, "On the Fintech revolution: Interpreting the forces of innovation, disruption, and transformation in financial services," *J. Manag. Inf. Syst.*, vol. 35, no. 1, pp. 220–265, 2018, doi: 10.1080/07421222.2018.1440766.

[5] D. W. Arner, J. Barberis, and R. P. Buckley, "The evolution of Fintech: A new post-crisis paradigm?," *Georgetown J. Int. Law*, vol. 47, no. 4, pp. 1271–1319, 2016.

[6] I. Lee and Y. J. Shin, "Fintech: Ecosystem, business models, investment decisions, and challenges," *Bus. Horiz.*, vol. 61, no. 1, pp. 35–46, 2018, doi: 10.1016/j.bushor.2017.09.003.

[7] A. V. Thakor, "Fintech and banking: What do we know?," *J. Financ. Intermed.*, vol. 41, Art. no. 100833, 2020, doi: 10.1016/j.jfi.2019.100833.

[8] T. Philippon, "The FinTech opportunity," National Bureau of Economic Research, Cambridge, MA, USA, Working Paper 22476, 2016.

[9] M. M. Queiroz, R. Telles, and S. H. Bonilla, "Blockchain and supply chain management integration: A systematic review of the literature," *Supply Chain Manag.: Int. J.*, vol. 25, no. 2, pp. 241–254, 2020, doi: 10.1108/SCM-03-2018-0143.

[10] M. Pournader, Y. Shi, S. Seuring, and S. C. L. Koh, "Blockchain applications in supply chains, transport and logistics: A systematic review of the literature," *Int. J. Prod. Res.*, vol. 58, no. 7, pp. 2063–2081, 2020, doi: 10.1080/00207543.2019.1650976.

[11] P. Dutta, T.-M. Choi, S. Somani, and R. Butala, "Blockchain technology in supply chain operations: Applications, challenges and research opportunities," *Transp. Res. Part E: Logist. Transp. Rev.*, vol. 142, Art. no. 102067, 2020, doi: 10.1016/j.tre.2020.102067.

[12] S. F. Wamba and M. M. Queiroz, "Blockchain in the operations and supply chain management: Benefits, challenges and future research opportunities," *Int. J. Inf. Manag.*, vol. 52, Art. no. 102064, 2020, doi: 10.1016/j.ijinfomgt.2019.102064.

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

[13] I. Goldstein, W. Jiang, and G. A. Karolyi, "To FinTech and beyond," *Rev. Financ. Stud.*, vol. 32, no. 5, pp. 1647–1661, 2019, doi: 10.1093/rfs/hhz025.

[14] L. M. Gelsomino, R. Mangiaracina, A. Perego, and A. Tumino, "Supply chain finance: A literature review," *Int. J. Phys. Distrib. Logist. Manag.*, vol. 46, no. 4, pp. 348–366, 2016, doi: 10.1108/IJPDLM-08-2014-0173.

[15] T. Suri and W. Jack, "The long-run poverty and gender impacts of mobile money," *Science*, vol. 354, no. 6317, pp. 1288–1292, 2016, doi: 10.1126/science.aah5309.

[16] J. Chod, N. Trichakis, G. Tsoukalas, H. Aspegren, and M. Weber, "On the financing benefits of supply chain transparency and blockchain adoption," *Manag. Sci.*, vol. 66, no. 10, pp. 4378–4396, 2020, doi: 10.1287/mnsc.2019.3434.

[17] Y. Guan, N. Sun, S. J. Wu, and Y. Sun, "Supply chain finance, fintech development, and financing efficiency of SMEs in China," *Adm. Sci.*, vol. 15, no. 3, Art. no. 86, 2025, doi: 10.3390/admsci15030086.

[18] C. G. Schmidt and S. M. Wagner, "Blockchain and supply chain relations: A transaction cost theory perspective," *J. Purch. Supply Manag.*, vol. 25, no. 4, Art. no. 100552, 2019, doi: 10.1016/j.pursup.2019.100552.

[19] N. Kshetri, "Blockchain's roles in meeting key supply chain management objectives," *Int. J. Inf. Manag.*, vol. 39, pp. 80–89, 2018, doi: 10.1016/j.ijinfomgt.2017.12.005.

[20] Y. Wang, J. H. Han, and P. Beynon-Davies, "Understanding blockchain technology for future supply chains: A systematic literature review and research agenda," *Supply Chain Manag.: Int. J.*, vol. 24, no. 1, pp. 62–84, 2019, doi: 10.1108/SCM-03-2018-0148.

[21] H. Min, "Blockchain technology for enhancing supply chain resilience," *Bus. Horiz.*, vol. 62, no. 1, pp. 35–45, 2019, doi: 10.1016/j.bushor.2018.08.012.

[22] H. Treiblmaier, "The impact of the blockchain on the supply chain: A theory-based research framework and a call for action," *Supply Chain Manag.: Int. J.*, vol. 23, no. 6, pp. 545–559, 2018, doi: 10.1108/SCM-01-2018-0029.

[23] S. Seuring and M. Müller, "From a literature review to a conceptual framework for sustainable supply chain management," *J. Clean. Prod.*, vol. 16, no. 15, pp. 1699–1710, 2008, doi: 10.1016/j.jclepro.2008.04.020.

[24] C. R. Carter and D. S. Rogers, "A framework of sustainable supply chain management: Moving toward new theory," *Int. J. Phys. Distrib. Logist. Manag.*, vol. 38, no. 5, pp. 360–387, 2008, doi: 10.1108/09600030810882816.

[25] F. Taghizadeh-Hesary and N. Yoshino, "The way to induce private participation in green finance and investment," *Financ. Res. Lett.*, vol. 31, pp. 98–103, 2019, doi: 10.1016/j.frl.2019.04.016.

[26] T. Muganyi, L. Yan, and H. Sun, "Green finance, fintech and environmental protection: Evidence from China," *Environ. Sci. Ecotechnol.*, vol. 7, Art. no. 100107, 2021, doi: 10.1016/j.ese.2021.100107.

[27] S. Saberi, M. Kouhizadeh, J. Sarkis, and L. Shen, "Blockchain technology and its relationships to sustainable supply chain management," *Int. J. Prod. Res.*, vol. 57, no. 7, pp. 2117–2135, 2019, doi: 10.1080/00207543.2018.1533261.

[28] I. Ioannou and G. Demirel, "Blockchain and supply chain finance: A critical literature review at the intersection of operations, finance and law," *J. Bank. Financ. Technol.*, vol. 6, pp. 83–107, 2022, doi: 10.1007/s42786-022-00040-1.

[29] P. Ruangtip, W. Rueboon, K. Jornkokgoud, and M. Faysal, "The role of trust in mediating the effect of blockchain and e-payment on Logistics 4.0 and supply chain capabilities in Thailand," *Glob. Bus. Financ. Rev.*, vol. 29, no. 7, pp. 168–182, 2024, doi: 10.17549/gbfr.2024.29.7.168.

License: CC BY 4.0

ISSN: 3124-8632
https://doi.org/10.58905/whoosh.v1i2.850

[30] E. Surucu-Balci, Ç. Iris, and G. Balci, "Digital information in maritime supply chains with blockchain and cloud platforms: Supply chain capabilities, barriers, and research opportunities," *Technol. Forecast. Soc. Change*, vol. 198, Art. no. 122978, 2024, doi: 10.1016/j.techfore.2023.122978.

[31] P. V. R. P. Raj, S. K. Jauhar, M. Ramkumar, and S. Pratap, "Procurement, traceability and advance cash credit payment transactions in supply chain using blockchain smart contracts," *Comput. Ind. Eng.*, vol. 167, Art. no. 108038, 2022, doi: 10.1016/j.cie.2022.108038.

[32] A. Rachana Harish et al., "Blockchain for Logistics 4.0: A systematic review and prospects," *Transp. Res. Part E: Logist. Transp. Rev.*, vol. 201, Art. no. 104269, 2025, doi: 10.1016/j.tre.2025.104269.

[33] M. Jovanovic, N. Kostić, I. M. Sebastian, and T. Sedej, "Managing a blockchain-based platform ecosystem for industry-wide adoption: The case of TradeLens," *Technol. Forecast. Soc. Change*, vol. 184, Art. no. 121981, 2022, doi: 10.1016/j.techfore.2022.121981.

[34] M. Kouhizadeh, S. Saberi, and J. Sarkis, "Blockchain technology and the sustainable supply chain: Theoretically exploring adoption barriers," *Int. J. Prod. Econ.*, vol. 231, Art. no. 107831, 2021, doi: 10.1016/j.ijpe.2020.107831.

[35] S. Kamble, A. Gunasekaran, and H. Arha, "Understanding the blockchain technology adoption in supply chains—Indian context," *Int. J. Prod. Res.*, vol. 57, no. 7, pp. 2009–2033, 2019, doi: 10.1080/00207543.2018.1518610.

License: CC BY 4.0