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**Blockchain-Enabled Traceability for Sustainability Claims
Compliance in Fashion Supply Chains: A Critical Review**

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Abstract

Purpose: This study critically examines how recent research explains the role, limitations and governance requirements of blockchain-enabled traceability in supporting sustainability claims compliance in fashion supply chains. It distinguishes the availability of product information from the stronger requirement that a claim is supported by relevant, reliable and current evidence.

Design/methodology/approach: A structured critical literature review was conducted using 88 peer-reviewed journal articles published between 2023 and 2026. Sources covered blockchain adoption, supply-chain provenance, Digital Product Passports, fashion sustainability, greenwashing, research philosophy and review methods. The evidence was coded through a critical realist lens and synthesised around roles, limitations and governance mechanisms. One recent process study was then examined in detail for its ontological, epistemological, axiological, methodological and ethical assumptions.

Findings: Blockchain can strengthen provenance, record persistence, authorised information sharing and consumer-facing visibility. These benefits remain conditional because a ledger cannot establish the truth of off-chain measurements, certificates or physical product identities. Compliance therefore depends on source-data verification, supplier capability, interoperability, independent assurance, clear decision rights and continuing claim review.

Originality/value: The review connects technical traceability research with the managerial problem of substantiating sustainability claims. It proposes a five-stage governance framework that treats blockchain as one layer within a wider claims-evidence and assurance system.

Keywords: blockchain; traceability; sustainability claims; fashion supply chains; compliance; governance

1. Introduction

Fashion sustainability is an inter-organisational problem rather than a property of a finished garment. Fibres, chemicals, trims, manufacturing, logistics and retail activities may be spread across several countries and tiers. Recent research describes the sector as a system in which environmental effects are shaped by sourcing, production volumes, business models and consumption, while fast and ultra-fast fashion intensify short product cycles and material throughput (Dzhengiz, Haukkala and Sahimaa, 2023; Karaosman and Marshall, 2023; Bonelli, Caferra and Morone, 2024). Circular strategies can improve product life, recovery and material use, but they require coordination across design, operations, suppliers and customers rather than isolated product claims (D'Itria and Aus, 2023; Abdelmeguid, Afy-Shararah and Salonitis, 2024; Bertola and Colombi, 2024).

This complexity creates an evidence problem. Fashion firms increasingly communicate claims about recycled content, responsible sourcing, lower emissions, circularity and reduced environmental harm. Yet sustainable fashion remains conceptually contested, and broad terms can hide the boundaries, assumptions and trade-offs behind a claim (Palm, 2023). Longitudinal disclosure evidence shows that major brands publish more sustainability information, but disclosure remains selective across corporate and supply-chain topics (Jestratijevic, Uanhoro and Rana, 2024). Critical studies also show that marketing narratives may define sustainability in ways that support commercial interests, while consumers detect ambiguity and greenwashing across fast-fashion communication (Heidenstrøm, 2025; Diaz-Bustamante-Ventisca et al., 2025). Transparency must therefore be separated from substantiation. Information may be visible without being accurate, complete or sufficient for the exact impression created by a claim.

Blockchain-enabled traceability is often proposed as a response. Distributed records can preserve time-stamped events, product identities, certificates and ownership transfers across participating organisations. Recent reviews link these affordances to provenance, transparency, efficiency and trust, while fashion applications include authentication, batch tracking, supplier evaluation and consumer-facing product histories (Cuc, 2023; Zhang, Jia and Chen, 2024; Vazquez Melendez, Bergey and Smith, 2024; Qiao et al., 2025). However, the same literature warns that a secure record does not validate the observation entered it. The physical item may be wrongly tagged, a

certificate may be invalid, or a supplier may provide incomplete information. Blockchain can preserve evidence, but it cannot create truth from weak evidence.

Digital Product Passports make the topic timely. Recent research presents passports as structured product-information ecosystems that may support lifecycle decisions, circularity and regulatory reporting (Jensen et al., 2023; King, Timms and Mountney, 2023; Voulgaridis et al., 2024; Zhang and Seuring, 2024). Yet a passport is not automatically blockchain-based, and its value depends on data definitions, access rights, interoperability and responsibility for updating or correcting records (Ducuing and Reich, 2023; Yuan, 2025). The managerial question is therefore not whether blockchain is innovative, but whether it can support defensible sustainability claims within a governed evidence process.

The problem addressed by this study is that research remains divided between technical traceability, organisational adoption, consumer signalling, Digital Product Passports and greenwashing. Positive studies often examine feasibility, perceptions or purchase intention, while fewer studies assess mature implementation or actual claims-compliance outcomes. This fragmentation can encourage technology-led conclusions that exceed the underlying evidence. A critical synthesis is needed to identify what blockchain can reasonably do, where its limitations arise and which governance controls are required.

The research question is: How does existing research explain the role, limitations and governance requirements of blockchain-enabled traceability in supporting sustainability claims compliance in fashion supply chains?

The research aim is: To critically examine how existing research explains the role, limitations and governance requirements of blockchain-enabled traceability in supporting sustainability claims compliance within fashion supply chains.

The objectives are:

- (1) To identify and synthesise the roles attributed to blockchain-enabled traceability in verifying and communicating sustainability claims within fashion supply chains.

- (2) To critically evaluate the technological, organisational, supply-chain and regulatory limitations affecting the use of blockchain-enabled traceability.
- (3) To examine the governance requirements needed to support reliable data, supplier accountability, independent verification and regulatory compliance.
- (4) To identify theoretical, methodological and philosophical gaps in the existing literature and develop a conceptual governance framework for fashion managers.

2. Method for Conducting the Literature Review

An extensive critical literature review rather than an exhaustive systematic review approach was adopted for this study. A critical literature review is recommended for cross-disciplinary questions, such as one involving management, information systems, sustainability and operational and legal/governance debates. Management literature review guidance highlights the need to state clearly purpose, search criteria, evidence screening criteria, analysis and presentation logic to make the synthesis clear and meaningful (Sauer and Seuring, 2023; Kraus et al., 2024). The literature review adopted a pre-specified protocol but retained judgement for comparing different forms of evidence and inclusion of evidence in related domains such as Digital Product Passport and fashion greenwashing.

Major keywords used included blockchain or distributed ledger technology; traceability, provenance or transparency; fashion, textile, apparel, garment or clothing; and sustainability claims, environmental claims, verification, compliance, governance or greenwashing. Scopus, Web of Science, Business Source Complete, ABI/INFORM, ScienceDirect and Emerald Insight were the key and secondary databases. Google Scholar and the university library catalogue facilitated citation searching and full text access. Primary publication period chosen was January 2023 to July 2026, to meet the requirement of recent evidence. The final corpus of evidence included 88 peer reviewed articles. Articles focused only on cryptocurrencies, pure technical studies unrelated to management and governance issues, unsubstantiated opinions and commentaries, conference papers and literature without adequate methodological details were excluded.

Evidence was inputted in a literature matrix recording the study design, context, theoretical perspective, findings, limitations and relevancy to the four objectives. Analysis was performed using deductive and inductive coding. Initial coding was based on the research question, that is roles, limitations and governance requirements. Further codes developed were physical-digital linkage, supplier capability, ownership of platform, assurance, right to correct and consumer signalling. Iterative process of coding and moving from organised data to themes follows the recent guidance on qualitative data analysis and thematic synthesis (Bingham, 2023; Gupta, 2025). Evidence quality was determined based on suitability of design, sample or data sources,

analytical clarity, inference, funding/conflicts of interests and identified limitations. Qualitative evidence quality appraisal was done based on credibility, transferability, dependability and confirmability (Ahmed, 2024).

Critical realism perspective guided the synthesis. Critical realism accepts the existence of actual causal structures such as supply networks, information systems and regulations and that outcomes are dependent on the mechanisms which differ in open organisations. Power, incentives, capability, trust, standards and assurance are among such mechanisms. Recent methodological development shows how critical realism can link observable events with mechanisms and enable abductive movements between evidence and theory (Nichol, Hastings and Elder-Vass, 2023; Mercier, Sanders and Munford, 2023; Fuchs and Robinson, 2024; Labas, 2024). Such perspective also stops the review from considering blockchain features as the cause of compliance.

Limitations of the review include language limitation and recentness criteria. Most of the evidence is reviews, surveys, modelling studies, experiments and proof-of-concepts and so findings are cautiously interpreted and claim of PRISMA-comprehensive evidence is not made.

3. Critical Literature Review

3.1 Sustainability Claims and Evidence Problems in Fashion Supply Chains

Sustainability claims come from the data generated across the disparate and imbalanced networks. While a brand makes a simple statement about its product, its claim will be supported with data provided by the raw-material producer, mill, dye house, factory, lab, certifier and logistic company. This situation creates multiple places where the information might be missing, simplified and strategically selected. Recent literature examines sustainable fashion as a broader transition, which includes operations, products, business models and social conditions. These works warn against the sustainability claims, which point out just one improved element without changing anything else in the production process (Karaosman and Marshall, 2023; Dzhengiz, Haukkala and Sahimaa, 2023; Bonelli, Caferra and Morone, 2024; Bertola and Colombi, 2024).

The concept behind the claim is unstable as well. Palm (2023) argues that the problem is not to reach some unique definition of sustainable fashion, but rather to formulate the basis and limitations of the claim. Circularity research indicates that there are various interventions to different parts of the value chain; hence the recycled content is not equal to the whole-product sustainability (D'Itria and Aus, 2023; Abdelmeguid, Afy-Shararah and Salonitis, 2024). This conceptual breadth leaves room for exaggeration. One can say something that is technically true at the certain stage but misleading when considered as an absolute environmental advantage.

Disclosure research is the evidence that more information does not mean more evidence. Jestratijevic, Uanhoro and Rana (2024) reveal the changes in the sustainability disclosures of 90 major brands for 7 years; however, this work focuses on publications but not on the validity of the underlying data. Schäfer, Petersen and Hörisch (2024) demonstrate that NGO pressure and transparency interact over time, thus providing the institutional reason of the firm disclosures. However, institutional pressure can also lead to symbolical reporting rather than substantial change. The critical aspect is that the information should be traceable to its credible source and checked against the exact claim.

The communication studies reveal further risks. The fashion claims are interpreted considering distance, authenticity and clarity of information, so that the vague language can foster scepticism

(Lee et al., 2024; Jung, Tian and Oh, 2024). Heidenstrøm (2025) finds that the fashion sustainability narrative may be still industry-beneficial, whereas social-media research proves that the consumers discuss and question the possible greenwashing (Li, Cavender and Lee, 2025; Kolotouchkina et al., 2025). Experimental and survey studies show that colour, price, type of claim and the presence of apology have a significant effect on the reaction of consumers; thus, there is no unified response to the greenwashing (Ende, Reinhard and Göritz, 2023; Wang and Jung, 2025; Paramitha, Tan and Lim, 2025). These evidence underline the necessity for credible information but consumer's perception is not enough to assess the compliance with the legal requirements.

The recent reviews regard greenwashing as a multi-level management problem. Greenwashing can occur due to the inappropriate lifecycle boundaries, eco-label weakness, unsupported comparison, incomplete supplier data and marketing (Mousavi et al., 2024; Santos, Coelho and Marques, 2024; Persakis et al., 2025). In fast-fashion studies, greenwashing is related to the consumer scepticism, word-of-mouth and brand evaluation (Promalessya and Handriana, 2024; Diaz-Bustamante-Ventisca et al., 2025). Social sustainability claims can affect the brand evaluation as well, but they should be credible in terms of organizational practice rather than just communication (Javed et al., 2024).

Thus, the recent literature shows that sustainability claims need substantiation. Managers must define a claim, select the relevant product, period and measurement or certification method and to get the upstream evidence as well as to control the translation of technical data into marketing message. Cooperation is required since the upstream suppliers usually have the original data, whereas downstream brands make claims. This distinction between the disclosure and verifiability is the starting point of blockchain-enabled traceability assessment, which implies the judgment of the technology in terms of strengthening evidence chain rather than increasing disclosure.

3.2 The Role of Blockchain-Enabled Traceability

The recent literature attributes four main functions to blockchain: provenance, record persistence, visibility and signalling. A blockchain can record the validated events in chronological order and prevent the retrospective changes. Design-science research describes

how the ownership transfers and provenance certificates can be represented using the smart contracts (Azevedo, Gomes and Romão, 2023). Reviews relate blockchain with traceability, security, coordination and data integrity, although they often combine conceptual propositions, pilots and mature applications in one evidence base (Zhang, Jia and Chen, 2024; Karaduman and Gülhas, 2025; Shamsuzzoha et al., 2025).

The provenance function is most effective in case if the digital record is linked with the physical product. Vazquez Melendez, Bergey and Smith (2024) emphasize product fingerprinting and identity-linking techniques because the blockchain cannot protect from substitution. In fashion, the blockchain can be used for fibres, batches, garments, certificates and the evaluation of the contractual parties (Cuc, 2023; Qiao et al., 2025). The value of the provenance lies in the practical aspect: participating firms can reconcile fewer records and inspect the shared chain of custody. However, the provenance proves just the documented route of a particular item. It does not validate any claim about carbon, water, labour or circularity.

Recent literature sees the blockchain as the infrastructure of organizational visibility. Heldt and Pikuleva (2025) demonstrate that the traceability appeared because of the collaboration across the opaque multi-tier network, including the upstream supplier, downstream partners and alliance forum. Broader studies relate the blockchain with supply chain mapping, resilience and operational coordination, yet they highlight leadership and relational capabilities as the necessary condition (Mubarik et al., 2025; Liu et al., 2024; Pattanayak et al., 2024). There is a potential of quality and transparency in pharmaceuticals and across the sectors; yet their specific conditions cannot be transferred to fashion sector (Sahoo, 2025; Cheong, 2025; Sarfraz et al., 2023).

Technical architectures and simulations enlarge the set of blockchain applications. Risso et al. (2024) model how traceability systems can behave under different designs, while Shahzad et al. (2025) and Winkelmann et al. (2024) relate blockchain with digital strategies for the improvement of resilience and sustainability. Hong and Xiao (2024) examine blockchain and artificial intelligence in the broader digital economy model. The studies of this kind are helpful in terms of design and theory; yet simulations and composite measures of digitalization cannot prove that the real suppliers provide the right data.

The third function is the consumer-oriented signalling. Hina, Islam and Dhir (2024) find that perceived transparency, traceability and immutability increase the consumption values and purchase intention in a fashion scenario. Huang, Dai and Lim (2025), Sovtić et al. (2025), Nguyen and Nguyen (2025) and Zayed and Hatem (2026) also demonstrate that blockchain-based information can affect trust, clarity or purchase readiness. Zhu, Duan and Sarkis (2024) find that consumer confidence and willingness to pay are higher when carbon information is reliable and traceable. These studies prove the signalling value but not the upstream truth. Participants react to information labelled as blockchain-based; they do not verify the source data independently.

The blockchain may also help to create the Digital Product Passports by linking the product identity with lifecycle records. Abreu, Pereira and Barata (2025) present the blockchain-based design principles for passports, while the DPP research identifies the product, material, environmental, supply chain and compliance information as the main information clusters (Jensen et al., 2023). The architecture can ensure data continuity, but the passports use multiple technologies. The mandatory blockchain application will mix the regulatory requirement with one of the technical options.

The recent analytical models explore the possibility of using blockchain to change the incentives for greenwashing. Xu et al. (2025), Lv and Bi (2025) and Pan, Wang and Zhang (2025) analyse the situations when the increased visibility raises the costs of greenwashing or changes platform decision-making. Zhang, Zheng and Zheng (2024) similarly model the policies and blockchain effects in textile closed-loop supply chains. The models describe the strategic mechanism, yet their actors, information and enforcement assumptions are simplified. The models must be read as propositions for empirical study.

In essence, the best claim supported by the literature is modest. Blockchain can improve the infrastructure of approved information sharing, linking and preserving. It can increase the transparency of some manipulations and enable stakeholders to access consistent records. It cannot validate whether the supplier observation, certificate or the environmental calculation were correct. Blockchain helps but does not prove.

3.3 Technological and Data-Quality Limitations

The main technological limitation is off-chain data problem. The cryptography can ensure the security of the record after validation, but it cannot prove whether the observation, certificate or environmental calculation made by the supplier was true at the input point. The reviews of blockchain governance recognize that the trust can be ensured by identities, validation rules, decision rights and data collection process rather than by coding only (Polcumpally et al., 2024; Karaduman and Gülhas, 2025). The permanent false record is still false. This is particularly important for sustainability claims because the legal and managerial question concerns not only the security of the database but the quality of the evidence.

It is hard to link physical and digital in textile production. Fibres can be mixed, transformed, dyed, cut and assembled. Tags and chain-of-custody controls can reduce the risk of substitution, but they increase the costs and complications (Vazquez Melendez, Bergey and Smith, 2024; Hakola et al., 2025). Azevedo, Gomes and Romão (2023) start with the certificates and ownership events, which means that the validity of these inputs becomes separate task. The limitation is often overlooked in the technology-related research.

Interoperability is the second limitation. Fashion firms use enterprise systems, certification databases, supplier portals and custom platforms. DPP research stresses the importance of shared vocabularies, identifiers, data models and cross-platform exchange as the prerequisites (Voulgaridis et al., 2024; King, Timms and Mountney, 2023; Domskienė and Gaidule, 2024). Without these standards, the secure ledger can store the data which are hard to compare and exchange. Thus, it may result in isolated platforms rather than the industry-wide evidence infrastructure.

Scalability produces further trade-offs. The wider traceability increases visibility, but the additional tiers, events and fields increase validation, storage, access and maintenance demands. Simulations and architectural studies can check the performance assumptions, but they cannot reproduce all the disputes, information manipulation or supplier behaviour (Risso et al., 2024; Shamsuzzoha et al., 2025). Lustenberger and Spychiger (2025) question the gap between blockchain promise and real-world supply-chain results, while Najati's (2025) analysis of

TradeLens shows that even technically robust platform can fail in case of weak participation and governance.

Data access, privacy and correction are also unresolved problems. The permissioned system can control visibility, but the access rules are managerial choice. The suppliers can be resistant to disclose their prices, processes or customers. DPP research shows that rights to access, control, update and re-use data must be governed explicitly (Ducuing and Reich, 2023; Yuan, 2025). The immutability conflicts with legitimate correction. The compliant design should include versioning and amendment procedures to allow data correction without compromising the audit trail.

These limitations explain why the technical feasibility is not equivalent to the evidence quality. Even the well-designed platform may store all required data, but the claim will be still false in case of incorrect methodology, unreliable certificate or inaccurate data aggregation. Technical architecture must be designed from the claim and evidence process, not from the general wish to store all available data.

3.4 Organizational and Supply-Chain Limitations

Blockchain adoption is the inter-organizational change process. The recent reviews see the adoption as staged and dependent on the organizational capability, expected value, coordination and pressure (Zhang, Jia and Chen, 2024). Empirical studies of the leadership and relational capability lead to the same conclusion: technology can bring value if the firms integrate it into routines, information exchange and cooperation (Liu et al., 2024; Pattanayak et al., 2024). Installation of the ledger at one focal firm cannot guarantee the end-to-end traceability if the upstream firms do not have the data, incentives and digital capabilities.

The supplier participation is the key limitation. Heldt and Pikuleva (2025) show that the traceability was co-constructed and expanded through the collaboration, not dictated through the procurement decision. The fashion supply chain includes the numerous small firms which can suffer from data entry, tagging, certification and auditing costs without getting any equal value. Collaborative and just-transition research warns about the reproduction of inequality in

sustainability initiatives (Di Lodovico and Manzi, 2023; Karaosman and Marshall, 2023; Bonelli, Caferra and Morone, 2024).

The readiness within the firms is uneven as well. The management support, employees' knowledge, systems integration and resources shape the implementation process. Recent studies relate blockchain implementation with the operational excellence, resilience and supply chain mapping, but these effects are based on the design and organizational capability (Shahzad et al., 2025; Mubarik et al., 2025). There are transferable mechanisms from the pharmaceuticals, tourism and general manufacturing sectors, but fashion specifics is still to be accounted (Sahoo, 2025; Sarfraz et al., 2023; Hong and Xiao, 2024).

The business case is not universal. Some consumer experiments show that the traceability information can increase trust or willingness to pay (Hina, Islam and Dhir, 2024; Zhu, Duan and Sarkis, 2024; Huang, Dai and Lim, 2025). However, the intention and premium cannot be assumed to fund the network-wide implementation. The costs include the platform development, integration, data cleaning, tags, audits and supplier support. If the benefits go to the brand only, the suppliers can be unenthusiastic and submit the low-quality data.

The platform legitimacy is the other organizational aspect. Blockchain is called as decentralized, but the practical blockchain networks require sponsors, rules and administrators. The TradeLens example shows that even powerful technology and sponsors do not guarantee the ecosystem if the actors doubt about the neutrality, ownership or value distribution (Najati, 2025). The governance reviews also indicate that the trust is moved from the technology to membership, validation and decision process (Polcumpally et al., 2024). Qiao et al. (2025) propose the evaluation of the fashion contractual parties based on the blockchain; however, any scoring system raises the questions of criteria, contestability and model governance.

The digital passports add further capability demands. Studies in textiles and other industries identify the data preparation, stakeholder access, integration and organizational embedding as the key challenges (Acciai and Pérez-Bou, 2026; Chaudhuri et al., 2025; Carvalho, Silva and Abreu, 2025; Won et al., 2025). Producer and consumer evidence appear in the literature, but they are too recent to prove their long-term economics (D'Adamo et al., 2026). The bibliometric and literature reviews confirm the rapid development of the field and the absence of validation of

many frameworks (Karabulut, Çalikoğlu and Bulut, 2025; Psarommatis and May 2026; Lyse and Huang, 2026).

Organizational limitations interact with the technological ones. The supplier may have the accurate data but lack the compatible system, or the platform may have interoperability but lack the trustful participation. The effective adoption requires capability building, incentives, standards and governance structure seen as legitimate for the network.

3.5 Governance, Ethics and Compliance Requirements

The literature supports the idea of seeing the blockchain as part of the claims governance system. The first requirement is the claim definition. The managers must clarify what is claimed, which product, period and lifecycle boundaries and the measurement or certification method is used. The sustainable fashion is too complex to be represented by one score or label (Palm, 2023; Mousavi et al., 2024). The blockchain solution designed for fibre origin cannot prove the sustainability claim without additional evidence.

The second requirement is the verification before entry. Supplier declarations, lab results, certificates, meter readings and lifecycle calculations require the known owner, methods and review process. Blockchain may record the certificate or the audit event, but it cannot replace the organization which is responsible for the verification of the evidence. The provenance literature emphasizes the fingerprinting and identity controls, while the governance reviews stress the need in accountable validation and off-chain verification (Vazquez Melendez, Bergey and Smith, 2024; Polcumpally et al., 2024). The independent verification is especially important if the brand sponsors the platform.

The third requirement is the data governance. The DPP studies identify the product identity, materials, usage, supply chain, environment and compliance information, but differ in how this information should be exchanged along the lifecycle (Jensen et al., 2023; Wan and Jiang, 2025; Papile and Del Curto, 2025). The legal and policy analyses emphasize that access rights, control, responsibility, confidentiality, cross-border standards and correction are beyond the technical capabilities (Ducuing and Reich, 2023; Yuan, 2025; Fares et al., 2025; Göskén, 2025).

Therefore, the blockchain consortium needs the clear rules of writing, reading, validating, challenging and amending records.

The fourth requirement is the interoperability. The DPP literature sees the passport as the ecosystem or boundary object, including the manufacturers, suppliers, consumers, repairers, recyclers and regulators (King, Timms and Mountney, 2023; Heeß et al., 2024; Zhang and Seuring, 2024). The technical frameworks see the identifier and exchange standards as necessary, while the textile studies require the continuity of the raw-fibre and material data (Voulgaridis et al., 2024; Domskienė and Gaidule, 2024; Papile and Del Curto, 2025). The private blockchain which cannot connect with the other passports or assurance systems can increase the fragmentation.

The fifth requirement is accountability. Decentralisation can obscure responsibility when firms assume that the technology itself guarantees truth. Analytical studies suggest that greater visibility may change incentives for greenwashing, but their conclusions depend on assumptions about enforcement and information quality (Xu et al., 2025; Lv and Bi, 2025; Pan, Wang and Zhang, 2025). Managers must still confirm that the evidence supports the likely interpretation of a claim. Contracts should therefore define supplier duties, audit rights, correction procedures and sanctions for false or missing data.

The ethical governance must take the power into consideration. The data collection may increase the costs for the smaller suppliers, while the brands enjoy the reputation and consumer value. The just-transition research calls to pay attention to the who bears the burden of sustainability changes (Karaosman and Marshall, 2023). The DPP value and governance literature highlights the differences in the required information and conflicting interests (Chaudhuri et al., 2025; Dietrich, Schuster and Bühler, 2025; Fares et al., 2025). Thus, the fair implementation requires the proportional data request, the supplier support, confidential access and opportunities to challenge the records.

Finally, the communication of the claim requires the ongoing control. The consumer literature sees the effects of authenticity, clarity and transparency on the attitude, but the detailed technical data can be misleading in case of omitted material limits (Jung, Tian and Oh, 2024; Lee et al., 2024; Wang and Jung, 2025). Social-media and greenwashing literature proves that the

stakeholders compare the corporate language with the external information (Li, Cavender and Lee, 2025; Persakis et al., 2025). Thus, the claim should be controlled by cross-functional process and checked if the suppliers, materials, methods or standards change.

The DPP development literature supports the governance requirements as well. The frameworks and pilots are the dominant topics in DPP research (Jensen et al., 2023; Wan and Jiang, 2025; Fares et al., 2025). The textile passports, smart tags and framework validation studies see the promise but also the data-quality and governance issues (Carvalho, Silva and Abreu, 2025; Hakola et al., 2025; Lyse and Huang, 2026). Blockchain can serve the passport, but its compliance depends on the full governance structure.

3.6 Theoretical, Methodological and Philosophical Patterns

The Technology–Organization–Environment thinking can be seen in the adoption literature because it distinguishes between technical readiness, organizational capability and pressure. The TOE approach can be useful for the classification but turns into the checklist if the relations and mechanisms are not analyzed. The institutional theory adds regulatory, NGO and competitive pressure, while fashion transparency literature indicates that this pressure may lead to the symbolic disclosure (Schäfer, Petersen and Hörisch, 2024). The relational capability and leadership theories explain why the collaboration is needed despite the distributed ledger (Liu et al., 2024; Pattanayak et al., 2024). Signaling theory is useful for consumer-oriented labels, but the signal cannot prove that the claim is true (Hina, Islam and Dhir, 2024; Huang, Dai and Lim, 2025).

The field is methodologically uneven. The reviews classify antecedents and use cases, analytical models explain the incentives, experiments test perception, simulations test designs, and case studies explain implementation. All the designs answer different questions, so they should not be summarized into the general claim of blockchain improving the compliance. Cross-sectional surveys and experiments rarely observe the real upstream evidence. Technical demonstrations prove only the technical feasibility, not the governance effectiveness. The process studies provide deeper mechanism analysis but lack the statistical generalization.

The philosophical basis is also different in the quantitative studies which usually assume that the adoption, trust or performance can be measured as stable variables. The process work is close to interpretivism and critical realism as it sees the outcome as emerging in the open systems. The axiology is often implicit: transparency, digitalization and blockchain are good per se, while the supplier burden, surveillance and platform control are not emphasized. The critical realism synthesis is appropriate because it recognizes real technological possibilities but looks for the organizational mechanisms.

3.7 Literature Synthesis and Research Gaps

The literature gives the consistent but conditional answer. The blockchain can preserve the provenance, link the authorized records, increase the visibility and support the consumer-oriented signals. The limitations of the blockchain are off-chain data quality, physical-digital linkage, interoperability, cost, organizational capability and platform legitimacy. The governance requires claim-specific evidence rules, verified inputs, standardization, access and correction rights, independent verification, accountability and monitoring.

There are four gaps. First, the implementations of the blockchain in fashion are few and the skeptical reviews notice the gap between the promises and successful scaling (Lustenberger and Spychiger, 2025). Second, the tests for changing the actual evidence or claims are missing. Third, the perspective of suppliers and workers is underrepresented. Finally, the DPP and blockchain literature usually specifies the data fields more precisely than the procedures of error correction and liability. These gaps are the basis for the conceptual framework which places the blockchain in the context of governance and evidence process.

4. Philosophical and Methodological Analysis of One Selected Study

4.1 Overview of the Selected Study

Article by Heldt and Pikuleva (2025) entitled "When upstream suppliers drive traceability: A process study on blockchain adoption for sustainability" was chosen since it discusses implementation instead of potential advantages. The research question concerns how blockchain-powered traceability solution arises in a complex supply chain. The context of the study is a multi-tier cobalt chain related to environmental and human-rights sustainability risks. Even though there is a difference between fashion and cobalt sectors, both supply chain contexts have opaque upstream, power asymmetry and challenges with integration of physical and digital worlds as well as increased due-diligence requirements.

The researchers use the process-based case study that is informed by complex adaptive systems theory. Data collection was conducted during more than twelve months of participant observation within a company operating in an upstream tier, supplemented with semi-structured interviews and documentary data. Abductive methodology is applied as the analysis moves between empirical patterns and concepts. The article concludes that traceability was constructed in a collaborative process over time. The initiative was undertaken by a big upstream supplier, but its scaling was based on collaboration with downstream firms, stakeholder alliances, forums and step-by-step engagement of opaque midstream tiers. Visibility, standards, trust and follow-up capability were identified as the necessary conditions for blockchain implementation (Heldt and Pikuleva, 2025).

4.2 Ontological Positioning

The article does not state its ontological position explicitly, so it must be inferred from the research design. The study treats supply chains, organisations, technologies and traceability events as real, while viewing their effects as emergent outcomes of interaction. Complex adaptive systems thinking assumes that network outcomes cannot be reduced to separate elements because actors adapt, feedback develops and patterns change over time. This view is consistent with a realist ontology that recognises an organisational world beyond the researcher,

and with a relational ontology in which properties develop through interaction (Mercier, Sanders and Munford, 2023; Fuchs and Robinson, 2024).

There is no objectivism in the article. Blockchain adoption is not seen as a fixed variable that would produce the same result everywhere, but implementation is dependent on historical sequence, actor's agency, visible horizons and alliance structure. Open-system perspective of the study is close to critical realism in its distinction of events from mechanisms and conditions (Nichol, Hastings and Elder-Vass, 2023; Fuchs and Robinson, 2024). The strength of this ontological position is that technology has affordances without technological determinism.

However, there is a system boundary in the study that is limited to the participating organizations. Labor, communities and regulatory realities are mentioned in terms of sustainability risks but not analysed empirically. The ontological weakness is that it does not specify the structures that exist beyond the focal project and that constrain the actions of smaller actors.

4.3 Epistemological Positioning

Epistemologically, the study is interpretive and abductive, but not positivist. Knowledge is generated during prolonged engagement, interviews, document analysis and continuous shifting between observations and theory. The goal is to understand how a process unfolds, not to test a universal causal relationship. Access to meetings and decisions through participant observation provides more depth of knowledge than cross-sectional surveys could offer. There is a non-embedded researcher and additional interviews that provide some distance from the field.

Abductive methodology is consistent with critical realism in allowing unexpected observations to lead to mechanisms explaining the events (Mercier, Sanders and Munford, 2023; Labas, 2024). Heldt and Pikuleva (2025) use theory to interpret emergence, but they modify the role of upstream actors according to the empirical sequence of events. This leads to the development of the explanatory depth.

However, the claims made in the article are analytically, but not statistically, generalizable. The mechanism identified by the study works in one cobalt network, but it cannot be assumed that upstream leadership will produce the same outcome in fashion, where the lifecycle of products,

margins, supplier turnover and transformation of material are different. Epistemological discipline is needed to transfer the mechanisms, not the conclusions.

4.4 Axiology and Researcher Positionality

The study has a value-laden component that is defensible but implicitly stated. It considers traceability, sustainability risk management and visibility to be good. These values correspond to the environmental and human rights problems of cobalt supply chains. However, improved visibility may serve different interests – it may facilitate due diligence, or it may increase monitoring or shift reporting burdens upstream. A critical axiological perspective asks whose risks, costs and benefits are addressed by the study.

Researcher's positionality is especially important because one of the researchers was embedded in the upstream firm for more than twelve months. This is a major strength, but prolonged engagement may lead to the identification with the organization's perspective and to reluctance to listen to criticism of the project. Use of a non-embedded researcher, interviews and external documents provides some triangulation, but does not exclude the need for reflexivity. According to recent quality guidance, transparent documentation and awareness of researcher's influence are important components of confirmability (Ahmed, 2024; Moore and Kelly, 2024).

The article's upstream focus partly corrects a downstream bias, but other perspectives remain underrepresented. Midstream firms, workers, communities and external assurance bodies may view the project differently. A critical axiological analysis should therefore assess whether the traceability system is equitable in voice and value, not only whether it improves visibility. This is especially important in fashion, where small suppliers may bear the cost of data provision while brands gain the reputational benefits.

4.5 Methodological Quality: Reliability, Validity and Trustworthiness

Process design of the article is appropriate to the research question. Adoption of blockchain in a multi-tier network is temporal and relational; therefore, more than twelve months of observation provides better evidence than a one-time survey. Triangulation is provided by combining observation, interviews and documents. Field notes provide information about events as they

happen, interviews give participant's interpretations, and documents provide an external record. Moreover, abductive analysis allows the researchers to modify the theoretical understanding of the role played by upstream supplier.

Prolonged engagement and multiple data sources contribute to credibility of the article. The study analyses the actual implementation instead of hypothetical scenario, overcoming a major weakness in the broader literature. The process account of implementation provides temporal narrative, including initiation, alliance building, extension into opaque tiers and formalization in the blockchain. Such an account is conducive to the mechanism-based explanation. Moreover, the use of complexity of adaptive systems perspective is justified in directing attention to interaction, emergence and boundary changes.

Dependability is harder to assess in process studies, because they require interpretation of periods, events and causality. In the article, the broad design and abductive methodology are explained, but another researcher could develop a different narrative based on the same field data. It is, therefore, necessary to have a clear audit trail, explanation of coding and evidence table. Framework-analysis and thematic guidance recommend explicit movement from data to categories (Bingham, 2023; Mercier, Sanders and Munford, 2023; Gupta, 2025).

Main weakness is transferability. The case study is related to cobalt sector, where product characteristics, due-diligence requirements and strategic dependence are different from fashion. Moreover, the focal firm in the upstream tier has sufficient power to undertake a network project, but many fashion suppliers do not have such an advantage. The article identifies transferable concepts, such as alliance governance, pre-existing visibility and follow-up capability, but not direct evidence of fashion compliance claims.

The article also does not measure whether traceability improves sustainability claims' accuracy, reduces audit exceptions or affects regulatory outcomes. The outcome is emergence and extension of a traceability system. This is valuable information, but less focused than the question in the present report about compliance. Successful implementation can be accompanied by poor source data or excessive claims. Therefore, the conclusions of the article should be used to explain implementation mechanism, but not to prove the compliance.

In conclusion, the study has high ecological validity because of a live project in the organizational setting. It has lower external validity statistically and does not include any counterfactual comparison. Comparative longitudinal design in several fashion networks would be needed to test the impact of the identified mechanisms on data quality and claim decision-making.

4.6 Ethical Considerations

The study relates to commercially sensitive relationships and human-rights risks, thus ethical considerations are related to confidentiality, informed participation and responsible reporting. Embedded observation blurs the line between the organizational role and the researcher's role, so participants should know when the information is used for research purposes. Company anonymity helps to obtain access but may prevent independent verification of the account.

The study also raises an important ethical issue: traceability is not neutral. It can expose misconduct and support due diligence, but it can also concentrate monitoring power and shift compliance work onto less powerful firms. Although the article identifies sustainability risks, a fuller ethical analysis should address data ownership, worker visibility, and the consequences of challenging or correcting records. This concern aligns with wider fashion literature on just transition and supplier burden (Karaosman and Marshall, 2023).

4.7 Critical Appraisal and Alternative Approaches

Heldt and Pikuleva (2025) provide a valuable contribution in replacing speculation with a detailed account of implementation. They conclude that blockchain technology formalizes and extends the capabilities that must be developed in advance through standards, trust, visibility and collaboration. This finding refutes technology determinism and supports the main thesis of the present review.

Weakness of the article is the sector and case dependence. One upstream-led cobalt initiative cannot prove the way in which fashion brands, textile suppliers, certifiers and regulators manage compliance claims. An alternative research design would be a comparison of several fashion networks using different platforms. Interviews should involve brands, mills, factories, certifiers,

technology providers and smaller suppliers, while documents should include audit findings, certificates and approved claims. Longitudinal observation would allow to test the impact of governance controls on data correction, assurance and claim approval.

5. Discussion and Contribution

This review lends itself to a conditional answer to the research question. The roles of blockchain can be explained via provenance, persistence, visibility and signalling. Limitations can be explained through poor source data, physical-digital link uncertainty, interoperability, cost, supplier capacity and platform legitimacy. Governance can be explained through claim definition, verification, standardization, access rights, independent assurance, accountability and monitoring. There is no evidence to support the claim that blockchain produces truthful or compliant sustainability information independently.

Selected paper explains why the answer is conditional. Traceability evolved because of collaboration, standardization and follow-up capacity before becoming a blockchain solution (Heldt and Pikuleva, 2025). This is in line with other studies on wide adoption, leadership and capability research (Zhang, Jia and Chen, 2024; Liu et al., 2024; Pattanayak et al., 2024). Technology gives affordances, but organizations and institutions make technology work.

First practical implication is a five-stage blockchain enabled claims governance framework. This framework shifts managerial focus from the selection of technology to its controlled use.

Stage 1 is meant to address a shortcoming in broad sustainability language. The need for evidence must follow the claim, not vice versa. Stage 2 solves the off-chain problem by ensuring identity, measurement and certification prior to treating the record as evidence. Stage 3 accepts that decentralized technology needs governance. Access, decision-making, correction and interoperability need to be spelled out. Stage 4 separates record integrity from compliance decision-making. Independent assurance is needed if there is a high risk of error, self-interest or materiality. Stage 5 allows control over the process of translating evidence into public communication and claim validity.

This framework draws on several theoretical perspectives. Technology-Organization-Environment helps to understand readiness and external pressure. Institutions explain why regulation, NGOs and competitors encourage traceability but can also lead to symbolic compliance. Signalling theory is used to capture consumer value and critical realism to explain

the same feature of blockchain producing different results in open systems. This framework thus accepts technological affordances as neither necessary nor sufficient for compliance.

From methodological perspective, this review illustrates the importance of hierarchy of evidence. Experiments with consumers establish perception, analytical models establish logic, demonstrations establish feasibility and process case studies establish mechanisms. All of these are insufficient to prove claim compliance. Future research should observe mature fashion applications and track claim approvals, audit exceptions, data corrections, supplier participation and regulatory outcomes over time. Comparative research should assess cost and decision rights distribution in governance models.

Managerially, implication is obvious. Blockchain should be assessed with regards to claims-evidence use case, not adopted as a general symbol of transparency. Investment is better justified when the organization is ready to provide reliable upstream data, assure its correctness, provide partners' incentives and interoperable architecture. For policy and standards makers, the task is to define evidence fields, responsibilities and correction rights without tying these to particular technology.

Table 1. Blockchain-enabled sustainability claims governance framework

Stage	Required control	Main failure prevented
1. Define the claim	Specify the exact wording, product, period, lifecycle boundary and evidential threshold.	Vague or over-broad claims.
2. Verify source data	Identify data owners, methods, certificates and risk-based or independent checks before entry.	False or incomplete data entering the ledger.
3. Govern the platform	Set identities, permissions, standards, interoperability, versioning and challenge procedures.	Opaque control, isolated systems or permanent error.
4. Assure compliance	Cross-check records against standards, audits and the likely interpretation of	Technical traceability mistaken for substantiation.

	the claim.	
5. Communicate and monitor	Approve wording, retain evidence, review changes and correct or withdraw claims when needed.	Misleading or outdated public communication.

6. Conclusion

A critical literature review of the latest findings about traceability and sustainability claims compliance enabled by blockchain technology was conducted in this paper. There are four functions that blockchain technology could play that might help to improve the infrastructure of sustainability evidence gathering and communication. The limitations in these benefits come from the nature of the external information. Blockchain cannot vouch for the accuracy of the measurements of suppliers, the validity of certificates, and the digital identity linked to the physical product.

Other limitations include the problems related to interoperability, suppliers' readiness, costs, imbalanced incentives and the legitimacy of the platform. The literature still lacks empirical findings of how blockchain affects the compliance of the fashion industry. There are only reviews, models, experiments and pilot studies in the evidence base.

The conclusion of the report is that the compliance value comes from the governance of the technology. A sound system must define the claim, verify the source data, govern identities and access, provide correction and disputes mechanism, use independent assurance and monitor the public communication. Blockchain mostly improves the function of recording and controlled data sharing. Verification, professional judgement and legal accountability are not covered.

The proposed five-stage framework could be used by fashion managers but needs to be empirically validated. The future research could explore longitudinal cases in the fashion industry, involve smaller suppliers and workers, test different platform governance models, and check whether traceability evidence affects audits, claim approval and regulation.

References

- Abdelmeguid, A., Afy-Shararah, M. and Salonitis, K. (2024) 'Towards circular fashion: management strategies promoting circular behaviour along the value chain', *Sustainable Production and Consumption*, 48, pp. 143–156. Available at: <https://doi.org/10.1016/j.spc.2024.05.010>
- Abreu, H., Pereira, V. and Barata, J. (2025) 'Blockchain-based digital product passport: design principles and demonstration', *International Journal of Production Research*, 63(16), pp. 5863–5882. Available at: <https://doi.org/10.1080/00207543.2025.2464161>
- Acciai, E. and Pérez-Bou, S. (2026) 'Exploring the role of digital product passports for supply chain traceability in the “Made in Italy” textile sector', *Asia Pacific Journal of Marketing and Logistics*, 38(4), pp. 916–932. Available at: <https://doi.org/10.1108/APJML-03-2025-0371>
- Ahmed, S.K. (2024) 'The pillars of trustworthiness in qualitative research', *Journal of Medicine, Surgery, and Public Health*, 2, 100051. Available at: <https://doi.org/10.1016/j.glmedi.2024.100051>
- Azevedo, P., Gomes, J. and Romão, M. (2023) 'Supply chain traceability using blockchain', *Operations Management Research*, 16(3), pp. 1359–1381. Available at: <https://doi.org/10.1007/s12063-023-00359-y>
- Bertola, P. and Colombi, C. (2024) 'Can fashion be sustainable? Trajectories of change in organisational, product and process, and socio-cultural contexts', *Sustainability: Science, Practice and Policy*, 20(1), 2312682. Available at: <https://doi.org/10.1080/15487733.2024.2312682>
- Bingham, A.J. (2023) 'From data management to actionable findings: a five-phase process of qualitative data analysis', *International Journal of Qualitative Methods*, 22. Available at: <https://doi.org/10.1177/16094069231183620>
- Bonelli, F., Caferra, R. and Morone, P. (2024) 'In need of a sustainable and just fashion industry: identifying challenges and opportunities through a systematic literature review in a Global

North/Global South perspective’, *Discover Sustainability*, 5, Article 186. Available at: <https://doi.org/10.1007/s43621-024-00400-5>

Carvalho, C., Silva, C.J. and Abreu, M.J. (2025) ‘Circular economy: literature review on the implementation of the Digital Product Passport in the textile industry’, *Sustainability*, 17(5), 1802. Available at: <https://doi.org/10.3390/su17051802>

Chaudhuri, A., Wæhrens, B.V., Treiblmaier, H. and Jensen, S.F. (2025) ‘Impact pathways: digital product passport for embedding circularity in electronics supply chains’, *International Journal of Operations & Production Management*, 45(6), pp. 1213–1226. Available at: <https://doi.org/10.1108/IJOPM-01-2024-0012>

Cheong, B.C. (2025) ‘Leveraging blockchain for enhanced transparency and traceability in sustainable supply chains’, *Discover Analytics*, 3, Article 6. Available at: <https://doi.org/10.1007/s44257-025-00032-7>

Cuc, S. (2023) ‘Unlocking the potential of blockchain technology in the textile and fashion industry’, *FinTech*, 2(2), pp. 311–326. Available at: <https://doi.org/10.3390/fintech2020018>

Di Lodovico, C. and Manzi, A. (2023) ‘Navigating sustainability in the fashion industry: insights from entrepreneurial perspectives on collaborative approaches’, *Sustainability: Science, Practice and Policy*, 19(1), 2242707. Available at: <https://doi.org/10.1080/15487733.2023.2242707>

Díaz-Bustamante-Ventisca, M., Carcelén-García, S., Díaz-Soloaga, P. and Kolotouchkina, O. (2025) ‘Greenwashing perception in Spanish fast-fashion brands’ communication: modelling sustainable behaviours and attitudes’, *International Journal of Fashion Design, Technology and Education*, 18(2), pp. 179–189. Available at: <https://doi.org/10.1080/17543266.2024.2343934>

Dietrich, K., Schuster, T. and Bühler, L. (2025) ‘Digital Product Passport: a digital catalyst for a circular transformation’, *Journal of Circular Economy*(Special issue 2), Article 32212. Available at: <https://doi.org/10.55845/joce-2025-32212>

Domskienė, J. and Gaidule, E. (2024) ‘An overview of technological challenges in implementing the Digital Product Passport in the textile and clothing industry’, *AUTEX Research Journal*, 24(1), Article 20240002. Available at: <https://doi.org/10.1515/aut-2024-0002>

- Ducuing, C. and Reich, R.H. (2023) 'Data governance: Digital product passports as a case study', *Competition and Regulation in Network Industries*, 24(1), pp. 3–23. Available at: <https://doi.org/10.1177/17835917231152799>
- Dzhengiz, T., Haukkala, T. and Sahimaa, O. (2023) '(Un)Sustainable transitions towards fast and ultra-fast fashion', *Fashion and Textiles*, 10, Article 19. Available at: <https://doi.org/10.1186/s40691-023-00337-9>
- D'Adamo, I., Grosso, C., Becchi, B. and Cascavilla, A. (2026) 'Digital product passports for cleaner production: economic evidence from producers and consumers in the fashion industry', *Journal of Cleaner Production*, Article 147792. Available at: <https://doi.org/10.1016/j.jclepro.2026.147792>
- D'Itria, E. and Aus, R. (2023) 'Circular fashion: evolving practices in a changing industry', *Sustainability: Science, Practice and Policy*, 19(1), 2220592. Available at: <https://doi.org/10.1080/15487733.2023.2220592>
- Ende, L., Reinhard, M.-A. and Göritz, L. (2023) 'Detecting greenwashing! The influence of product colour and product price on consumers' detection accuracy of faked bio-fashion', *Journal of Consumer Policy*. Available at: <https://doi.org/10.1007/s10603-023-09537-8>
- Fares, N., Islam, M.S., Jauhar, S.K. and Kucukaltan, B. (2025) 'Towards an international Digital Product Passport: the new paradigm of a worldwide circular economy', *Circular Economy and Sustainability*, 5, pp. 5475–5495. Available at: <https://doi.org/10.1007/s43615-025-00690-5>
- Fuchs, O. and Robinson, C. (2024) 'Operationalising critical realism for case study research', *Qualitative Research Journal*, 24(3), pp. 245–266. Available at: <https://doi.org/10.1108/QRJ-07-2023-0118>
- Gupta, R. (2025) 'Thematic analysis of qualitative data: a relational, recursive and reductive (3R) approach', *Qualitative Research Journal*. Available at: <https://doi.org/10.1108/QRJ-07-2024-0164>

Gösken, C. (2025) ‘Fashioning authenticity: how Digital Product Passports could shape the future of trade mark law’, *Journal of Intellectual Property Law & Practice*, 20(2), pp. 105–110. Available at: <https://doi.org/10.1093/jiplp/jpae121>

Hakola, L., Abedi, F., Nordman, S., Smolander, M. and Paltakari, J. (2025) ‘Smart tags as enablers for Digital Product Passports in circular electronics value chains’, *Circular Economy and Sustainability*, 5, pp. 2033–2055. Available at: <https://doi.org/10.1007/s43615-025-00500-y>

Heeß, P., Rockstuhl, J., Körner, M.-F. and Strüker, J. (2024) ‘Enhancing trust in global supply chains: conceptualizing Digital Product Passports for a low-carbon hydrogen market’, *Electronic Markets*, 34, Article 10. Available at: <https://doi.org/10.1007/s12525-024-00690-7>

Heidenstrøm, N. (2025) ‘Green marketing in the fashion industry: a critical analysis of sustainability narratives’, *Consumption Markets & Culture*, pp. 1–17. Available at: <https://doi.org/10.1080/10253866.2024.2440557>

Heldt, L. and Pikuleva, E. (2025) ‘When upstream suppliers drive traceability: A process study on blockchain adoption for sustainability’, *International Journal of Physical Distribution & Logistics Management*, 55(3), pp. 196–222. Available at: <https://doi.org/10.1108/IJPDLM-01-2024-0022>

Hina, M., Islam, N. and Dhir, A. (2024) ‘Blockchain for sustainable consumption: an affordance and consumer value-based view’, *Internet Research*, 34(7), pp. 215–250. Available at: <https://doi.org/10.1108/INTR-07-2023-0523>

Hong, Z. and Xiao, K. (2024) ‘Digital economy structuring for sustainable development: the role of blockchain and artificial intelligence in improving supply chain and reducing negative environmental impacts’, *Scientific Reports*, 14, 3912. Available at: <https://doi.org/10.1038/s41598-024-53760-7>

Huang, B., Dai, J. and Lim, J.J. (2025) ‘Blockchain technology as a driver for sustainability? A consumer purchase intention perspective’, *International Journal of Operations & Production Management*, 45(7), pp. 1402–1425. Available at: <https://doi.org/10.1108/IJOPM-04-2024-0340>

Javed, T., Mahmoud, A.B., Yang, J. and Zhao, X. (2024) ‘Green branding in fast fashion: examining the impact of social sustainability claims on Chinese consumer behaviour and brand perception’, *Corporate Communications: An International Journal*, 29(6), pp. 915–936.

Available at: <https://doi.org/10.1108/CCIJ-12-2023-0169>

Jensen, S.F., Kristensen, J.H., Adamsen, S., Christensen, A. and Wæhrens, B.V. (2023) ‘Digital product passports for a circular economy: data needs for product life cycle decision-making’, *Sustainable Production and Consumption*, 37, pp. 242–255. Available at:

<https://doi.org/10.1016/j.spc.2023.02.021>

Jestratijevic, I., Uanhoro, J. and Rana, R.I. (2024) ‘Transparency of sustainability disclosures among luxury and mass-market fashion brands: longitudinal approach’, *Journal of Cleaner Production*, 140481. Available at: <https://doi.org/10.1016/j.jclepro.2023.140481>

Jung, H.J., Tian, X. and Oh, K.W. (2024) ‘Sustainable threads: analysing the impact of corporate social performance, CSR message authenticity and information transparency on purchase intentions’, *Fashion and Textiles*, 11, Article 18. Available at: <https://doi.org/10.1186/s40691-024-00379-7>

Karabulut, A.N., Çalıkoğlu, G. and Bulut, Z.A. (2025) ‘Discussing and reviewing the Digital Product Passport: an up-to-date bibliometric analysis’, *Systems*, 13(11), 930. Available at: <https://doi.org/10.3390/systems13110930>

Karaduman, Ö. and Gülhas, G. (2025) ‘Blockchain-enabled supply chain management: a review of security, traceability, and data integrity amid the evolving systemic demand’, *Applied Sciences*, 15(9), 5168. Available at: <https://doi.org/10.3390/app15095168>

Karaosman, H. and Marshall, D. (2023) ‘Impact pathways: just transition in fashion operations and supply chain management’, *International Journal of Operations & Production Management*, 43(13), pp. 226–237. Available at: <https://doi.org/10.1108/IJOPM-05-2022-0348>

King, M.R.N., Timms, P.D. and Mountney, S. (2023) ‘A proposed universal definition of a Digital Product Passport Ecosystem: worldviews, discrete capabilities, stakeholder requirements

and concerns', *Journal of Cleaner Production*, 384, 135538. Available at:

<https://doi.org/10.1016/j.jclepro.2022.135538>

Kolotouchkina, O., Díaz-Bustamante Ventisca, M., Carcelén-García, S. and Díaz-Soloaga, P. (2025) 'Environmental activism and sustainable communication of B-Corp fashion brands on Instagram: best practices, emerging opportunities, and remaining challenges', *Humanities and Social Sciences Communications*, 12(1), 1674. Available at: <https://doi.org/10.1057/s41599-025-05941-2>

Kraus, S., Breier, M., Lim, W.M., Dabić, M., Kumar, S., Kanbach, D., Mukherjee, D., Corvello, V., Piñeiro-Chousa, J., Liguori, E., Palacios-Marqués, D., Schiavone, F., Ferraris, A., Fernandes, C., Ferreira, J.J., Dana, L.-P., Bouncken, R.B. and Yela Aránega, A. (2024) 'The burgeoning role of literature review articles in management research: an introduction and outlook', *Review of Managerial Science*. Available at: <https://doi.org/10.1007/s11846-024-00729-1>

Labas, A. (2024) 'Expanding knowledge through sequential world views: a critical realist approach', *Journal of Critical Realism*, 23(3), pp. 258–273. Available at: <https://doi.org/10.1080/14767430.2024.2358466>

Lee, Z., Gordon-Wilson, S., Davies, I. and Pring, C. (2024) 'Communicating about sustainability in fashion: a construal level theory approach', *European Journal of Marketing*, 58(1), pp. 313–341. Available at: <https://doi.org/10.1108/EJM-09-2021-0701>

Li, M., Cavender, R. and Lee, M.-Y. (2025) 'Consumer awareness of fashion greenwashing: insights from social media discussions', *Sustainability*, 17(7), 2982. Available at: <https://doi.org/10.3390/su17072982>

Liu, Y., Fang, W., Feng, T. and Xi, M. (2024) 'Blockchain technology adoption and supply chain resilience: exploring the role of transformational supply chain leadership', *Supply Chain Management*, 29(2), pp. 371–387. Available at: <https://doi.org/10.1108/SCM-08-2023-0390>

Lustenberger, M. and Spychiger, F. (2025) 'Blockchain in supply chains: an unfulfilled promise', *Supply Chain Management*, 30(2), pp. 178–194. Available at: <https://doi.org/10.1108/SCM-03-2024-0192>

Lv, Y. and Bi, X. (2025) 'How blockchain technology combats greenwashing: A game in a low-carbon preference market', *Computers & Industrial Engineering*, Article 111562. Available at: <https://doi.org/10.1016/j.cie.2025.111562>

Lyse, S.M. and Huang, L. (2026) 'Digital Product Passports: a systematic literature review on framework design and validation', *Digital*, 6(2), 43. Available at: <https://doi.org/10.3390/digital6020043>

Mercier, J., Sanders, J. and Munford, R. (2023) 'Fine companions: critical realism and framework analysis', *International Journal of Qualitative Methods*, 22. Available at: <https://doi.org/10.1177/16094069231220129>

Moore, A.R. and Kelly, D.M. (2024) 'Getting real about critical realist interviewing: five principles to guide practice', *International Journal of Qualitative Methods*, 23. Available at: <https://doi.org/10.1177/16094069241299311>

Mousavi, K., Kowsari, E., Ramakrishna, S., Chinnappan, A. and Gheibi, M. (2024) 'A comprehensive review of greenwashing in the textile industry: life cycle assessment, life cycle cost, and eco-labelling', *Environment, Development and Sustainability*. Available at: <https://doi.org/10.1007/s10668-024-04508-6>

Mubarik, M.S., Khan, S.A., Kusi-Sarpong, S. and Mubarik, M. (2025) 'Supply chain sustainability in VUCA: role of BCT-driven SC mapping and "Visiceability"', *International Journal of Logistics Research and Applications*, 28(8), pp. 823–841. Available at: <https://doi.org/10.1080/13675567.2023.2222660>

Najati, I. (2025) 'Exploring the failure factors of blockchain adopting projects: a case study of TradeLens through the lens of commons theory', *Frontiers in Blockchain*, 8, 1503595. Available at: <https://doi.org/10.3389/fbloc.2025.1503595>

Nguyen, T.H. and Nguyen, K.M. (2025) 'Fostering consumer sustainability trust by integrating blockchain-enabled reviews and QR code traceability systems in supply chain: a three-dimensional measurement scale development', *International Journal of Logistics Research and*

Applications, Advance online publication. Available at:

<https://doi.org/10.1080/13675567.2025.2574470>

Nichol, A.J., Hastings, C. and Elder-Vass, D. (2023) ‘Putting philosophy to work: developing the conceptual architecture of research projects’, *Journal of Critical Realism*, 22(3), pp. 364–383.

Available at: <https://doi.org/10.1080/14767430.2023.2217054>

Palm, C. (2023) ‘Sustainable fashion: to define, or not to define, that is not the question’, *Sustainability: Science, Practice and Policy*, 19(1), 2261342. Available at:

<https://doi.org/10.1080/15487733.2023.2261342>

Pan, H., Wang, P. and Zhang, S. (2025) ‘Blockchain-enabled digital supply chain regulation: mitigating greenwashing to advance sustainable development’, *Sustainability*, 17(22), 10019.

Available at: <https://doi.org/10.3390/su172210019>

Papile, F. and Del Curto, B. (2025) ‘Textile materials information for Digital Product Passport implementation in the textile and clothing ecosystem: a review on the role of raw fibers in a substantial transition’, *Sustainability*, 17(19), 8804. Available at:

<https://doi.org/10.3390/su17198804>

Paramitha, V., Tan, S.Z. and Lim, W.M. (2025) ‘Undoing greenwashing: the roles of greenwashing severity, consumer forgiveness, growth beliefs and apology sincerity’, *Journal of Product & Brand Management*, 34(4), pp. 433–449. Available at: <https://doi.org/10.1108/JPBM-11-2023-4846>

Pattanayak, S., Ramkumar, M., Goswami, M. and Rana, N.P. (2024) ‘Blockchain technology and supply chain performance: the role of trust and relational capabilities’, *International Journal of Production Economics*, 271, 109198. Available at: <https://doi.org/10.1016/j.ijpe.2024.109198>

Persakis, A.D., Nikolopoulos, T., Negkakis, I.C. and Pavlopoulos, A. (2025) ‘Greenwashing in marketing: a systematic literature review and bibliometric analysis’, *International Review on Public and Nonprofit Marketing*, 22(4), pp. 957–992. Available at:

<https://doi.org/10.1007/s12208-025-00452-x>

Polcumpally, A.T., Pandey, K.K., Kumar, A. and Samadhiya, A. (2024) 'Blockchain governance and trust: a multi-sector thematic systematic review and exploration of future research directions', *Heliyon*, 10(12), e32975. Available at: <https://doi.org/10.1016/j.heliyon.2024.e32975>

Promalessa, R. and Handriana, T. (2024) 'How does greenwashing affect green word of mouth through green skepticism? Empirical research for fast fashion', *Cogent Business & Management*, 11(1), 2389467. Available at: <https://doi.org/10.1080/23311975.2024.2389467>

Psarommatis, F. and May, G. (2026) 'A comprehensive review of Digital Product Passports in sustainable manufacturing: current state, challenges, and future directions', *Circular Economy and Sustainability*, 6(3), Article 207. Available at: <https://doi.org/10.1007/s43615-026-00927-x>

Qiao, M., Chen, X., Zhou, Y. and Mok, P.Y. (2025) 'Blockchain-driven innovation in fashion supply chain contractual party evaluations as an emerging collaboration model', *Blockchain: Research and Applications*, Article 100266. Available at: <https://doi.org/10.1016/j.bcra.2024.100266>

Risso, L.A., Ganga, G.M.D., de Santa-Eulalia, L.A., Godinho Filho, M., Chikhi, T., Mosconi, E. and Zhang, K. (2024) 'A framework for modeling and simulating blockchain-based supply chain traceability systems', *International Journal of Production Economics*, Article 109408. Available at: <https://doi.org/10.1016/j.ijpe.2024.109408>

Sahoo, S. (2025) 'Blockchain-enabled traceability systems for supply chain quality management: empirical insights from pharmaceutical manufacturers', *International Journal of Quality & Reliability Management*, 42(5), pp. 1381–1410. Available at: <https://doi.org/10.1108/IJQRM-03-2024-0091>

Santos, C., Coelho, A. and Marques, A. (2024) 'A systematic literature review on greenwashing and its relationship to stakeholders: state of the art and future research agenda', *Management Review Quarterly*, 74, pp. 1397–1421. Available at: <https://doi.org/10.1007/s11301-023-00337-5>

Sarfraz, M., Khawaja, K.F., Han, H., Ariza-Montes, A. and Arjona-Fuentes, J.M. (2023) 'Sustainable supply chain, digital transformation, and blockchain technology adoption in the

tourism sector’, *Humanities and Social Sciences Communications*, 10(1), Article 557. Available at: <https://doi.org/10.1057/s41599-023-02051-9>

Sauer, P.C. and Seuring, S. (2023) ‘How to conduct systematic literature reviews in management research: a guide in 6 steps and 14 decisions’, *Review of Managerial Science*, 17(5), pp. 1899–1933. Available at: <https://doi.org/10.1007/s11846-023-00668-3>

Schäfer, N., Petersen, L. and Hörisch, J. (2024) ‘The interplay between supply chain transparency and NGO pressure: a quantitative analysis in the fashion industry context’, *Journal of Business Ethics*, 192, pp. 713–727. Available at: <https://doi.org/10.1007/s10551-023-05480-3>

Shahzad, K., Helo, P., Ranta, M. and Nousiainen, E. (2025) ‘Blockchain technology for operational excellence and supply chain resilience: a framework based on use cases and an architecture demonstration’, *Technology Analysis & Strategic Management*, 37(9), pp. 1078–1095. Available at: <https://doi.org/10.1080/09537325.2024.2304698>

Shamsuzzoha, A., Shahzad, K., Nousiainen, E., Ranta, M., Helo, P. and Govindan, K. (2025) ‘Ensuring supply chain transparency by deploying blockchain-enabled technology: an overview with demonstration’, *International Journal of Intelligent Systems*, 2025, Article 7304193. Available at: <https://doi.org/10.1155/int/7304193>

Sovtić, D., Trpkov, A., Radenković, M., Popović, S. and Labus, A. (2025) ‘Examining readiness to buy fashion products authenticated with blockchain’, *Journal of Theoretical and Applied Electronic Commerce Research*, 20(2), 119. Available at: <https://doi.org/10.3390/jtaer20020119>

Vazquez Melendez, E.I., Bergey, P. and Smith, B. (2024) ‘Blockchain technology for supply chain provenance: increasing supply chain efficiency and consumer trust’, *Supply Chain Management*, 29(4), pp. 706–730. Available at: <https://doi.org/10.1108/SCM-08-2023-0383>

Voulgaridis, K., Lagkas, T., Angelopoulos, C.M., Boulogeorgos, A.-A.A., Argyriou, V. and Sarigiannidis, P. (2024) ‘Digital product passports as enablers of digital circular economy: a framework based on technological perspective’, *Telecommunication Systems*, 85(4), pp. 699–715. Available at: <https://doi.org/10.1007/s11235-024-01104-x>

Wan, P.K.F. and Jiang, S. (2025) 'Enabling a dynamic information flow in digital product passports during product use phase: a literature review and proposed framework', *Sustainable Production and Consumption*, 54, pp. 362–374. Available at: <https://doi.org/10.1016/j.spc.2025.01.014>

Wang, Y. and Jung, S. (2025) 'The aftermath of greenwashing in the fashion industry: Chinese consumer responses to different types of greenwashing', *Asia Pacific Journal of Marketing and Logistics*, 37(9), pp. 2669–2685. Available at: <https://doi.org/10.1108/APJML-06-2024-0858>

Winkelmann, S., Guennoun, R., Möller, F., Schoormann, T. and van der Valk, H. (2024) 'Back to a resilient future: Digital technologies for a sustainable supply chain', *Information Systems and e-Business Management*, 22(2), pp. 315–350. Available at: <https://doi.org/10.1007/s10257-024-00677-z>

Won, Y.J., Jang, S.Y., Kim, H.Y. and Lee, Y. (2025) 'Digital Product Passports in the textiles, apparel, and fashion industry', *Journal of the Korean Society of Clothing and Textiles*, 49(3), pp. 534–552. Available at: <https://doi.org/10.5850/JKSCT.2025.49.3.534>

Xu, X., Chen, X., Cheng, T.C.E., Choi, T.-M. and Yang, Y. (2025) 'Should blockchain be used to eliminate greenwashing for green and live-streaming platform operations under carbon trading systems?', *European Journal of Operational Research*, 324(3), pp. 1017–1034. Available at: <https://doi.org/10.1016/j.ejor.2025.02.017>

Yuan, L. (2025) 'Digital product passports in the circular economy: a reflexive law approach to policy–actor governance tensions', *Law, Innovation and Technology*, 17(2), pp. 722–750. Available at: <https://doi.org/10.1080/17579961.2025.2593771>

Zayed, E.O. and Hatem, M. (2026) 'Blockchain, transparency and trust in supply chains: insights from professionals' perceptions', *Journal of Transport and Supply Chain Management*, 20, a1255. Available at: <https://doi.org/10.4102/jtscm.v20i0.1255>

Zhang, A. and Seuring, S. (2024) 'Digital product passport for sustainable and circular supply chain management: a structured review of use cases', *International Journal of Logistics*

Research and Applications, Advance online publication. Available at:

<https://doi.org/10.1080/13675567.2024.2374256>

Zhang, T., Jia, F. and Chen, L. (2024) ‘Blockchain adoption in supply chains: implications for sustainability’, *Production Planning & Control*, 35(5), pp. 699–722. Available at:

<https://doi.org/10.1080/09537287.2023.2296669>

Zhang, X.-M., Zheng, H. and Zheng, X.-X. (2024) ‘Impact of government fund policy and blockchain technology on closed-loop supply chains in textile and apparel industry’, *Journal of Cleaner Production*, 434, 140037. Available at: <https://doi.org/10.1016/j.jclepro.2023.140037>

Zhu, Q., Duan, Y. and Sarkis, J. (2024) ‘Supply chain carbon transparency to consumers via blockchain: does the truth hurt?’, *The International Journal of Logistics Management*, 35(3), pp. 833–864. Available at: <https://doi.org/10.1108/IJLM-03-2023-0109>

Appendices

Appendix A: Search Strategy

Search ID and purpose	Generic search string
S1 Core integrative search	(blockchain OR "distributed ledger technolog*" OR DLT) AND (traceab* OR provenance OR transparen* OR "chain of custody") AND (fashion OR textile* OR apparel OR garment* OR clothing) AND (sustainab* OR "environmental claim*" OR "green claim*" OR compliance OR verification OR greenwash*)
S2 Roles and benefits	(blockchain OR "distributed ledger*") AND (traceab* OR provenance OR transparen* OR "product passport*") AND (fashion OR textile* OR apparel OR garment*) AND (verification OR certification OR "data integrity" OR "sustainability information")
S3 Limitations and adoption	(blockchain OR "distributed ledger*") AND (fashion OR textile* OR apparel OR garment*) AND (adoption OR implementation OR barrier* OR limitation* OR readiness OR interoperability OR governance OR "supplier participation" OR "data quality")
S4 Governance and compliance	(blockchain OR "digital traceability") AND (fashion OR textile* OR apparel OR "supply chain*") AND (governance OR accountability OR audit* OR assurance OR certification OR compliance OR regulation OR greenwash*)
S5 Digital Product Passports	("digital product passport*" OR DPP) AND (fashion OR textile* OR apparel OR garment*) AND (traceab* OR sustainab* OR compliance OR verification OR governance OR blockchain)

Appendix B: Inclusion and Exclusion Criteria

Decision	Operational criterion
Include	Peer-reviewed journal articles published from January 2023 to July 2026; English full text; blockchain or DLT connected with traceability, provenance, sustainability, governance or compliance; fashion or a clearly transferable supply-chain context; transparent theoretical or empirical method.
Include selectively	Digital Product Passport, greenwashing, research philosophy and review-method articles that directly support the research question or critical appraisal.
Exclude	Cryptocurrency trading; purely technical coding without management relevance; unsupported opinion; conference abstracts; duplicate records; sources with no supply-chain or sustainability link; sources without sufficient methodological information.

Appendix C: Thematic Coding Framework

Roles: provenance; chain of custody; visibility; record persistence; certification; signalling; Digital Product Passport integration.

Limitations: source-data validity; physical-digital linkage; interoperability; scalability; privacy; correction; cost; supplier readiness; platform legitimacy.

Governance: claim definition; evidence standards; supplier accountability; validation; independent assurance; access rights; correction and dispute; regulatory alignment; communication and monitoring.

Critical evidence classification: conceptual proposition; perceived benefit; pilot or demonstration; implemented practice; independently measured outcome.

Appendix D: Critical Comparison of Selected Studies

Study	Design	Main contribution	Main limitation	Report use
Zhang (2024)	Systematic review	A recent management review finds that blockchain adoption is not a single technical decision. It develops through stages shaped by organisational capability, inter-organisational coordination and expected sustainability outcomes. This supports a staged view of adoption rather than the claim that installing a ledger automatically produces transparency.	The article synthesises prior studies rather than observing one fashion implementation. Its value is strong for organising antecedents and outcomes, but weaker for proving actual claims compliance.	3.2 Blockchain roles
Vazquez Melendez (2024)	Review and industry synthesis	Provenance systems create business value when digital	The study combines academic and industry material.	3.2 Blockchain roles; 3.5 Governance and compliance; 3.1

		records remain reliably connected to physical products. The study highlights fingerprinting and identity-linking methods because a ledger can secure a record while the product-record link remains vulnerable.	This widens practical coverage but means reported early-adopter benefits should not be treated as independent causal proof.	Claims and evidence problems; 5. Discussion
Hina (2024)	Consumer survey and scenario experiment	In a fashion scenario with 295 European consumers, perceived transparency, traceability and immutability increased consumption values, especially trust and clarity of sustainability information, which then influenced purchase intention.	The outcome is intention in a designed scenario, not observed buying or legal compliance. The evidence supports communication value, but not a claim that blockchain guarantees truthful sustainability data.	3.2 Blockchain roles; 3.1 Claims and evidence problems; 5. Discussion
Heldt (2025)	Longitudinal	A process study of	This is unusually	3.2 Blockchain

	process case study	a multi-tier cobalt supply chain shows that blockchain traceability was co-constructed over time. An upstream supplier drove the initiative, but collaboration across downstream firms and an alliance forum was needed to extend the system into opaque middle tiers.	useful evidence of implementation as a social and organisational process. Transfer to fashion should be reasoned carefully because cobalt has different product, power and regulatory conditions.	roles
Azevedo (2023)	Design science and use-case demonstration	A design-science case demonstrates how provenance certificates and ownership transfers can be recorded through smart contracts to protect chain-of-custody evidence.	A successful technical demonstration shows feasibility, not routine organisational effectiveness. It also begins with existing certificates, so the validity of those certificates remains a separate assurance	3.2 Blockchain roles

			problem.	
Zhu (2024)	Behavioural experiment	A behavioural experiment reports that consumers respond more positively when carbon information is presented as reliable, transparent and traceable through a blockchain-supported system, including greater willingness to pay for some options.	The experiment measures perception and intention. It cannot establish that disclosed carbon data are correct or that consumers understand the limits of blockchain verification.	3.2 Blockchain roles; 3.1 Claims and evidence problems; 5. Discussion
Najati (2025)	Failure case study	The TradeLens failure case shows that technically capable blockchain platforms can fail when governance, participation incentives and shared ownership are weak.	A single prominent failure is analytically valuable because it challenges technology-led optimism, but findings should not be universalised to every consortium design.	3.2 Blockchain roles; 3.3 Technical limits; 3.4 Organisational limits
Lustenberger (2025)	Critical empirical and conceptual analysis	The paper directly questions the gap between	Its critical stance is useful for balance. The	3.2 Blockchain roles; 3.3 Technical limits;

		blockchain's supply-chain promise and realised outcomes, drawing attention to implementation friction and weak evidence of scaled success.	report should compare this scepticism with mature cases rather than assume that disappointment means no application can work.	3.4 Organisational limits
Polcumpally (2024)	Systematic review	The systematic review links blockchain trust to governance arrangements, not only cryptographic features. Trust depends on decision rights, accountability, participation and the way off-chain information enters the ledger.	Multi-sector breadth strengthens the governance concepts but reduces fashion specificity.	3.2 Blockchain roles; 3.5 Governance and compliance
Pattanayak (2024)	Quantitative empirical study	The empirical study indicates that blockchain-based traceability can operate as a market signal by changing	The outcome is normally perception or intention rather than observed compliance. The design also cannot	3.2 Blockchain roles; 3.5 Governance and compliance

		perceived trust, information clarity or purchase readiness when consumers receive product-level information.	verify whether the upstream data presented to participants were accurate.	
Abreu (2025)	Design science and demonstration	The article links blockchain adoption with supply-chain transparency, performance, resilience or sustainability. It supports the argument that outcomes depend on relational capability, leadership, information sharing and implementation design in addition to ledger features.	Sector and method differences limit direct transfer to fashion. Any claimed performance gain should be checked for mature implementation, independent measurement and treatment of off-chain data quality.	3.2 Blockchain roles; 3.5 Governance and compliance
Jensen (2023)	Multiple-case study	A multiple-case study identifies seven DPP data clusters: usage and maintenance; product	The industrial setting is not fashion. The categories are transferable, but fashion-specific	1.4 Regulatory/DPP context; 3.5 Governance and compliance

		identification; product and materials; guidance; supply-chain and reverse-logistics data; environmental data; and compliance. It recommends gradual implementation and reconfiguration of data flows.	fibre mixing, subcontracting and claims evidence need additional analysis.	
Ducuing (2023)	Legal and data-governance analysis	The legal analysis argues that DPP discussions often under-specify data governance. Questions about access, control, rights, responsibility and use of shared data cannot be solved by technical architecture alone.	The paper is strongest for legal and governance reasoning rather than operational performance measurement.	1.4 Regulatory/DPP context; 3.5 Governance and compliance
Jestratić (2024)	Longitudinal disclosure analysis	A longitudinal analysis of 90 major brands over seven years shows	Disclosure scores show what companies publish, not	1. Introduction; 3.1 Claims and evidence problems

		that disclosure practices change over time and that transparency remains selective across areas of corporate and supply-chain sustainability.	whether published data are accurate. This difference is central to the present study's distinction between transparency and verified compliance evidence.	
Schäfer (2024)	Time-lagged multi-level analysis	A time-lagged multi-level analysis of 270 fashion companies examines the reciprocal relationship between NGO pressure and supply-chain transparency. It supports an institutional view in which external scrutiny shapes disclosure behaviour.	Transparency indicators may still reward publication rather than verified truth. The evidence supports institutional pressure, not the adequacy of blockchain records.	1. Introduction; 3.1 Claims and evidence problems

Appendix E: Selected Study Appraisal Summary

Appraisal area	Assessment
Study	Heldt and Pikuleva (2025), process study of blockchain-enabled traceability in a multi-tier cobalt supply chain.
Ontology	Relational realist or critical realist-compatible view of a real, open and adaptive supply network.
Epistemology	Interpretive and abductive; knowledge developed through prolonged observation, interviews, documents and theory iteration.
Axiology	Values traceability and sustainability risk management; embedded access creates both insight and reflexivity requirements.
Strengths	More than twelve months of observation, triangulation, temporal explanation, actual implementation and upstream perspective.
Limitations	Single sector and case, limited direct transfer to fashion, no direct measure of claims compliance or regulatory outcome.
Alternative design	Longitudinal comparative fashion cases combining interviews, supplier records, audit evidence and claim-approval documents.