



The Digital Product Passport as a Tool Against Greenwashing: Verifiability versus Marketing Claims in Fashion Brands

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Abstract: Greenwashing has become a defining credibility problem of the fashion industry: environmental claims proliferate faster than consumers' or regulators' ability to verify them. This conceptual paper examines the European Union's Digital Product Passport (DPP), introduced under the Ecodesign for Sustainable Products Regulation (ESPR), as a structural remedy to this credibility gap. Drawing on information asymmetry and signaling logic as developed in the recent greenwashing literature, the paper argues that the core deficiency of conventional green marketing claims is not their content but their unverifiability: when credible and deceptive claims are indistinguishable at the point of purchase, consumers rationally discount all sustainability communication. The DPP is conceptualized as a verifiability infrastructure that converts environmental claims from unverifiable assertions into falsifiable signals anchored in standardized, product-level data. The paper develops a conceptual framework and five propositions linking claim verifiability to perceived credibility, greenwashing perceptions, green trust, purchase intention, and firms' claim strategies. Theoretical contributions, managerial implications for fashion brands preparing for ESPR compliance, and policy implications are discussed, and a four-condition experimental design is proposed as a future research agenda. All literature reviewed is drawn from the period 2021-2026.

Keywords: Digital Product Passport; greenwashing; verifiability; sustainable fashion; ESPR; signalling; green claims; circular economy

I. INTRODUCTION

The fashion industry occupies a paradoxical position in the sustainability transition. It is among the most environmentally burdensome consumer industries EU textile consumption alone is associated with roughly 270 kg of CO₂ emissions per capita, while textile dyeing contributes around one fifth of global clean water pollution and less than 1% of discarded garments are recycled into new clothing [17]. At the same time, fashion is one of the most prolific producers of environmental marketing claims: collections are labelled 'conscious', 'responsible' or 'circular', and sustainability has become a central axis of brand positioning.

A substantial share of these claims cannot be substantiated. Recent reviews document that greenwashing misleading communication about environmental performance is 'more virulent than ever', expanding from product-level exaggeration into ESG reporting, net-zero pledges and future-oriented commitments that may never be fulfilled [11]. Field evidence from the textile sector shows that while most brands publish CSR commitments, very little verifiable traceability information reaches consumers at product level [9]. Regulatory enforcement has followed: the Norwegian Consumer Authority's 2022 assessment of Higg MSI-based environmental

claims warned that aggregated sustainability scores in consumer marketing risk being misleading, prompting brands to withdraw such labelling [15].

Greenwashing is not merely an ethical lapse of individual firms; it is a market failure rooted in information asymmetry. Environmental attributes of garments are credence attributes: they cannot be inspected before purchase or verified through use, creating conditions of adverse selection and moral hazard in which deceptive claims crowd out honest ones and consumers become skeptical of all green communication [14]. Recent syntheses confirm that perceived greenwashing damages consumer trust, purchase intention and brand relationships across stakeholder groups [10], [16].

The European Union is now attempting a structurally different response. The Ecodesign for Sustainable Products Regulation (ESPR), Regulation (EU) 2024/1781, introduces the Digital Product Passport (DPP): a machine-readable, product-level record of standardized sustainability information accessible via a data carrier such as a QR code [1]. Textiles are a first-priority product group in the Commission's 2025-2030 ESPR working plan, with the textile delegated act expected in 2027 [4]. In parallel, Directive (EU) 2024/825 prohibits generic, unsubstantiated environmental claims [2], and the proposed Green Claims Directive would require ex-ante verification of explicit claims [3].

While a growing technical literature addresses DPP architecture, data requirements and ecosystem design [5][8], the marketing-theoretical question has received far less attention: does making product-level sustainability data verifiable change how consumers evaluate brand claims, and does it alter the strategic calculus that produces greenwashing in the first place? This paper addresses that question conceptually. Its objectives are: (1) to theorise the DPP as a verifiability infrastructure; (2) to develop a framework and testable propositions linking verifiability to consumer response and firm strategy; and (3) to derive implications for theory, fashion brand management and policy.

II. LITERATURE REVIEW (2021-2026)

A. *Greenwashing: forms, drivers and consequences*

Contemporary reviews conceptualize greenwashing as an evolving family of misleading practices. Montgomery, Lyon and Barg [11] periodize the phenomenon into successive waves, culminating in emergent forms in which firms exploit uncertainty pledging future action, using selective ESG disclosure, and leveraging sympathetic intermediaries so that misleading communication increasingly evades claim-by-claim enforcement. Santos, Coelho and Marques [10] show through bibliometric synthesis that greenwashing research has concentrated on impacts on branding, consumer attitudes and purchase behaviour, and call for research on mechanisms that restore claim credibility. Agency-theoretic work demonstrates that greenwashing thrives where monitoring is weak and information environments are opaque [13], while experimental evidence frames green markets explicitly in terms of moral hazard and adverse selection: when consumers cannot verify organic or environmental quality, deceptive sellers profit and honest sellers are discounted [14].

Fashion adds a distinctive complication: supply chains are long, fragmented and multi-jurisdictional, so a brand's claims often rest on supplier conduct the brand itself cannot fully observe. Pizzetti, Gatti and Seele [12] introduce 'vicarious greenwashing' reputational damage arising when suppliers' misconduct contradicts a brand's green communication showing that consumers blame the communicating brand even when deception originates upstream. Verifiable, product-level traceability is therefore relevant not only to deterring deliberate deception but also to protecting honest brands from vicarious exposure.

B. *The Digital Product Passport*

The DPP literature has matured from architectural proposals to implementation frameworks. Early work positioned the passport as an information backbone for circular economy decision-making, specifying data on materials, substances of concern, durability, reparability and recyclability [5]. Requirements-focused studies identify the informational, technical and governance conditions passports must satisfy, including data standardization, interoperability and access-rights management [6], and definitional work frames the DPP as an ecosystem of stakeholders, capabilities and concerns rather than a mere label [7]. Jensen et al. [8] develop an ecosystem-orchestration framework for designing passports in circular value chains, while Macchio [18] proposes a strategic

implementation framework specifically for fashion, emphasizing that DPP adoption is a transparency strategy, not only a compliance exercise. Policy analysis for the European Parliament documents the textile sector's transparency deficit and the passport's intended remedial role [9].

Consumer-side evidence is emerging. Colasante et al. [16] find that consumers expect DPPs to carry broad lifecycle information and connect passport content to trust formation; industry survey data indicate that verification of authenticity and of sustainability claims is the dominant consumer expectation of passports [19]. Recent work on consumer acceptance identifies technological awareness and value orientations as adoption antecedents [20]. What remains undertheorized across this literature is the causal pathway from verifiability to claim credibility and, further, to the strategic supply of claims by firms. The present paper develops that pathway.

III. METHODOLOGY

This is a conceptual paper. Following the logic of theory-synthesis papers in the greenwashing review tradition [10], [11], it integrates two previously separate literatures consumer research on greenwashing perception and the socio-technical literature on Digital Product Passports through the shared lens of information asymmetry and signaling. Literature was restricted to the period 2021-2026 to reflect the post-ESPR regulatory environment, drawing on peer-reviewed articles, EU legislative texts and policy studies, and documented industry evidence. The output is a conceptual framework and five propositions formulated to be empirically testable.

IV. CONCEPTUAL FRAMEWORK AND PROPOSITIONS

A. The DPP as verifiability infrastructure

The framework's central move is to treat verifiability not as an attribute of the firm or of a claim's content, but as a property of the information environment in which claims are made. A claim is verifiable when a receiver can, at acceptable cost, check it against an independent, standardized data source, and when discrepancies carry consequences. The DPP institutionalizes verifiability in four ways. First, standardization: data points are defined by delegated acts, so 'recycled content' means the same thing across brands, defeating the vagueness on which much greenwashing relies [1], [6]. Second, granularity: disclosure occurs at product level rather than brand level, defeating selective disclosure in which one green capsule collection greenwashes an entire assortment [11]. Third, accessibility: the data carrier places verification one scan away from the point of purchase, collapsing the receiver's verification cost [17]. Fourth, accountability: because the same data are visible to market surveillance authorities and civil society, false entries create legal and reputational exposure under Directive (EU) 2024/825 [2], converting unverifiable assertions into falsifiable statements.

This yields two theoretically distinct effects: a receiver-side effect (how consumers evaluate claims that are DPP-verifiable) and a signaler-side effect (how mandatory verifiability changes which firms make which claims).

B. Receiver-side propositions

Consumer skepticism toward green claims is a learned response to an environment saturated with unverifiable communication [10], [14]. A claim presented alongside standardized, product-level passport data is harder to fake, costlier to fake, and checkable properties that should raise perceived credibility relative to an identical unverified claim. Hence:

P1. *An environmental claim accompanied by DPP-based verifiable product data is perceived as more credible than the same claim presented as an unverified marketing assertion.*

Perceived greenwashing is the receiver's attribution that communication overstates performance. Verifiability attacks the antecedents of this attribution vagueness, absence of proof, selectivity directly. Hence:

P2. *DPP-based verifiability reduces consumer-perceived greenwashing relative to unverified claims of equivalent content.*

Credibility matters because it transmits to brand-level trust and behaviour: perceived greenwashing erodes green trust and purchase intention, while credible claims rebuild them [10], [16]. Hence:

P3. *The positive effect of claim verifiability on purchase intention is mediated by perceived claim credibility and green brand trust.*

Verification and reputation are partial substitutes. A brand with a strong sustainability reputation already enjoys credibility; incremental verification adds less. For weakly reputed or unknown brands, the passport supplies credibility the brand cannot supply itself. Hence:

P4. *Credibility gains from DPP-based verifiability are stronger for brands with weak or ambiguous prior sustainability reputations than for brands with strong sustainability reputations.*

C. Signaler-side proposition

Greenwashing persists because it is profitable when claims cannot be distinguished: low performers mimic the communication of high performers and capture part of the green premium [13], [14]. Mandatory, standardized disclosure changes the payoff structure twice over. It raises the expected cost of false claims, since discrepancies between marketing and passport data become detectable by authorities, competitors and NGOs [2]; and it lowers persuasion costs for genuine performers, whose data speak for themselves [18]. The predicted result is a re-sorting of claim strategies: high performers claim more and prove it, while low performers retreat to silence or to narrow claims they can support. A corollary risk is 'greenhushing' under-communication of genuine achievements to avoid substantiation burdens [11]. Hence:

P5. *Mandatory DPP disclosure shifts the population of environmental claims toward substantiable, attribute-specific claims, deterring unsubstantiated generic claims by low performers while reducing persuasion costs for high performers.*

V. DISCUSSION

A. Theoretical contributions

The paper makes three contributions. First, it repositions the greenwashing debate from claim content to claim verifiability: the decisive variable is not what firms say but whether what they say can be checked, and regulation can manipulate this variable at the level of market infrastructure. Second, it connects the consumer literature on greenwashing perception [10], [16] with the socio-technical DPP literature [5][8], which have so far developed in isolation. Third, it frames the DPP in information-economic terms as a device for converting credence attributes into quasi-search attributes at the point of sale, extending recent adverse-selection accounts of green markets [14].

B. Managerial implications

For fashion brands, DPP readiness is a marketing problem, not only a compliance problem. Three implications follow. (1) Claims discipline: brands should audit existing claims against the data the passport will expose; any claim not traceable to a passport data point is a legal liability under Directive (EU) 2024/825 [2] and a reputational risk once discrepancies become scannable. (2) Data as brand asset: brands with genuinely strong product-level performance should integrate passport access into packaging, e-commerce and retail experience, because P4 implies the largest credibility dividends accrue where reputation alone does not yet carry the claim [18], [19]. (3) Supply chain investment: passport credibility is only as strong as upstream data quality, elevating traceability systems and supplier data governance from operational tooling to marketing infrastructure and protecting brands against vicarious greenwashing originating with suppliers [8], [12].

C. Policy implications

The framework identifies conditions under which the DPP will suppress rather than relocate greenwashing. Verifiability must reach the consumer interface: if passport data are technically accessible but practically illegible, the receiver-side effects (P1-P3) will not materialise, arguing for standardised consumer-facing presentation [9], [16]. Enforcement must make false entries costly, which requires resourced market surveillance and third-party scrutiny of passport data [1], [2]. Finally, regulators should monitor

greenhushing: if substantiation burdens fall disproportionately on smaller honest firms, policy could silence the very signals it aims to purify [11].

VI. LIMITATIONS AND FUTURE RESEARCH

As a conceptual paper, the propositions are theoretically derived and await empirical test; the framework abstracts from heterogeneity in consumer environmental involvement, digital literacy and willingness to scan data carriers [20]; and the textile delegated act specifying DPP data requirements was still pending at the time of writing [4], [17], so the operational form of verifiability may differ from the infrastructure theorised here.

A concrete empirical agenda follows. The receiver-side propositions (P1-P4) are testable in a scenario-based online experiment with a four-condition between-subjects design manipulating claim verifiability: (1) no environmental claim (control); (2) generic unverified claim; (3) specific claim without verification; and (4) specific claim accompanied by DPP-style verifiable product data blocked by brand sustainability reputation to test the moderation in P4, with established scales for perceived greenwashing, claim credibility, green trust and purchase intention enabling the mediation model in P3. The signaller-side proposition (P5) requires longitudinal content analysis of fashion brands' claims before and after the textile DPP enters into application, or comparison of claim populations across regulated and unregulated markets. Cross-cultural replication would probe whether verifiability effects generalise beyond the EU's high-regulation context [20].

VII. CONCLUSION

Greenwashing in fashion is the predictable output of a market in which environmental quality is a credence attribute and claims are costless to make. The Digital Product Passport attacks this structure at its root: by standardising, granularising and publishing product-level sustainability data, it converts unverifiable assertions into falsifiable signals and re-prices deception. This paper has theorised that shift, proposed five testable propositions spanning consumer response and firm strategy, and argued that for fashion brands the passport is simultaneously a compliance obligation and the most credible marketing channel the industry has yet been offered. Whether the DPP fulfils this promise is now an empirical question one the proposed research design is intended to answer.

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