

Weaving sustainability: Integrating systems thinking into ecolabel design in the textile fashion industry in the UK

Abstract The Textile Fashion Industry (TFI) faces growing scrutiny over its environmental footprint amidst climate and biodiversity crises. Ecolabels as voluntary certifications are intended to signal environmentally preferable products promoting sustainable production and consumption. Yet, their effectiveness remains limited by standards' inconsistencies and weak lifecycle integration. This paper re-conceptualises ecolabels as systemic tools for embedding ecological sustainability into organisational processes. Drawing on theories of information asymmetry, ecological embeddedness, and social-ecological systems, we develop a novel framework with four dimensions: standardisation, transparency, lifecycle integration, and communication. We apply this framework to the UK TFI through a qualitative thematic analysis of ecolabel data, identifying how design features enable or constrain ecological transformation. Our contribution is threefold: First, we reframe ecolabels not merely as market signals, but as organizational tools capable of driving *ecological embeddedness*. Second, we integrate and operationalize the concept of *ecological embeddedness* by linking it to *social-ecological systems* theory, offering a framework that identifies how ecolabel design features enable or inhibit firms' response to ecological challenges. Third, we contribute to *systems thinking in sustainability* by showing how ecolabel governance is entangled with value chain complexity, and planetary boundaries.

Keywords Ecolabels. UK Textile Fashion Industry. information asymmetry. ecological embeddedness. social-ecological systems

Introduction

As climate change and biodiversity loss intensify, the Textile Fashion Industry (TFI) faces increasing scrutiny over its ecological footprint and its relationship with natural systems (Niinimäki et al., 2020). Ecolabels are voluntary self-regulatory instruments that signal products or processes as environmentally preferable and are potential tools for promoting sustainable consumption and production. Yet, the real-world effectiveness of ecolabels remains contested. For instance, fragmented standards, vague definitions, and weak lifecycle integration often hinder their credibility and impact. This paper proposes a systems-based re-conceptualisation of ecolabels as mechanisms for driving ecological embeddedness within TFI organizations.

Although ecolabels aim to provide consumers and supply chain actors with transparent, credible signals about a product's sustainability attributes, their actual performance has been limited by several key issues. These include inconsistent environmental criteria, lack of scientific integration, and vague terminology (Thøgersen et al., 2010; Henninger, 2015; Žurga and Tavčer, 2014). Moreover, opacity in certification processes, especially concerning the governance and ownership of certifiers erodes stakeholder trust. Despite the prominence of ecolabels, there is no consensus on their definition or evaluative framework (Ranasinghe and Jayasooriya, 2021), and much of the existing research focuses on narrow environmental aspects (e.g., carbon or water) rather than adopting a holistic systems-based perspective. This siloed approach contrasts with ecological science, which stresses the interconnectedness of biophysical and social systems (Rockström et al., 2009).

This paper contends that ecolabels, when designed and implemented holistically, can transcend their conventional role as market signals. We argue that ecolabels can function as organizational tools for ecological transformation by embedding sustainability into organizational processes, enabling firms to align their operations with planetary boundaries. In

the TFI, an industry characterized by global, fragmented value chains and high environmental intensity, ecolabels can help translate ecological principles into actionable business practices. This re-framing positions ecolabels not only as tools of compliance but as instruments for systemic transformation.

We develop a novel conceptual framework by integrating three theoretical perspectives. *First*, anchored on information asymmetry theory (Akerlof, 1970; Cashore, 2002), we emphasise the role of ecolabels in addressing market inefficiencies by reducing uncertainty and improving trust through independent verification. In sustainability-focused markets, this allows firms to differentiate themselves and mitigate reputational risks. *Second*, building on the concept of ecological embeddedness (Whiteman and Cooper, 2000), we point out the dependence of firms on natural systems. From this perspective, ecolabels can support lifecycle thinking and circular practices that strengthen organizational resilience. *Third*, we use insights from social-ecological systems thinking (Folke et al., 2005), which frames sustainability in terms of feedback loops, thresholds, and cross-scalar dynamics. Based on this lens, we articulate the need for ecolabels to reflect spatial and temporal complexities across value chains.

Synthesis of these complementary theories forms the basis of a novel conceptual framework with four dimensions: i) standardisation of environmental attributes, ii) transparency in certification, iii) lifecycle and value chain integration, and iv) effective communication strategies. Furthermore, operationalisation of this framework guides our empirical analysis, which generates a practical tool for evaluating ecolabel effectiveness.

In this study we address the following research questions: What are the key design and governance features that determine the effectiveness of ecolabels in the TFI? How can ecolabels be used as tools for enhancing ecological embeddedness? What roles do

standardisation, transparency, lifecycle consideration, and communication play in enabling ecolabels to support systems-level sustainability?

Our empirical focus is on the UK TFI, an industry positioned at the intersection of consumer closeness, environmental impact, and globalized supply chains. We employ a qualitative research design and analyse the data thematically, using the proposed conceptual framework to identify how specific ecolabel attributes contribute to or limit systemic change within the industry. Our methodological approach allows us to move beyond normative assessments, towards an empirically grounded understanding of ecolabel effectiveness.

This paper makes three contributions to the literature. *First*, it reframes ecolabels not merely as market instruments that address information asymmetry (Akerlof, 1970; Cashore, 2002), but as organizational tools capable of stimulating *ecological embeddedness* (Whiteman & Cooper, 2000). While earlier work emphasized ecolabels' role in signalling environmental credentials to consumers (Thøgersen et al., 2010), we argue that ecolabels can also shape organizational processes by embedding ecological considerations into value chain governance. This advances the understanding of ecolabels from signalling devices to internal enablers of sustainable transformation.

Second, we integrate and operationalise the concept of *ecological embeddedness* (Whiteman & Cooper, 2000) by combining it with insights from *social-ecological systems theory* (Folke et al., 2005). Prior literature has primarily discussed these theories in abstract or conceptual terms. By applying them to the mechanisms of ecolabelling within the TFI, our study develops a novel multidimensional framework (standardisation, transparency, lifecycle orientation, and communication) that identifies how ecolabel design features enable or inhibit firms' capacity to respond to ecological challenges.

Third, this research contributes to *systems thinking in sustainability* by emphasizing the interdependence of ecolabel governance, value chain complexity, and biophysical boundaries

(Rockström et al., 2009; Cornell et al., 2021a). Existing research often isolates the impacts of ecolabels on narrow ecological metrics (e.g., carbon footprints, water use), overlooking how ecolabels interact with the feedback-driven character of global production systems. By positioning ecolabels within the system thinking domain, we show how their design can either support or undermine resilience across time and space. This approach extends systems theory applications in organizational studies (e.g., Bansal & Song, 2017) by offering concrete action in complex, environmentally vulnerable industries like fashion.

Literature and theoretical framework

Understanding ecolabels

The academic and gray literature on ecolabels offers a wide range of definitions, reflecting the diverse roles they play in promoting more sustainable production and consumption. Ecolabels are often described as voluntary, visual symbols or logos that signify a product's lower environmental impact compared to conventional alternatives (GOV.UK, 2022; Henninger, 2015). These symbols serve as 'green claims' designed to inform and guide consumers, differentiating products based on their environmental credentials. They are awarded, typically as tags, to products and services that demonstrate environmentally friendly attributes compared to their competition, with the overall goal of stimulating market-driven environmental improvement through verified and accurate information (Fashion United, 2024; Henninger, 2015). For example, the Global Ecolabelling Network defines ecolabelling as a voluntary method of product environmental performance labelling, meant to inform consumers about the positive environmental aspects of a product ("Global Ecolabelling Network," 2024).

From a consumer perspective, ecolabels are decision-making tools, helping consumers to distinguish more sustainable products from conventional ones through standardised criteria and third-party verification (Darnall et al., 2024; Thøgersen et al., 2010). Ecolabels address the

information asymmetry often present in markets, where consumers lack sufficient information about the environmental impacts of their choices (Akerlof, 1970). By providing independently verified, non-misleading information, ecolabels reduce this credibility gap, enhancing trust and potentially driving more sustainable consumption patterns (Cashore, 2002; Darnall et al., 2018).

Ecolabels are also defined by their life-cycle considerations, assessing products based on their environmental impacts from raw material extraction through production, use, and disposal (Ranasinghe and Jayasooriya, 2021). For example, the EU Ecolabel incorporates a wide range of environmental criteria, including resource use, pollution, and end-of-life impacts, providing a more comprehensive measure of sustainability (European Commission, 2025). This lifecycle approach aims to capture the intertwined nature of environmental impacts, reflecting a more holistic understanding of sustainability (“ISO 14021,” n.d.; “ISO 14024,” n.d.).

In a business context, ecolabels serve as tools for market differentiation, signalling a firm’s commitment to sustainability and offering a competitive advantage in increasingly environmentally conscious markets (KPMG, 2023). However, the proliferation of ecolabels has also led to significant challenges for businesses. The Ecolabel Index, for example, lists over 100 ecolabels specific to the TFI, each with varying criteria and levels of credibility (Ecolabel Index, 2024). This diversity creates confusion for both consumers and producers, complicating decision-making and potentially undermining trust (Boström and Micheletti, 2016). The lack of standardised assessment methods further exacerbates this issue, reducing the effectiveness of ecolabels in driving systemic change within the TFI (Henninger, 2015; Žurga and Tavčer, 2014). Given these considerations, we define ecolabels as:

voluntary self-regulation tools that indicate products (or processes) as environmentally preferable based on life-cycle considerations. Ecolabels

signifies that the product meets stated environmental and social criteria, thereby claiming it has less negative environmental (and/or social) impacts compared to similar products. Ecolabels with independently verified, credible, non-misleading information about the environmental impacts of products, differentiates products in the marketplace with an aim to promote more sustainable production and consumption practices.

Despite their potential, we know ecolabels face several challenges, including credibility issues, consumer confusion, and the need for robust, standardised verification processes. These challenges highlight the importance of clear, transparent criteria and the need for continuous improvement to maintain consumer trust and drive meaningful environmental outcomes.

Contextualising ecolabels in the textile fashion industry

The textile fashion industry (TFI) is one of the most environmentally impactful sectors globally, contributing significantly to carbon emissions, freshwater use, and pollution (Anguelov, 2015; Niinimäki et al., 2020; Peters et al., 2021). Its complex, global value chains, high resource demands, and rapid production cycles present unique challenges for sustainable transformation (Palm, 2023a).

The demand for sustainable practices within the TFI has grown alongside rising consumer awareness, regulatory pressure, and shifting market expectations (Cornell et al., 2021a; EMF, 2017; European Commission, 2022; European Environment Agency., 2023; House of Commons, 2019). However, these pressures are not new. The industry's environmental impact has been noted since the 1850s, when reports highlighted soil salinisation caused by intensive cotton irrigation (Beckert, 2015). Social concerns also emerged in the late 1800s as sweatshops became notorious for hazardous working conditions and exploitative labour practices (Powell, 2014). More recently, the 1990s Nike scandal

underscored the power of media in exposing poor labour conditions, prompting calls for greater transparency and sustainable practices within the industry (Doorey, 2011; Hart, 2017).

However, the rapid rise of fast fashion, characterised by its focus on low-cost, high-turnover production, has created significant challenges for ecolabel adoption. Despite growing awareness of sustainability, many consumers continue to prioritise price and convenience, reflecting a persistent disconnect between ethical intentions and actual purchasing behaviour (Henninger, 2015; Lou and Xu, 2024). This cognitive dissonance is often shaped by a complex interplay of cultural, economic, and social factors, as highlighted by Entwistle's (2000) 'situated bodily practice' framework, which emphasises the multiple influences that shape consumer choices.

Despite these challenges, ecolabels remain an important tool for promoting sustainability within the TFI. However, their effectiveness relies on improved consumer awareness, clearer standards, and more robust verification processes to bridge the gap between ethical intentions and actual purchasing behaviour.

Here, we stress four critical gaps that persist. First, the effectiveness of ecolabels in changing consumer behaviour is still debated. While some studies indicate a willingness to pay more for sustainably produced goods, this often fails to translate into actual purchasing behaviour, reflecting the well-documented attitude-behaviour gap (Henninger, 2015; Lou and Xu, 2024). Additionally, the specific impact of ecolabels within the TFI remains underexplored, with most research focusing on food and household products rather than textile fashion. Second, the economic implications for firms adopting ecolabels are not fully understood. While some evidence suggests that ecolabels can enhance or undermine brand reputation and reduce operational risks (Darnall et al., 2024), there is limited empirical data on their long-term financial impact, particularly in the TFI.

Third, the diversity of ecolabels and the lack of standardised criteria and varying levels of third-party oversight complicate both consumer choices and firm compliance, undermining the credibility and effectiveness of ecolabels as market signals (Boström and Micheletti, 2016). For instance, to provide a more nuanced understanding of the role of ecolabels in the TFI, it is also essential to differentiate between third-party verified ecolabels, self-declared claims, and lifecycle assessments (LCAs). LCAs are primarily internal tools used by firms to assess and improve their environmental impacts, while third-party verified ecolabels are based on verified LCA data and intended for external communication to consumers (ISO, 2019, p. 14025; “ISO 14024,” n.d., p. 140). In contrast, self-declared claims are issued by firms without independent verification, relying on the credibility of the company itself to substantiate environmental claims (“ISO 14021,” n.d.). The key differences between third-party verified and self-declared claims are not necessarily externally visible unless the results are transparent and available.

Fourth, there is limited research on the effectiveness of ecolabels in emerging markets, where price sensitivity and limited environmental awareness may reduce their impact. Understanding these is critical for developing more effective, context-specific ecolabelling strategies. We argue that addressing these gaps requires further cross-disciplinary research, and a more nuanced understanding of the complex, evolving relationship between ecolabels, consumer behaviour, and sustainable business practices.

Theoretical background and Conceptual framework

In this study we draw on three complementary theoretical perspectives, each offering insights into the challenges and opportunities ecolabels present for managers seeking to drive sustainable business practices. While our focus here is not theoretical, these frameworks are essential for understanding the systemic impacts and business value of ecolabels.

First, theories of information asymmetry and uncertainty (Akerlof, 1970; Cashore, 2002) help us highlight the critical role of ecolabels in reducing market inefficiencies and building trust. Information asymmetry arises when consumers lack accurate, transparent data about the environmental impacts of products, leading to reputational risks for firms. Effective ecolabels address these issues through independent, third-party verification, clear criteria, and robust communication, helping firms differentiate their products in increasingly sustainability-focused markets. For managers, this means that ecolabels are more than compliance tools they are strategic assets for building brand credibility and competitive advantage.

Second, the concept of ecological embeddedness (Whiteman and Cooper, 2000) emphasizes the interwovenness of firms and the natural systems on which they depend. Firms can reduce their ecological footprint by incorporating lifecycle thinking and circular economy principles (Cornell et al., 2021a). However, fragmented ecolabel standards and inconsistent criteria limit their potential to act as catalysts for regenerative practices that actively rebuilds soil and that also strengthens long-term resilience by which we mean a firm's capacity to anticipate, absorb, adapt to and recover from a wide range of internal and external disturbances, while continuing to pursue its strategic objectives and sustain value creation over time. For managers, this highlights the importance of aligning ecolabel strategies with broader environmental goals to reduce operational risks and enhance resource efficiency.

Finally, social-ecological systems thinking which emphasizes the interdependence between human and natural systems, highlighting the feedback loops and thresholds that influence sustainability outcomes (Folke et al., 2005). This systems approach emphasises the importance of addressing impacts across both spatial and temporal scales, ensuring that short-term business actions align with long-term sustainability goals. For managers, ecolabels can serve as practical tools for aligning product life cycles with broader ecological principles, particularly in the TFI, as its value chains span multiple regions and ecosystems. A systems

perspective supports more resilient value chains and strengthens firms' capacity to anticipate and respond to environmental challenges.

To translate these theoretical insights into actionable criteria for managers, we developed a conceptual framework consisting of four key dimensions that characterise effective ecolabelling. This framework guided both data collection and analysis and is also presented in Figure 1 below:

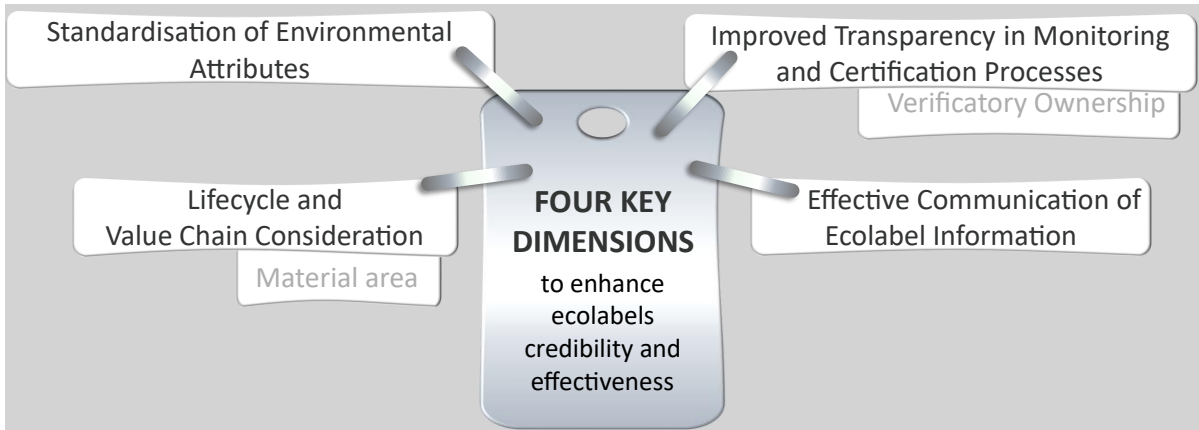
Standardisation of Environmental Attributes: Robust ecolabels are grounded in clearly defined and standardised environmental criteria. This ensures consistency across products and producers, enabling comparability and minimising greenwashing by anchoring claims in established sustainability metrics.

Improved Transparency in Monitoring and Certification Processes: Credibility is reinforced through transparent governance structures, third-party verification, and clear certification procedures. Alignment with global frameworks, such as the UN Sustainable Development Goals (United Nations, 2015), enhances legitimacy and accountability.

Lifecycle and Value Chain Consideration: Effective ecolabels account for environmental impacts across the full product lifecycle, from raw material extraction to end-of-life. This includes attention to supply chain dynamics, use-phase performance, and disposal or circularity options.

Effective Communication of Ecolabel Information: Communication strategies must strike a balance between scientific rigour and consumer accessibility. Ecolabels should translate complex sustainability data into clear, trustworthy messages for diverse stakeholders, including consumers, retailers, and investors

Figure 1. Conceptual framework: Four key dimensions for effective ecolabels



Source: Authors

Methodology

A Systems-Based, Iterative Assessment Approach

We employ a qualitative study, exploring ecolabels in the UK market using a systems-based approach. We manually collected data from multiple sources such as the Ecolabel Index (Ecolabel Index, 2024). Out of 155 ecolabels, 44 were deemed relevant as shown in Table 1 (Supplement A), and were mapped and analysed using our conceptual framework. A summary of the codes used is presented in

Table 2.

Table 1. Ecolabel selection process.

Source	Ecolabel Index 103 'ecolabels'	Fashion United 24 additional 'ecolabels'	Ecolabel Guide App 9 additional 'ecolabels'
Excluded	• 11 inactive websites • 15 websites not in English • 8 not defined as ecolabels (platforms, certification body of ecolabels and providers of standardized documents) • 27 for products other than textile fashion (carpets, furniture, shoes, paper, food)	• 14 not defined as ecolabels (advocacy and partnership initiative and platforms) • 1 for a product other than textile fashion (Shoes) • 2 only include social dimensions, not environmental	• 2 websites not in English • 4 not defined as ecolabels (certifiers and platforms) • 1 for a product other than textile fashion (Household cleaners)
Ecolabels' Certifiers	• 5 of the remaining 40 ecolabels are certifiers with 17 ecolabels relevant for Textile Fashion	n.a	n.a
Excluded	• 16 ecolabels – designed for exclusive domestic use within various nations outside the UK		
Result	44 active international and UK National ecolabels Addressing environmental aspects, applicable for the Textile Fashion industry		

Note: The process highlights the evaluation and selection criteria used to identify relevant and active ecolabels applicable to the TFI.

Source: Authors

Categories used to map and assess the ecolabels

To systematically identify, map, and assess ecolabels relevant to TFI, we developed a structured coding framework, summarised in table 2, grounded in key themes emerging from peer-reviewed literature spanning environmental science, industrial ecology, and sustainability governance. This framework aligns closely with our conceptual model.

First, ecolabels are categorised based on the environmental attributes they address, drawing on the planetary boundaries framework (Cornell et al., 2021) to capture six critical environmental dimensions: climate change, biodiversity loss, freshwater use, land system change, chemical pollution and other novel entities, and altered nitrogen and phosphorus flows. This approach corresponds with established impact categories in textile Life Cycle Assessment (Sandin et al., 2019), supporting a systems-level understanding of sustainability. Notably, certain materials, such as organic cotton, are coded as addressing climate change only where empirical evidence substantiates a reduction in emissions, consistent with current scientific consensus.

Second, we code ecolabels according to their level of verification (first-, second-, or third-party) and evaluates their compliance with ISO 14024 Type I criteria, which mandate third-party verification, multiple assessment criteria, and lifecycle consideration. The ownership and governance structure of the certification body is also coded, distinguishing between private, public, and non-profit entities to assess institutional legitimacy and trustworthiness.

Third, we code to capture ecolabels' lifecycle and value chain stages, by using standard lifecycle terminology such as Cradle-to-Grave, Cradle-to-Gate, Gate-to-Gate, Gate-to-Grave, and Cradle-to-Cradle. To further refine this dimension, we also code for the material focus and whether ecolabel's address the final product (e.g., garments), a component (e.g., fibre), or production processes (e.g., firm or factory operations).

Finally, to understand ecolabel communication and positioning, each is classified by its primary audience, differentiating between Business-to-Consumer (B2C) and Business-to-Business (B2B) orientations, reflecting whether the ecolabel is designed to influence consumer purchasing decisions or support value chain management.

Table 2. Summary of the codes used for mapping ecolabel according to the conceptual framework

Category	Category codes
Standardisation of Environmental Attributes	Climate change, Biodiversity loss, Freshwater change, Land system change, Chemical pollution and other novel entities, Altered Nitrogen & Phosphorus flows
Improved Transparency in Monitoring and Certification Processes <i>Sub-dimension: Verificatory Ownership</i>	ISO 14024, Type I, 3 rd party verified , 2 nd party verified, Self-declared Private, Public, Non-profit
Lifecycle and Value Chain Consideration <i>Sub-dimension: Material area</i>	Cradle-to-Grave, Cradle-to-Gate, Gate-to-Gate, Gate-to-Grave, Cradle-to-Cradle Final Product (Garment), Component (Fiber), Process (Firm/Organisational level)
Effective Communication of Ecolabel Information	Business-to-consumer (B2C) Business-to-business (B2B)

Source: Authors

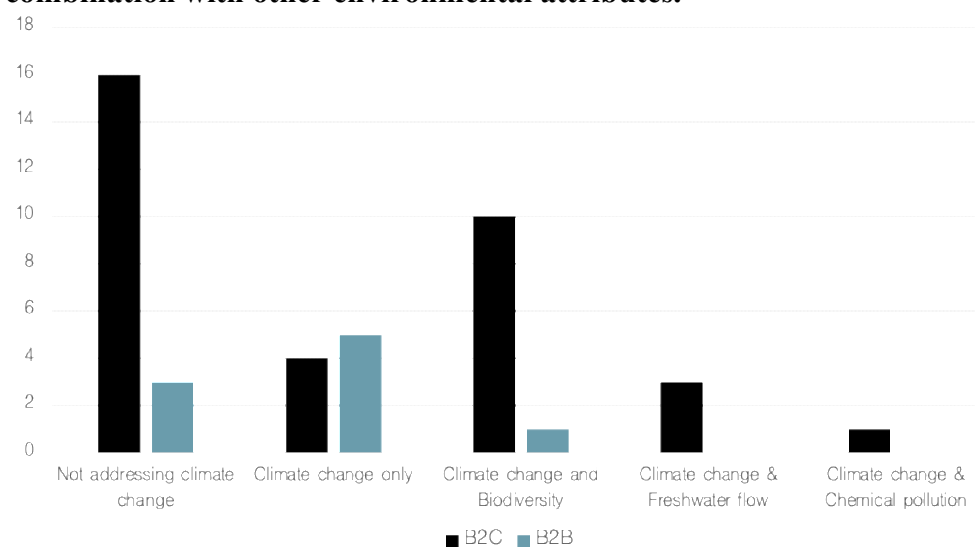
Findings

In this section, we present our findings, structured according to the conceptual framework shown in **Error! Reference source not found..** This structure helps clearly link the findings to the core themes and challenges identified in our analysis.

Standardisation of Environmental Attributes

Our findings reveal a significant inconsistency in the environmental attributes included in different ecolabel standards (Figure 2). Nearly half of the 44 ecolabels analysed do not address climate change, a critical gap considering the urgency of climate action (Figure 2). This omission is particularly pronounced among organic cotton ecolabels, where nine out of ten fail to include climate change as a criterion, despite addressing other environmental impacts. This fragmentation reduces the potential for ecolabels to provide comprehensive, systems-oriented sustainability guidance, limiting their effectiveness in promoting ecological alignment across the value chain.

Figure 2. Distribution of ecolabels addressing climate change, either exclusively or in combination with other environmental attributes.



Note: Business-to-Consumer (B2C) and Business-to-Business (B2B).

Source: Authors

Improved Transparency in Monitoring and Certification Processes

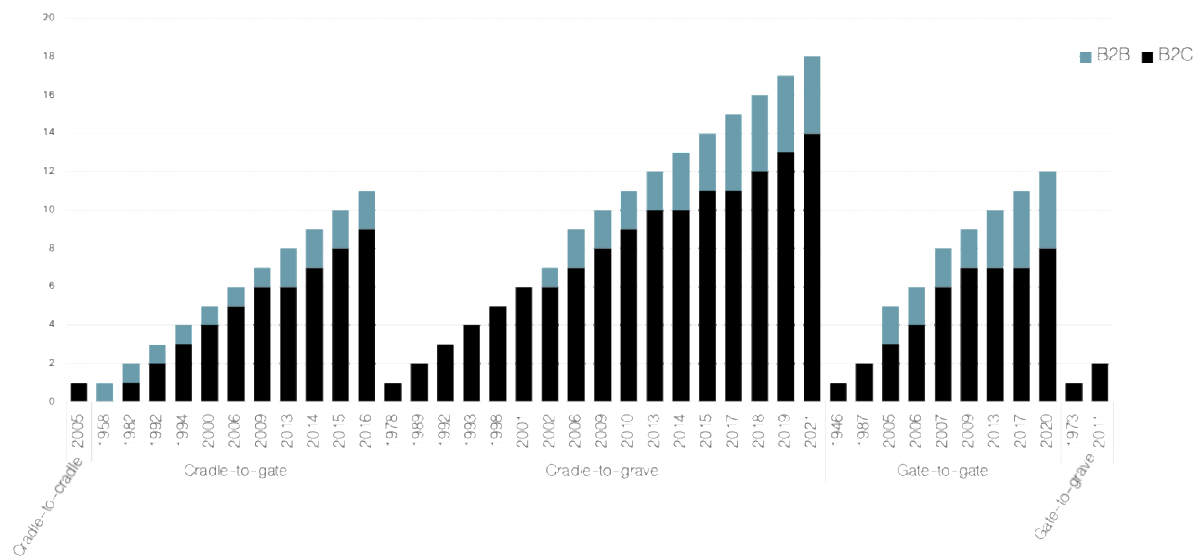
Transparency in verification remains a challenge, with our analysis showing that 40 of the 44 ecolabels rely on third-party verification, three of which are ISO 14024 Type I ecolabels (Blue Angel, EU Ecolabel, Nordic Ecolabel 'Swan'). Only one ecolabel (Vaude) is self-assessed,

highlighting a general trend towards third-party verification. However, this structure does not guarantee transparency, as many ecolabels still lack clear disclosure of ownership and assessment criteria, potentially undermining consumer trust. Most of these verified ecolabels are operated by non-profit entities, which tend to be more transparent than their for-profit counterparts.

Lifecycle and Value Chain Consideration

The distribution of ecolabels across value chain stages demonstrates significant variation, as illustrated in Figure 3. Cradle-to-grave certifications are increasingly common, particularly for B2C ecolabels, reflecting the growing consumer demand for comprehensive lifecycle assessments. One additional contributing factor to the increase of ecolabels certifying cradle-to-grave scope is the growing interest in circularity within the TFI and by policy initiatives (European Commission, 2022; UKRI, 2023; United Nations System Staff College UNSSC, 2020). However, this trend masks critical data gaps, as many cradle-to-grave certifications fail to fully account for upstream and downstream emissions, including Scope 3 impacts. The second most common certification scope for B2C ecolabels is gate-to-gate, primarily focused on textile fibres and components. In contrast, B2B ecolabels tend to focus on firms' processes or specific components, aligning more closely with operational efficiencies and systemic challenges like climate change.

Figure 3. Cumulative number of ecolabels launched over time, categorised by value chain scope and market type.



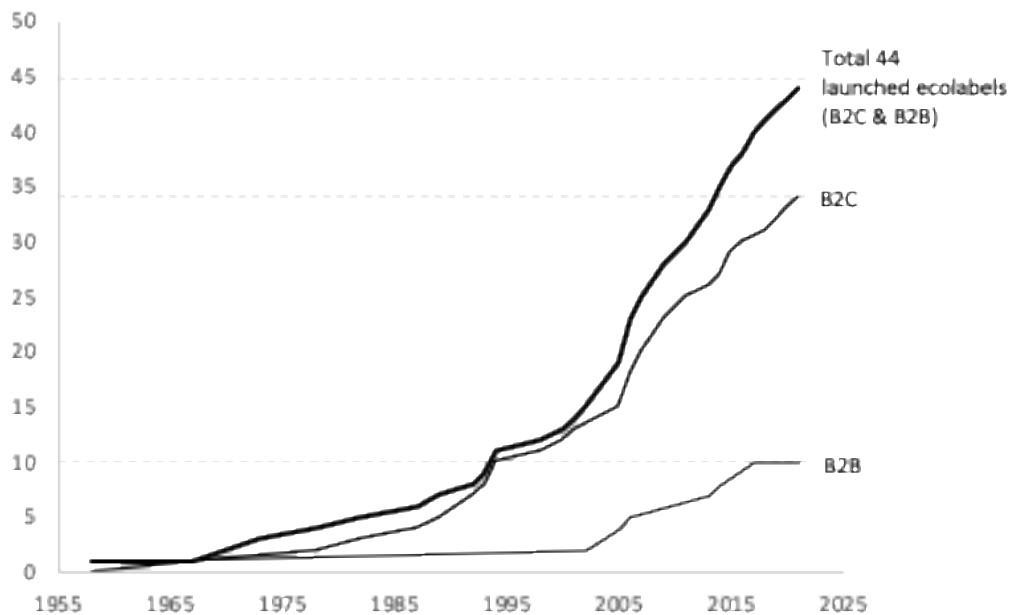
Note: Business-to-Consumer (B2C) and Business-to-Business (B2B) and organised by targeted environmental focus areas. The timeline illustrates growth trends across various ecolabels, highlighting their focus within specific value chain stages and the intended market audience, thereby reflecting shifts in environmental certification priorities over time.

Source: Authors

Effective Communication of Ecolabel Information

Our analysis highlights the stark contrast in the communication strategies employed by B2C and B2B ecolabels. While B2C ecolabels tend to emphasise consumer-relevant attributes, such as chemical safety and end-of-life impacts, B2B ecolabels are more likely to focus on broader systemic issues, including climate change and circularity. This differentiation reflects the distinct information needs of these audiences but also reveals a challenge in effectively conveying the full lifecycle impacts of products, which remains a critical barrier to achieving absolute sustainability within the TFI.

Figure 4. Three timelines of the introduction of ecolabels for various audiences.



Note: Top section displays the cumulative number of ecolabels launched over time, providing an overview of the growth in ecolabel certifications. Middle section highlights the timeline of ecolabels intended for Business-to-Consumer (B2C) markets, showcasing when these consumer-oriented ecolabels were introduced. Bottom section outlines the timeline of ecolabels designed for Business-to-Business (B2B) markets, indicating launch dates of ecolabels for a business audience. Note: timeline shows currently active ecolabels only.

Source: Authors

Discussion

Systems Perspective and Ecological Embeddedness

This study adopts a systems perspective, whereby we show that ecolabels often fail to address the intertwined nature of Earth systems, leading to suboptimal sustainability outcomes. By focusing on isolated environmental attributes, most ecolabels overlook broader systemic challenges like biodiversity loss and climate change, undermining their capacity to align production practices with ecological principles across spatial and temporal scales. Moreover, the narrow focus on specific value chain stages often ignores substantial environmental impacts earlier in the lifecycle, leaving gaps in sustainability assessments. For example, benefits at the resource extraction stage may be offset by high impacts during garment production, a fact not disclosed to consumers. This piecemeal approach results in misleading assessments of sustainability, as decisions based on incomplete data fail to capture the full environmental cost of production.

In line with previous research (Palm, 2023b), we demonstrate that ecolabels within the TFI are part of a broader business ecosystem, which includes not just firms but also policymakers, a context not captured by a simple value chain perspective. Ecolabels used within TFI do not operate in isolation; as all environmental certifications (Iatridis and Kesidou, 2018), they evolve in response to shifts in regulatory, market, and consumer expectations, which is why tracking their development over time (see **Figure 4 & 4**) is valuable for all stakeholders.

This findings of our study indicate that ecolabels targeting Business-to-Consumer (B2C) and Business-to-Business (B2B) audiences reflect the complexity of addressing multiple stakeholder needs within the TFI ecosystem. B2C ecolabels tend to prioritise attributes relevant to consumer safety and preferences, while B2B ecolabels are more aligned with systemic challenges like climate change and circularity. This differentiation is logical, given the distinct needs of each audience, but it highlights the difficulty in fully operationalising ecological embeddedness within the TFI. From the perspective of ecological embeddedness (Whiteman and Cooper, 2000), effective ecolabels should clearly separate certification and verification roles to avoid conflicts of interest. However, the observed vagueness in these roles hinders operationalising ecological embeddedness within the TFI.

Information asymmetry, uncertainty and market differentiation

Our evidence points out that information asymmetry, a concept first formalised by (Akerlof, 1970) is a persistent challenge in the TFI ecolabel landscape. It arises when consumers lack the necessary information to accurately assess the environmental impact of products, leading to potential misinterpretations of ecolabel claims. This asymmetry is further complicated by the diversity of ecolabels, which target both Business-to-Consumer (B2C) and Business-to-Business (B2B) audiences with varying levels of transparency and certification rigour.

Verification Structures and Trust Issues

The findings of this study underline that independent third-party verification is widely adopted as a mechanism to address the above-mentioned information asymmetry and enhance trust in ecolabels. This approach aims to reduce uncertainty (Cashore, 2002) by providing more reliable, externally validated information about product sustainability.

The EU Strategy for Sustainable and Circular Textiles mandates third-party verification for voluntary sustainability labels, reflecting this commitment to transparency and accountability. This EU Strategy explicitly states that “*General environmental claims, such as “green”, “eco-friendly”, “good for the environment”, will be allowed only if underpinned by recognised excellence in environmental performance, notably based on the EU Ecolabel, type I ecolabels, or specific EU legislation relevant to the claim*” (European Commission, 2022. p. 6). However, our findings indicate that even with third-party verification, significant gaps remain. Many verifier websites use vague, promotional language, presenting criteria as ‘*good for the environment*’ (Federal Ministry for the Environment, 2024) or promoting ‘*resource efficiency, reduced climate impact, a non-toxic circular economy and conservation of biodiversity*’ (Nordic Ecolabelling, 2024). These broad claims, while appealing, often lack specificity and may serve more as marketing tools than as rigorous, educational resources.

The EU Strategy for Sustainable and Circular Textiles mandates third-party verification for voluntary sustainability labels, reflecting this commitment to transparency and accountability.

Additionally, our study unravels concerns about conflicts of interest within the verification process. Robust ecolabels should ideally separate the role of the certifier (who sets the standards) from the verifier (who assesses compliance), reducing the risk of biased evaluations. However, our review revealed that this separation is often poorly defined. For-profit verifiers, in particular, tend to obscure their ownership structures, creating ambiguity about their independence and potentially undermining consumer trust. This aligns with

observations by Darnall et al. (2018), who noted that “*consumers appear to be more distrustful of ecolabels sponsored by business associations*”. Our analysis also shows that non-profit status is typically clearly stated, while for-profit verifiers often present themselves, similarly, blurring the lines between independent verification and corporate interests.

Market Differentiation and Stakeholder Complexity

Ecolabels targeting Business-to-Consumer (B2C) and Business-to-Business (B2B) audiences reflect the diverse priorities of different stakeholder groups. While B2C ecolabels prioritise attributes relevant to consumer safety and preferences, B2B ecolabels are more aligned with systemic challenges like climate change, resource efficiency and circularity. This differentiation is logical but also reflects the complexity of addressing multiple stakeholder needs within the TFI ecosystem (Palm, 2023b). For example, B2C ecolabels often adopt a cradle-to-grave approach, which is highly relevant to consumers but may obscure critical upstream and downstream impacts if data gaps exist (Figures 3 and 4). B2B ecolabels, by contrast, may focus on specific components or processes, addressing lifecycle impacts at a more granular level. However, this differentiation also risks reinforcing information asymmetry. B2C ecolabels often present themselves as comprehensive indicators of sustainability, yet they may omit critical data about upstream resource extraction or downstream waste management.

We argue that this selective transparency can create a misleading impression that a product’s full environmental impact is being managed, when significant lifecycle impacts remain unaddressed. Furthermore, the complexity of value chain interactions means that even well-intentioned ecolabels may fail to account for cumulative, system-level impacts, contradicting the principles of ecological embeddedness (Whiteman and Cooper, 2000).

Balancing Educational and Marketing Roles of Ecolabels

Our findings show that ecolabels assume dual roles as educational tools and market differentiators. Ecolabels are designed to influence consumer choices by highlighting sustainable production practices. They also act as branding tools, positioning products as more environmentally superior. This duality is particularly evident for ecolabels targeting B2C, where they function not only as certifications but also as important marketing symbols. However, this market-driven approach can undermine their credibility if the focus on brand differentiation overshadows the commitment to transparency and thorough assessment.

From an information asymmetry perspective, the rise of cradle-to-grave ecolabels targeting B2C audiences is a step forward in enhancing consumer awareness. However, for ecolabels to effectively address information asymmetry, they must improve transparency and consistency in both their criteria and verification processes. This includes clearly communicating the lifecycle stages covered, the scope of environmental impacts assessed, and the independence of verification bodies. Without these measures, ecolabels risk becoming mere marketing tools, failing to drive meaningful sustainability improvements within the TFI.

Lifecycle complexity and data gaps

We show that ecolabels lack a comprehensive lifecycle perspective, overlooking the crucial distinction between absolute and relative sustainability. Current ecolabel standards primarily focus on relative sustainability, which aims to improve existing production practices without fully accounting for cumulative impacts. For example, a product may be labelled as sustainable due to reduced environmental impacts per unit, yet the total number of units produced may increase, leading to a higher overall environmental footprint. In short, without addressing absolute sustainability limits, this fragmented approach will lead to continued contributions of climate emissions and environmental degradation, undermining global sustainability goals.

The growing adoption of cradle-to-grave ecolabels, largely driven by the growing interest in the circular economy, presents its own challenges. While these certifications aim to account for the entire product lifecycle, there is a persistent lack of standardised data for assessing cradle-to-gate stages. This gap is further widened by limited research on the potential benefits of various circular strategies (Cornell et al., 2021b; Corvellec et al., 2022; Kirchherr et al., 2018). As a result, even though cradle-to-grave certifications are highly relevant to consumers, who typically purchase final products, these ecolabels fail to disclose critical data gaps, leaving significant aspects of a product’s lifecycle unassessed (Figure 3).

It is noteworthy that while the TFI increasingly launches ecolabels with a cradle-to-grave value chain scope, claiming to control the entire value chain, they simultaneously state that more data is needed to accurately assess carbon emissions from their upstream and downstream activities. This includes Scope 3 which are defined as “*emissions [that] are a consequence of the activities of the company, but occur from sources not owned or controlled by the company*” (World Resources Institute, 2015, p. 25). This inconsistency creates a misleading impression that a product’s full environmental impact is being managed, when in reality, significant data gaps remain.

Strengths and Weaknesses of ecolabels

Our findings address both the strengths (e.g., standardisation, enhanced transparency and lifecycle integration) and weaknesses (e.g., lack consistency, fragmented sustainability approaches, and communication issues) of ecolabels in the TFI. Addressing these strengths and weaknesses is important as it will help firms, policymakers, and customers to make informed decisions. In

RDISATION OF NMENTAL ATTRIBUTES	IMPROVED TRANSPARENCY IN MONITORING AND CERTIFICATION PROCESSES	LIFECYCLE AND VALUE CHAIN CONSIDERATION	EFFECTIVE COMM OF ECOLABEL INFOR
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<i>Setting consistent environmental benchmarks</i> Ecolabels can establish consistent standards for environmental attributes, such as carbon emissions, resource consumption, and biodiversity protection. These standards can harmonise industry practices with global sustainability goals, reducing information asymmetries in B2C and B2B contexts. Ecolabels that effectively balance industry needs with consumer expectations can contribute to drive market-wide sustainability trends.	<i>Setting clear environmental benchmarks</i> Ecolabels enhance trust through rigorous, often third-party, certification processes, reinforcing their credibility as reliable environmental assessments. Many ecolabels are owned by nonprofit organisations, aligning with consumer preferences for independent verification.	<i>Credible certification and transparency</i> Ecolabels increasingly address multiple lifecycle stages within complex global value chains. This approach supports more comprehensive environmental assessments, encouraging businesses to adopt more transparent and responsible practices. The growing focus on cradle-to-grave assessments signals a potential shift towards full lifecycle accountability.	<i>Lifecycle integration and chain coverage</i> Ecolabels serve as effective tools for communicating sustainability across diverse audiences. B2B ecolabels guide consumer choices through eco-credentials, while B2C labels offer process and product verification, supporting transparent value chain management.
<i>Unified standards and approach</i> Inconsistent definitions and "cherry-picking" of environmental attributes undermine ecolabel credibility and comparability, complicating consumer decision-making. The lack of standardised, systems-based approaches limits the capacity of ecolabels to reflect the intertwined nature of production and consumption.	<i>Transparency and trust challenges in certification</i> A lack of clear, accessible information regarding the ownership and roles of certifiers versus verifiers complicates consumer trust. This can obscure accountability and undermine confidence in ecolabel claims. Few TFI ecolabels meet Type I standards endorsed by EU policies, limiting their transparency and credibility. The tension between aligning with policy requirements and responding to evolving consumer expectations also creates credibility challenges for the industry.	<i>Lifecycle data gaps and narrow attribute focus</i> Limited data across lifecycle stages and focus on specific components, such as organic cotton, can obscure products' full environmental impact, reducing ecolabel effectiveness. For example, a focus on organic cotton overlooks the broader environmental footprint of synthetic fibres, limiting the effectiveness of ecolabel assessments. This lack of transparency hinders comprehensive, science-based decision-making.	<i>Data gaps and narrow focus</i> Ecolabels suffer from oversimplified messaging, technical language, and mismatches that hinder their accessibility. Data gaps, mismatches, and unclear information is confusing hindering scientifically informed decisions. Oversimplification risks greenwashing, while technical language alienates consumers. Inconsistent messaging across B2C and B2B contexts further hampers stakeholder engagement and informed decision-making.

, we present a summary of strengths and weaknesses of ecolabels in the industry based on our findings.

Table 3. Strengths and Weaknesses of ecolabels in the TFI based on four key dimensions.

STRENGTHS	STANDARDISATION OF ENVIRONMENTAL ATTRIBUTES	IMPROVED TRANSPARENCY IN MONITORING AND CERTIFICATION PROCESSES	LIFECYCLE AND VALUE CHAIN CONSIDERATION	EFFECTIVE COMMUNICATION OF ECOLABEL INFORMATION
	<i>Establishing consistent environmental benchmarks</i> Ecolabels can establish consistent benchmarks for environmental attributes, such as carbon emissions, water consumption, and biodiversity preservation. These standards can help align industry practices with sustainability goals, reducing information asymmetries in B2C and B2B contexts. Ecolabels that effectively balance industry needs and consumer expectations can contribute to drive market-wide sustainability trends.	<i>Setting clear environmental benchmarks</i> Ecolabels enhance trust through rigorous, often third-party, certification processes, reinforcing their credibility as reliable environmental assessments. Many ecolabels are owned by nonprofit organisations, aligning with consumer preferences for independent verification.	<i>Credible certification and transparency</i> Ecolabels increasingly address multiple lifecycle stages within complex global value chains. This approach supports more comprehensive environmental assessments, encouraging businesses to adopt more transparent and responsible practices. The growing focus on cradle-to-grave assessments signals a potential shift towards full lifecycle accountability.	<i>Lifecycle integration and value chain coverage</i> Ecolabels serve as effective tools for communicating sustainability to diverse audiences. B2C ecolabels guide consumer choices by signalling eco-credentials, while B2B labels offer process and component-level verification, supporting sustainable value chain management.

WEAKNESSES	<i>Lack of unified standards and systems approach</i> Inconsistent definitions and "cherry-picking" of environmental attributes undermine ecolabel credibility and comparability, complicating informed decision-making. The lack of a standardised, systems-based approach limits the capacity of ecolabels to reflect the intertwined impacts of production and consumption.	<i>Transparency and trust challenges in certification</i> A lack of clear, accessible information regarding the ownership and roles of certifiers versus verifiers complicates consumer trust. This can obscure accountability and undermine confidence in ecolabel claims. Few TFI ecolabels meet Type I standards endorsed by EU policies, limiting their transparency and credibility. The tension between aligning with policy requirements and responding to evolving consumer expectations also creates credibility challenges for the industry.	<i>Lifecycle data gaps and narrow attribute focus</i> Limited data across lifecycle stages and focus on specific components, such as organic cotton, can obscure products' full environmental impact, reducing ecolabel effectiveness. For example, a focus on organic cotton overlooks the broader environmental footprint of synthetic fibres, limiting the effectiveness of ecolabel assessments. This lack of transparency hinders comprehensive, science-based decision-making.	<i>Data gaps and narrow focus</i> Ecolabels suffer from either oversimplified messaging or overly technical language, both of which hinder their accessibility. This mismatch, and unclear or incomplete data is confusing hindering informed, scientifically informed decisions. Oversimplification risks greenwashing, while overly technical language alienates consumers. Inconsistent messaging between B2C and B2B contexts further complicates stakeholder engagement and informed decision-making.
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Source: Authors

Conclusions

This study contributes to the literature by bridging the gap between theoretical insights and practical challenges in the design and implementation of ecolabels within the TFI. Drawing on theories of information asymmetry, ecological embeddedness, and socio-ecological systems our approach addresses critical shortcomings in current ecolabel practices, particularly the lack of comprehensive lifecycle integration, consumer distrust, and misalignment with regenerative sustainability principles. Table 4 presents a structured mapping of our theoretical insights to industry challenges, including actionable managerial responses.

Table 4. Theoretical foundation, Industry challenge and Managerial responses for effective ecolabelling

Theoretical foundation	Industry challenge	Managerial responses
Information Asymmetry	Consumer distrust due to vague criteria, inconsistent standards, and lack of transparency in ecolabel certification.	Implement robust, third-party verification with clearly defined roles, transparent ownership structures, and explicit criteria to reduce greenwashing, address conflicts of interest, and restore consumer trust. This includes aligning claims with recognised excellence in environmental performance, as outlined in the EU Strategy for Sustainable and Circular Textiles.
Ecological Embeddedness	Ecolabels often miss the broader environmental context, overlooking the need to restore and enhance natural systems.	Develop ecolabels that integrate a comprehensive lifecycle perspective, accounting for both upstream and downstream impacts, and align with broader ecosystem principles to avoid piecemeal assessments and misleading sustainability claims.
Social-Ecological Systems Thinking	Ecolabels risk missing cumulative, long-term impacts if they focus only on isolated aspects of production.	Design ecolabels that reflect the intertwined nature of Earth systems, incorporating both absolute and relative sustainability metrics to prevent the unintended expansion of environmental footprints as production scales.

Source: Authors

By repositioning ecolabels as tools for systemic transformation, our research moves beyond traditional consumer-focused perspectives. We stress that ecolabelling needs to be embedded within lifecycle thinking and respond to broader socio-environmental dynamics. This approach highlights the importance of enhanced transparency, clearer communication, and stronger stakeholder trust. Our findings provide a foundation for both academic advancement and practical industry interventions, by positioning ecolabels as catalysts for systemic change and addressing the pressing challenges of sustainability within the TFI.

Implications, Limitations, and Future Directions

Our analysis highlights the multifaceted challenges and opportunities presented by ecolabels in the TFI. These findings carry a number of implications for firms, policymakers, and consumers seeking to enhance the efficacy and credibility of ecolabels as sustainability governance tools.

From a policymaking perspective, our findings suggest the need for clearer distinctions between certifiers and verifiers, particularly in for-profit settings where ownership structures are not transparent. Policymakers may strengthen ecolabel reliability by requiring minimum lifecycle coverage standards, aligned with the EU's recognition of Type I ecolabels, and encouraging integration of Scope 3 emissions data. Firms, in turn, can improve ecolabel credibility by voluntarily adopting clearer certification structures, investing in data collection that supports absolute sustainability assessments, and enhancing transparency around the lifecycle stages covered by ecolabel claims. For consumers, our findings emphasise the need for critical engagement with ecolabel messaging, particularly in recognising the limitations of communication that prioritise branding over educational clarity.

This study has certain limitations, which further research could address. First, our analysis focuses predominantly on ecolabels that operate within or in alignment with the UK and EU's regulatory frameworks. Ecolabels used under less stringent policy environments may

exhibit different characteristics, particularly in relation to verification practices and stakeholder trust. Second, the distinction between B2C and B2B ecolabels, while analytically useful, may be less clear-cut in practice. Some ecolabels examined in this study are designed to address both consumer and business audiences, although we have categorised them according to their primary target group. Third, while our study focuses on the TFI value chain, it is important to note that the global TFI operates within a more complex system beyond any value chain perspective.

As such, our research has limitations that offer opportunities for future exploration. We did not conduct a deep textual analysis of legislation to identify synergies, gaps, or contradictions, nor did we address social aspects, which are vital to understanding sustainability as defined by policy (WCED, 1987, p. 73). Future research should incorporate social dimensions and a broader range of environmental factors using frameworks like regulatory ecology (Sjåfjell and Cornell, 2024) to explore how markets, law, and social norms shape sustainable business. This would offer deeper insights into the relationship between social systems and the natural environment, providing a clearer understanding of how sustainability efforts interact with broader societal contexts. Additionally, further research is needed on the extended business ecosystem of UK TFI firms of varying sizes to understand how regulatory impacts influence operations. This would enable a more nuanced understanding of how regulations play out across diverse business models, supporting more effective and inclusive sustainability strategies within the industry.

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Supplementary materials

Supplement A. Overview of 44 International and UK Ecolabels Used in the TFI

Overall: Green = Yes, Red = No, Grey = n.a

Under: Communication channel, B2C = Business-to-Consumer, B2B = Business-to-Business; Verifier ownership, N-P = non-profit, P = private, Publ. = public; Geographical scope,

Int = International, Reg. EU = European Union, Nat. UK = United Kingdom; ISO Type “I” = ISO 14024 Type I; Source, EI = Ecolabel Index, FU = Fashion United, EGA = Ecolabel Guide App.

Ecolabel	Communication	Material area	Requirements to Social	Only mass recycled	Organic agriculture of	Environmental attributes					Land system	Verifier Ownership	Geographical scope	Value chain scope	ISO Type	1-2-3 party verification	Launch year	Source	Certifier website
						Climate	Biodiversity	Freshwater	Chemical	Altered P&N									
ABNT Ecolabel	B2C	Component										N-P	Int.	Gate-to-gate	n.a	3rd	2007	EI	abnt.org.br
B Corporation	B2B	Process incl. component										N-P	Int.	Cradle-to-grave	n.a	3rd	2006	EI	bcorporation.net
Better Cotton Initiative	B2C	Component										N-P	Int.	Gate-to-gate	n.a	3rd	2009	EI	bettercotton.org
Blue Angel	B2C	Final product										N-P	Int.	Cradle-to-grave	I	3rd	1978	EI	blauer-engel.de

bluesign® standard	B 2 C	Final product											Pri v.	Int.	Cradle-to- gate	n.a	3rd	20 00	EI	bluesign.c om
Carbon Neutral Certification	B 2 B	Process											Pri v.	Int.	Cradle-to- grave	n.a	3rd	20 02	EI	carbonneu tral.com
Carbon Reduction Label	B 2 C	Final product											Pu bl.	Int.	Cradle-to- grave	n.a	3rd	20 01	EI	carbontrus t.com
CarbonFree® Certified	B 2 C	Process											Pri v.	Int.	Cradle-to- grave	n.a	3rd	20 09	EI	shop.clime co.com
Certified Wildlife Friendly®	B 2 C	Final product											N- P	Int.	Gate-to- gate	n.a	3rd	20 07	EI	wildlifefri endly.org
Compostability Mark of European Bioplastics	B 2 C	Final product											N- P	Reg. EU	Cradle-to- grave	n.a	3rd	19 93	EI	european- bioplastics .org
Cotton Made in Africa	B 2 C	Compo nent											N- P	Int.	Gate-to- gate	n.a	3rd	20 05	EI	cottonmad einafrica.o rg
Cradle to Cradle Certified (CM) Products Program	B 2 C	Final product											N- P	Int.	Cradle-to- cradle	n.a	3rd	20 05	EI	c2ccertifie d.org
EU Ecolabel	B 2 C	Final product											Pu bl.	Reg. EU	Cradle-to- grave	I	3rd	19 92	EI	environme nt.ec.euro pa.eu
Fairtrade	B 2 C	Final product											N- P	Int.	Cradle-to- gate	n.a	3rd	19 94	EI	fairtrade.n et

Global Organic Textile Standard (GOTS)	B 2 C	Final product												N-P	Int.	Cradle-to-grate	n.a	3rd	2006	EI	globalstandard.org
Green Shape	B 2 C	Final product												Priv.	Int.	Cradle-to-grave	n.a	1st	2010	EI	csrreport.vande.com
Green Tick - Sustainable	B 2 C	Final product												Priv.	Int.	Cradle-to-grave	n.a	3rd	1998	EI	greentick.com
GreenCircle - Carbon Footprint reduction	B 2 B	Process												Priv.	Int.	Gate-to-gate	n.a	3rd	2017	EI	greencirclecertified.com
GreenCircle - Dematerialization	B 2 B	Final product												Priv.	Int.	Cradle-to-grave	n.a	3rd	2014	EI	greencirclecertified.com
GreenCircle - Life Cycle Assessment Optimized	B 2 C	Final product												Priv.	Int.	Cradle-to-grave	n.a	3rd	2018	EI	greencirclecertified.com
GreenCircle - Product Optimization	B 2 C	Final product												Priv.	Int.	Cradle-to-grave	n.a	3rd	2013	EI	greencirclecertified.com
GreenCircle - Recycled content, Recycled material, Closed Loop Product	B 2 C	Final product												N-P	Int.	Cradle-to-grate	n.a	3rd	2009	EI	www.greencirclecertified.com
GreenCircle - Sustainable Energy Practices	B 2 B	Final product												Priv.	Int.	Cradle-to-grave	n.a	3rd	2017	EI	greencirclecertified.com
LowCO2 Certification	B 2 B	Process												N-P	Int.	Gate-to-gate	n.a	3rd	2005	EI	noco2.com.au

Made Safe	B 2 C	Compo nent										N- P	Int.	Cradle-to- gate	n.a	3rd	20 15	FU	madesafe. org
Naturland e.V.	B 2 C	Compo nent										N- P	Int.	Cradle-to- gate	n.a	3rd	19 82	EI	naturland. de
NoCO2 Certification	B 2 C	Final product										Pri v.	Int.	Cradle-to- grave	n.a	3rd	20 06	EI	noco2.com .au
Nordic Ecolabel or "Swan"	B 2 C	Final product										N- P	Int.	Cradle-to- grave	I	3rd	19 89	EI	nordic- swan- ecolabel.or g
Oeko-Tex Standard 101 - Made in Green	B 2 C	Final product										N- P	Int.	Cradle-to- gate	n.a	3rd	20 14	EI	oeko- tex.com
Oeko-Tex Standard 102 - Standard 100	B 2 C	Final product										N- P	Int.	Cradle-to- gate	n.a	3rd	19 92	EI	oeko- tex.com
Oeko-Tex Standard 103 - Organic Cotton	B 2 C	Compo nent										N- P	Int.	Cradle-to- grave	n.a	3rd	20 21	EI	www.oeko tex.com
Oeko-Tex Standard 104 - STeP	B 2 B	Process										N- P	Int.	Gate-to- gate	n.a	3rd	20 13	EI	oeko- tex.com
Oeko-Tex Standard 105 - Eco Passport	B 2 B	Compo nent										N- P	Int.	Gate-to- gate	n.a	3rd	20 05	EI	oeko- tex.com
Organic content Standard	B 2 B	Compo nent										N- P	Int.	Cradle-to- gate	n.a	3rd	20 13	EI	textileexch ange.org

Organic Farmers & Growers Certification	B 2 C	Compo nent										N- P	Nat. UK	Gate-to- grave	n.a	3rd	19 73	EI	ofgorganic .org
Rainforest Alliance	B 2 C	Final product										N- P	Int.	Gate-to- gate	n.a	3rd	19 87	EC A	rainforest- alliance.or g
Recycled Claim Standard	B 2 C	Final product										Pri v.	Int.	Gate-to- grave	n.a	3rd	20 11	EI	scsglobals ervices.co m
Regenerative Organic Certified	B 2 C	Compo nent										N- P	Int.	Gate-to- gate	n.a	3rd	20 20	FU	regenorga nic.org
Responsible Wool Standard	B 2 C	Compo nent										Pri v.	Int.	Cradle-to- gate	n.a	3rd	20 16	EI	scsglobals ervices.co m
Sane Standard	B 2 C	Final product										N- P	Int.	Cradle-to- grave	n.a	3rd	20 19	FU	sanestanda rd.com
SMaRT Consensus Sustainable Product Standards	B 2 C	Final product										N- P	Int.	Cradle-to- grave	n.a	3rd	20 15	EI	mts.sustai nableprod ucts.com
Soil Association Organic Standard	B 2 C	Compo nent										N- P	Nat. UK	Gate-to- gate	n.a	3rd	19 46	EI	soilassocia tion.org
World Fair Trade Organization (WFTO)	B 2 B	Process										N- P	Int.	Cradle-to- gate	n.a	3rd	19 58	FU	wfto.com
ZQ Natural Fibre	B 2 C	Compo nent										N- P	Int.	Gate-to- gate	n.a	3rd	20 06	EI	discoverzq .com

Source: Authors