CONSUMER RESPONSES TO BLOCKCHAIN-BASED TRANSPARENCY

Investigating the Moderating Role of Product Category and the Mediating Roles of Trust in Labels and Greenwashing Concerns

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Dissertation written under the supervision of Professor Maria Estarreja.

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Abstract

Consumers are increasingly interested in sustainability when it comes to supermarket purchases, but their attitudes do not always translate into actual buying behavior. Main reasons are mistrust in sustainability labels and greenwashing concerns. This thesis investigates blockchain-based transparency as an underexplored solution to increase perceived credibility and sustainable purchase intention.

A mixed-methods approach was used, including a literature review, exploratory interviews, a pilot survey and an experimental online survey with a 2x2 between-subjects design (label type: blockchain versus traditional; product category: milk versus day cream). 206 valid responses were used for the analysis. The findings show that blockchain-based transparency can increase perceived credibility and purchase intention more than traditional sustainability labels. The moderation of product category and mediations of trust in sustainability labels and greenwashing concerns are not significant but reveal positive trends. These findings offer important insights for retailers, policy makers and technology developers who want to reduce greenwashing and improve sustainability communication.

Keywords: Blockchain-Based Transparency, Trust in Sustainability Labels, Greenwashing Concerns, Credibility of Sustainability Information, Sustainable Purchase Intention

Title: Consumer Responses to Blockchain-Based Transparency

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Resumo

Os consumidores estão cada vez mais interessados na sustentabilidade quando se trata de compras em supermercados, mas as atitudes nem sempre se traduzem em comportamentos de compra. As principais razões são a desconfiança nos rótulos de sustentabilidade e as preocupações com greenwashing. Esta tese investiga a transparência baseada em blockchain como solução pouco explorada para aumentar a credibilidade percebida e a intenção de compra sustentável.

Foi utilizada uma abordagem de métodos mistos, incluindo uma revisão da literatura, entrevistas exploratórias, um inquérito piloto e um inquérito experimental online com um desenho 2x2 entre sujeitos (tipo de rótulo: blockchain versus tradicional; categoria de produto: leite versus creme de dia). Foram utilizadas 206 respostas válidas para a análise. Os resultados mostram que a transparência baseada em blockchain pode aumentar a credibilidade percebida e a intenção de compra mais do que os rótulos de sustentabilidade tradicionais. A moderação da categoria de produtos e as mediações da confiança nos rótulos de sustentabilidade e nas preocupações com o greenwashing não são significativas, mas revelam tendências positivas. Essas descobertas oferecem insights importantes para varejistas, políticos e desenvolvedores de tecnologia que desejam reduzir o greenwashing e melhorar a comunicação sobre sustentabilidade.

Palavras-chave: Transparência em Blockchain, Confiança nos Rótulos de Sustentabilidade, Preocupações com Greenwashing, Credibilidade das Informações sobre Sustentabilidade, Intenção de Compra Sustentável

Título: Respostas dos Consumidores à Transparência Baseada em Blockchain

Investigando o Papel Moderador da Categoria do Produto e os Papéis Mediadores da Confiança nos Rótulos e das Preocupações com o Greenwashing

Autora: Matilda Sara Obermeier

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1. Introduction

Sustainability is a core element in addressing climate change and protecting the environment (Greenpeace, 2025). The phrase describes causing little damage to the environment to protect resources over time (Cambridge University Press & Assessment, 2025b). Consumers become more aware of sustainability and studies suggest that consumers prefer sustainable products and packaging (Bar Am & Noble, 2023). Retailers, positioned between producers and consumers, are especially responsible for integrating sustainable practices into supply chains (Munro et al., 2023; Wiese et al., 2012). But even when companies offer sustainable products, sales often fall short of expectations (Bar Am & Noble, 2023; Wiese et al., 2012). This reveals a difference between consumers' attitudes and their actual purchase behavior, known as the attitude-behavior gap in sustainable purchasing (Bar Am & Noble, 2023; Park & Lin, 2018). A survey from Zalando (Europe's leading fashion and lifestyle online platform) with 2,500 consumers found that 60% considered transparency important, but only 20% actively review information when making purchases (Heiny & Schneider, 2021).

A key challenge in this mismatch is trust in sustainability labels. If reliable labels are not recognized, information can be understood as greenwashing, which refers to misleading impressions of sustainability and falsely advertised environmental benefits (Bar Am & Noble, 2023; KPMG, 2024; Munro et al., 2023; Trudel, 2018). As a result, greenwashing concerns and mistrust in labels can lower the perceived credibility of company claims, reducing purchase intentions (McKnight & Kacmar, 2007). Consequently, it is important for retailers to rebuild consumer trust and increase purchase intentions and perceived credibility in sustainability communication, but there is little research on which retail interventions can achieve this (Trudel, 2018). Research findings indicate that measures taken at the point of purchase can influence the final purchasing decision (Carrington et al., 2014). Consumers often rely on cognitive heuristics and visual characteristics such as design and user friendliness, which makes clear and transparent information important (Metzger & Flanagin, 2013). The literature mainly focuses on the problem, but few studies identify measures in retail to reduce greenwashing concerns and strengthen trust, purchase intention and perceived credibility. It is suggested that labels alone are less effective than combined with production information, but too much information can be overwhelming (Bălan, 2021; Shahrin et al., 2017). The optimal balance is still unclear.

Blockchain technology is a way to make information more transparent, easier to track and harder to manipulate (Susnjara & Smalley, 2021; The European Business Review, 2024). Various companies have already integrated blockchain. The more knowledge there is about the technology, the greater the value (IBM, 2023; Raddatz et al., 2023; Sunny et al., 2020). According to Berry et al. (2010), such traceability could help reduce uncertainty and strengthen trust. While prior work from Treiblmaier & Garaus (2022) on branded products revealed positive effects of blockchain-based traceability on purchase intention, evidence on consumer responses in unbranded retail contexts remains limited. Consequently, this thesis investigates whether a blockchain-based transparency cue on unbranded products, delivered through a QR code that links to product traceability data (see Nestlé, 2019), compared to a traditional sustainability label, can increase key consumer responses. Research Question (RQ) 1: Does blockchain-based transparency, compared with a traditional sustainability label, increase (a) purchase intention and (b) the perceived credibility of sustainability information?

Consumer responses can depend on context. Product characteristics such as hedonic versus utilitarian traits can moderate the effect on perceptions (Floyd et al., 2014; Kushwaha & Shankar, 2013; You et al., 2015). Reliable and transparent labeling is particularly important in the food sector (World Health Organization, 2024). Blockchain-based transparency can support this demand with easily accessible tracking information, although the findings are focused on single branded products (Treiblmaier & Garaus, 2022). Likewise, the beauty sector has been proposed as an additional industry to increase perceived value through blockchain technology (Sangal et al., 2024). Short exploratory interviews further indicate that traceability matters most in animal-based foods (especially milk) and in cosmetics/hygiene, which guided the choice of categories. RQ2: Does product category (food versus skincare) moderate the relationship between blockchain-based transparency and (a) purchase intention and (b) the perceived credibility of sustainability information?

Beyond main and moderating effects, the final step is to clarify the mechanism. Existing research and interviews indicate that two beliefs are central at the point of purchase. These are trust in sustainability labels and greenwashing concerns. Trust is central for evaluating claims and making purchase decisions (Cook et al., 2023; Gorton et al., 2021), whereas greenwashing risk undermines trust and affects sustainable purchase intention (Trudel, 2018; Organisation for Economic Co-operation and Development Digital Economy Papers, 2025). Therefore, it will be examined whether blockchain-based transparency can increase purchase intention and perceived credibility through more trust in sustainability labels and reduced greenwashing

concerns. RQ3: Does trust in sustainability labels mediate the effect of blockchain-based transparency on (a) purchase intention and (b) the perceived credibility of sustainability information? RQ4: Do greenwashing concerns mediate the effect of blockchain-based transparency on (a) purchase intention and (b) the perceived credibility of sustainability information?

The thesis is divided into seven chapters. Chapter 2 includes a literature review. Chapter 3 develops the conceptual framework with eight hypotheses. Chapter 4 explains the methodology and data collection, including a 2x2 between-subjects experiment design comparing blockchain-based transparency with traditional sustainability labels. Chapter 5 reports the results using SPSS and the PROCESS macro (Hayes, 2022). Chapter 6 concludes with theoretical and managerial implications. Chapter 7 contains limitations and suggestions for further research.

2. Literature Review

2.1 Blockchain-Based Transparency

Blockchain was introduced in 2008 as a decentralized technology that records transactions. The term refers to a "chain" of individual and time stamped "blocks", which include a list of transactions or data records. Due to the interdependence between the blocks, blockchain systems offer a high level of security and are difficult to manipulate or hack (Susnjara & Smalley, 2021; The European Business Review, 2024). Blockchain therefore increases safety, traceability and transparency. Hofstede et al. (2004) define transparency as a state in which all supply-chain stakeholders can assess product information in time and without any losses. As the whole process of production and delivery of a product is documented from the manufacturer to the point of sale, end consumers can gain insights into the origin of the product, the manufacturing process as well as ingredients (Mukherjee et al., 2023). Access to the blockchain data can, for instance, be provided through a QR code on the product packaging, as demonstrated by the Nestlé and Carrefour pilot project (Nestlé, 2019). After scanning, production dates, control parameters for quality, storage times and farmer entries on supply are presented (Nestlé, 2019). Beyond its technical features, blockchain can improve efficiency by reducing the need for third-party verification. It records data in a shared system without a single trusted central party (Puthal et al., 2018).

Companies already develop transparency solutions based on blockchain technology. One example is the partnership between IBM and iFoodDS, a supply chain traceability platform (IBM, 2023; iFoodDS, 2025). Together, they support other companies' food traceability in sharing data securely with trade partners (IBM, 2023). Many industries have already adopted blockchain, such as food and pharmaceuticals (Sunny et al., 2020). Case studies on egg supply chains (Bumblauskas et al., 2020) and on electronic medical records and pharmaceutical supply chains (Agbo et al., 2019) demonstrate the flexibility of blockchain technology. They suggest that blockchain technology can address the growing demand for traceability and safety in complex supply chains. Blockchain may even help to reduce food waste through expiry dates and batch numbers on products (Antonucci et al., 2019). According to Sander et al. (2018), blockchain is also used to improve traceability and access to information for consumer goods. Although some service providers already offer blockchain solutions, adoption in retail remains slow due to technical and practical barriers. From a technical perspective, the validation of each block in the chain needs storage and transaction time, which can cause problems (Puthal et al., 2018). On the practical side, barriers include that supply chain stakeholders are resistant to

change, the potential overload of information, unclear cost allocation and the need for common data standards and transparency goals (Sander et al., 2018). Raddatz et al. (2023) suggest that awareness has a strong influence on the perceived value of blockchain and the willingness to switch to such systems. However, even informed users may be reluctant to adopt blockchain due to low motivation.

In this context, Jacobs (2020) investigate how trust in technology plays a role. Many authors assume a common definition when dealing with trust in blockchain technology, but there is none (Jacobs, 2020). Still, users need visible system stability as there is a shift from interpersonal trust to system-based trust, being a "positive expectation for the future", but connected to a system (Sumpf, 2017, p. 26). In this thesis, trust refers to sustainability labels as a baseline belief (measured before exposure), not to blockchain technology. Blockchain-based transparency is further compared with a traditional sustainability label as the independent variable (IV). Given these constraints, the consumer outcomes sustainable purchase intention and perceived credibility are considered next to assess under which conditions blockchain technology may affect retail contexts.

2.2 Sustainable Purchase Intention

Ajzen (1991) positions intention within the theory of planned behavior (TPB) as a factor that influences behavior. Intention is predicted by three components: the attitude toward the behavior, the subjective norm, which reflects the perceived social pressure, and the perceived behavioral control, described as the perceived "ease or difficulty of performing the behavior" (Ajzen, 1991, p.183).

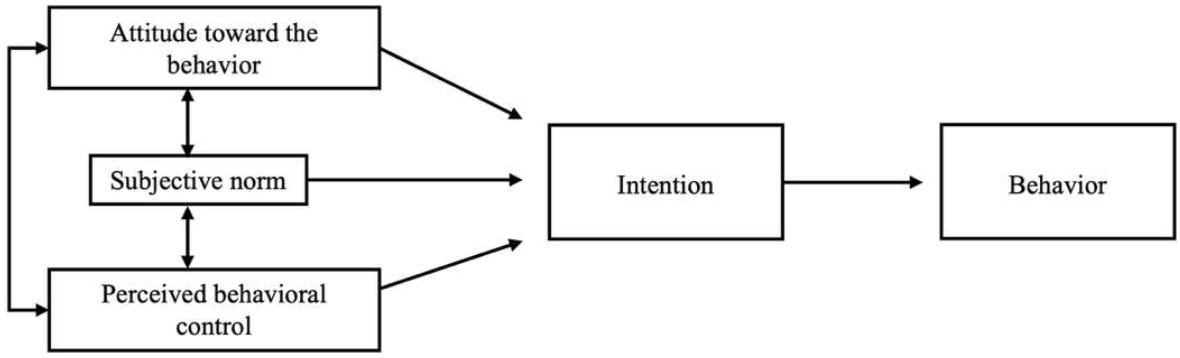


Figure 1. Theory of Planned Behavior (Own Illustration Based on Ajzen, 1991, p.188)

Together, these components predict intention (Figure 1), which then leads to behavior. Purchase intention is defined as the decision and willingness of a customer to buy a particular product or

service and has long been used to predict consumer behavior (Mirabi et al., 2015; Morrison, 1979; Shah et al., 2012). Morrison (1979) shows that purchase intentions do not always lead to purchases, known as the intention-behavior gap. Within the TPB, intention mediates the effect of attitudes (together with subjective norms and perceived behavioral control) on behavior (Ajzen, 1991; Bagozzi, 1981). Accordingly, the quality of intentions and goal pursuit processes play a key role in explaining whether intentions lead to action (Sheeran & Webb, 2016). This is more broadly discussed as the attitude-behavior gap (Bar Am & Noble, 2023; Park & Lin, 2018). Building on this, the likelihood that consumers favor products with environmentally friendly characteristics over those without is known as sustainable purchase intention (Rashid et al., 2009; Shang et al., 2024). It is a useful indicator of the current and future demand for environmentally friendly products (Zhuang et al., 2021).

New research tests the potential impact of signals on purchase intention. Huang et al. (2025) compare blockchain-based traceability labels with traditional certification labels on branded products and report that blockchain labels can lead to higher sustainable purchase intentions for profit driven brands. At the same time, consumers can be skeptical about corporate social responsibility (CSR), especially when they perceive companies to be driven by self-centered or stakeholder related motives rather than genuine values. As a result, retailers can weaken consumer trust and credibility perceptions (Skarmeas & Leonidou, 2012). This may explain the mixed findings in the literature. Cook et al. (2023) show that consumers generally show a willingness to pay more for products with sustainability labels than for those without them, but the influence of socio-demographic characteristics such as gender or education remains unknown and requires more research. Gong et al. (2023) mentions that CSR does not directly increase sustainable purchase intention in China but can strengthen the connection between brand image and green purchasing behavior.

Sustainable purchase intentions are shaped by internal beliefs (attitudes, norms, perceived behavioral control) and external signals (traceability labels). In this thesis, purchase intention refers to sustainable purchase intention (the likelihood of favoring the product because of its sustainability information (Rashid et al., 2009; Shang et al., 2024)). It serves as a dependent variable (DV) here. At the point of purchase, however, an influencing factor is how credible the sustainability information appears. The next section therefore reviews perceived credibility and its role in connecting transparency cues to purchase intention.

2.3 Perceived Credibility of Sustainability Information

This section explores why consumers may not find sustainability information on products credible. Perceived credibility is the extent to which information is judged as believable or trustworthy (McKnight & Kacmar, 2007; Cambridge University Press & Assessment, 2025). Although the term is sometimes used interchangeably with trust, the approach of Renn & Levine (1991) is followed: credibility refers to a shared, generalized confidence in a source's trustworthiness, whereas trust refers to an individual expectation that a particular message is true and that the communicator is honest. In this thesis, perceived credibility is treated as a dependent variable, because it captures the situational evaluation of the experimental stimuli and trust in labels is measured as a general belief.

Credibility can shape how sustainability information is evaluated (Rieh & Danielson, 2007). McKnight & Kacmar (2007) highlight that perceived credibility helps to predict consumer loyalty, which is connected to intentions that do not always translate into behavior. Credibility is subjective and not a fixed feature of a message, depending on the consumer's perception (Visentin et al., 2018). Metzger & Flanagin (2013) add that people often rely on cognitive heuristics and visual features such as design and navigability rather than detailed evaluation. This raises the question of whether the use of blockchain-based transparency on products can increase perceived credibility when users rely on surface cues rather than on technical accuracy. The source credibility theory (SCT) goes to a deeper level. The persuasiveness of a communication depends on the perceived credibility of the source, whether in a personal, written or electronic context (Lowry et al., 2013). Blockchain-based transparency could make it easier to trust sustainable information, as it can be traced and is hard to manipulate (Susnjara & Smalley, 2021; The European Business Review, 2024). However, it is unclear whether consumers perceive blockchain as more credible compared to familiar sustainability labels.

A further challenge is where credibility originates from. Consumers are often not well informed about the environmental footprint of their purchases and make less sustainable choices, as they cannot access reliable information before the purchase (Yokessa & Marette, 2019). To meet demand for transparency, companies increasingly use sustainability labels to signal product quality and environmental responsibility. In 2018, there were already 463 eco-labels in 199 countries (Yokessa & Marette, 2019). Common ecolabels are the Blue Angel, the Nordic Swan, the Austrian Ecolabel and the EU Ecolabel. B Corp, Rainforest Alliance, UTZ Certified and Fairtrade are known social and ethical labels, while the EU organic logo and Demeter are mostly used for organic standards and animal welfare (European Forest Institute, 2024). Bălan (2021)

suggests that a logo alone might be less effective than combining an organic label with more specific information, including production details or certificates. Nevertheless, too much information or unclear messages can have the opposite effect, so it is important to avoid false and misleading claims (Shahrin et al., 2017).

2.4 Trust in Sustainability Labels

Sustainability labels are important communication tools for companies to communicate their product's environmental impact and influence purchase decision (Munro et al., 2023). Cook et al. (2023) examine how consumers interact with sustainability labels on food products, because they keep making new judgements about whether to "trust specific products and food system actors when they navigate shopping environments" (Cook et al., 2023, p.7). Personal values, knowledge, demographics and label design shape whether consumers trust labels. Based on these factors, consumers form expectations before they see a label. If the label appears clear and trustworthy, they are more likely to prefer and purchase the product (Cook et al., 2023). When claims are not trusted, labeling information can be seen as greenwashing and credibility decreases (Munro et al., 2023). Trust not only depends on label design or consumer knowledge, but also on who the source of the information is. To make a purchasing decision, consumers need to interpret the information source, understand its content and trust it enough (Rupprecht et al., 2020). Expert-sourced labels, which are designed to appear as if created by scientists, received high trust levels across all countries and food categories, whereas labels sourced from consumers were rated as the least trustworthy (Rupprecht et al., 2020). Bălan (2021) suggests that adding production details or certifications strengthens the effect of a logo and therefore improves perceptions. At the same time, Cook et al. (2023) call for more research in real store settings and across consumer groups, because the role of demographics is still unclear. Munro et al. (2023) further suggest to explore which information features need to be included for building trust.

In this thesis, trust in sustainability labels is specified as a mediator (RQ3), measured before exposure as a general belief. In line with literature on perceived credibility, trust and message evaluation, higher trust should facilitate perceived credibility at the point of purchase (Lowry et al., 2013; Rieh & Danielson, 2007). In the following, greenwashing concerns as the second mediator are investigated.

2.5 Greenwashing Concerns

Greenwashing was first described by the activist Jay Westerveld in 1986, when he criticized hotels for presenting towel reuse programs as environmentally friendly while they were mainly designed to save costs (Pearson, 2010). There is no general definition of the term. Some see it as an environmental issue, while others consider it a "social environmental phenomenon" (De Freitas Netto et al. 2020, p. 10). Cambridge University Press & Assessment (2025a) defines greenwashing as making people believe that a company does more to protect the environment than it really does and KPMG (2024) describes it as marketing practices that create a false impression of sustainability. Key factors include the search for competitive advantage, growing consumer demand for sustainability and regulatory gaps (Feghali et al., 2025). Greenwashing often appears on product packaging and labels, making verification difficult even for experts (De Freitas Netto et al., 2020). Such misleading claims can involve vague terms or fake third-party certifications (Organization for Economic Co-operation and Development Digital Economy Papers 2025, p.5).

Greenwashing has become one of the most serious corporate risks and public and regulatory pressure against misleading claims has grown, therefore a large market for sustainability certification has emerged (Free et al., 2024). When consumers realize they were misled by false claims or labels, they start to doubt the authenticity, which leads to feelings of betrayal and frustration (Durmuş Şenyapar, 2024). Greenwashing can damage brand reputation as well as a company's environmental legitimacy (Berrone et al., 2017; KPMG, 2024; Pizzetti et al., 2021). A survey from 2020 reveals the extent of the trust gap: 49% of 7,520 consumers reported lacking access to the information needed to verify product sustainability claims and 44% stated they do not trust such claims (Jacobs et al., 2020, p. 17). In food retail, greenwashing concerns emerge through the product packaging and presented labels, as well as information disclosure (Montero-Navarro et al., 2021). In this context, signaling theory explains the behavior of two parties with different information, as companies send sustainability claims and consumers interpret them and decide whether they are trustworthy (Connelly et al. 2011). Misleading claims can encourage consumers to select cheaper, unsustainable products over genuinely sustainable ones, particularly if the sustainable products are more expensive. This could result in fewer sales of authentic sustainable products (Organisation for Economic Co-operation and Development Digital Economy Papers, 2025). To support these findings, Bonicelli et al. (2023) showed that greenwashed packaging, such as using green colors, can increase market share, which in turn poses risks in retail environments. To reduce uncertainty and prevent

greenwashing, mandatory and reliable reporting is suggested (Free et al., 2024). Blockchain technology could offer a transparent way for verifying sustainability claims and data to rebuild consumer trust (Feghali et al., 2025).

In this thesis, greenwashing concerns are specified as a mediator (RQ4) and are measured before exposure as a general belief. Higher greenwashing concerns are expected to lower perceived credibility and purchase intention at the point of purchase (Montero-Navarro et al., 2021; Organisation for Economic Co-operation and Development Digital Economy Papers, 2025; Trudel, 2018).

2.6 Product Category

Studies have shown that product characteristics can influence consumer responses. For example, hedonistic versus utilitarian features as well as perceived risks can influence preferences for certain distribution channels and customer benefits (Floyd et al., 2014; Kushwaha & Shankar, 2013; You et al., 2015). Bettiga et al. (2020) further discover that hedonic and functional products evoke emotional responses through different mechanisms, suggesting that reactions to sustainability and transparency labeling may vary by product category.

Reliable and transparent labeling is particularly important in food, where quality, safety and nutritional value play a major role (World Health Organization, 2024). According to Treiblmaier & Garaus (2022), the dilution of milk and the addition of additives are frequent cases of food fraud. To prevent such problems, traceability systems could allow consumers to access all information throughout the supply chain, which blockchain technology could support through immutable, shared and easily accessible traceability in agri-food (Treiblmaier & Garaus, 2022). Traceability can further improve perceived quality and purchase decisions in meat supply chains and blockchain can also raise purchase intention in beauty, especially when brand awareness is low (Sangal et al., 2024). However, most findings come from branded products or single categories, which is why Sangal et al. (2024) explicitly recommend testing blockchain-based transparency across product categories. These gaps motivate the examination of unbranded products and comparing categories directly. Previous research has further shown that involvement depends on the context. Food is not necessarily low involvement, despite being an everyday purchase category (Kuenzel & Musters, 2007). Chu (2020) defines skincare as a high involvement category, because purchases require more cognitive effort to compare alternatives and prices.

Product category serves as the moderator in this thesis (RQ2), included in a between-subjects design (milk versus day cream) with unbranded stimuli. The categories differ in attributes and typical involvement, which may have an effect of how the transparency cue affects perceived credibility and purchase intention. To further justify the category choice, five exploratory interviews (Section 4.4) show that transparency concerns are most critical for animal-based foods, especially milk, and for cosmetics or hygiene products.

3. Conceptual Framework and Hypotheses

Building on prior work, this study tests whether blockchain-based transparency (versus a traditional sustainability label) increases the perceived credibility of sustainability information and purchase intention in a retail context. For brevity, this study uses *purchase intention* to refer to sustainable purchase intention and it is measured for products with a sustainability cue. Product category (food versus skincare; milk versus day cream) serves as the moderator. Trust in sustainability labels and greenwashing concerns are defined as mediators. The conceptual framework (Figure 2) shows the relationship between blockchain-based transparency and perceived credibility and purchase intention (in a sustainability context), mediated by trust and greenwashing concerns and moderated by product category.

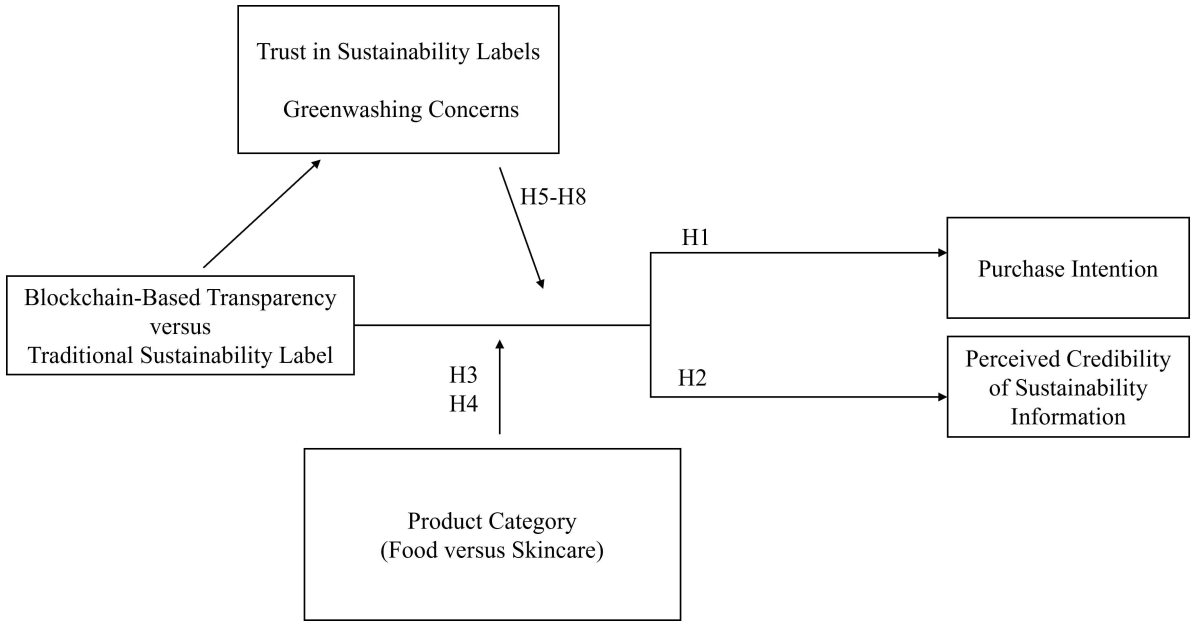


Figure 2. Conceptual Framework

Main Effects of the Transparency Type on the Dependent Variables

The literature has shown that detailed and well-presented product information can improve consumer perception, especially when labels are paired with concrete product details (Bălan, 2021; Cook et al., 2023; Munro et al., 2023). At the same time, consumers often use mental shortcuts and rely on visual features such as design instead of detailed information when judging information (Metzger & Flanagin, 2013). Therefore, a clear and easily understandable transparency cue can have a big influence on perceptions. Blockchain-based transparency provides secure and transparent information that is resistant to manipulation and traceable at any time (Mukherjee et al., 2023; Treiblmaier & Garaus, 2022). It has further shown positive

effects on purchasing behaviors on specific branded products (Huang et al., 2015; Treiblmaier & Garaus, 2022). Based on RQ1, this thesis tests whether a blockchain-based transparency cue outperforms a traditional label regarding perceived credibility and purchase intention in an unbranded retail context.

H1: Blockchain-based transparency increases purchase intention compared with a traditional sustainability label.

H2: Blockchain-based transparency increases the perceived credibility of sustainability information compared with a traditional sustainability label.

Moderation Effect of Product Category

The product category could moderate the effect of transparency type on purchase intention and perceived credibility (Bettiga et al., 2020; Floyd et al., 2014; Kushwaha & Shankar, 2013; You et al., 2015). Quality, safety and transparency are extremely important when it comes to food. Cases of fraud in the food sector highlight the need for traceability (Treiblmaier & Garaus, 2022; World Health Organization, 2024). In the beauty industry, blockchain technology could have an influence on purchase intention, especially when brand awareness is low (Sangal et al., 2024). Involvement further differs by context, as food is (not necessarily) low involvement (Kuenzel & Musters, 2007) and skincare is often high involvement (Chu, 2020). Building on this, stronger effects in the food category are expected, because blockchain-based transparency might resolve bigger uncertainties.

H3: The positive effect of blockchain-based transparency on purchase intention is stronger for milk than for day cream.

H4: The positive effect of blockchain-based transparency on perceived credibility of sustainability information is stronger for milk than for day cream.

Mediation Effects of Trust in Sustainability Labels and Greenwashing Concerns

Label design, among other factors, can influence consumer trust (Cook et al., 2023). If a label is trustworthy, purchase intention increases, but when general trust is low and claims seem false, they are more easily viewed as greenwashing and purchase intention decreases (Munro et al., 2023). Self-centric motives of companies weaken trust (Skarmeas & Leonidou, 2012), while adding concrete production details or certifications helps (Bălan, 2021). Following this, greenwashing concerns are related to lower credibility and less sustainable purchase intentions (Montero-Navarro et al., 2021; Organisation for Economic Co-operation and Development

Digital Economy Papers, 2025; Trudel, 2018). Therefore, higher trust in sustainability labels and lower greenwashing concerns mediate the effect of the transparency type on perceived credibility and purchase intention.

H5: The positive effect of blockchain-based transparency on purchase intention is mediated by higher trust in sustainability labels.

H6: The positive effect of blockchain-based transparency on perceived credibility of sustainability information is mediated by higher trust in sustainability labels.

H7: The positive effect of blockchain-based transparency on purchase intention is mediated by lower greenwashing concerns.

H8: The positive effect of blockchain-based transparency on perceived credibility of sustainability information is mediated by lower greenwashing concerns.

First, the effects of blockchain-based transparency are analyzed in comparison to traditional labels (H1-H2). Next, the different product categories are examined (H3-H4). Finally, possible relationships between blockchain-based transparency and general beliefs about trust in sustainability labels as well as greenwashing concerns are considered in relation to purchase intention and perceived credibility (H5-H8).

4. Methodology and Data Collection

4.1 Research Method

This thesis applied an exploratory sequential mixed-methods design, collecting and integrating qualitative and quantitative data (Creswell & Creswell, 2018). Data were gathered in separate phases, with a qualitative phase followed by a quantitative phase (Ziegler & Kang, 2016): (1) the literature review, (2) two rounds of exploratory interviews with a pilot survey in between and (3) a quantitative online survey with an embedded 2x2 between-subjects experiment.

(1) A literature review summarized existing research on blockchain-based transparency, sustainability communication and greenwashing, perceived credibility of sustainability information, trust in labels and product categories.

(2) Exploratory in-depth interviews identified the key factor product category used in section 2.6 and 3.1, but also price sensitivity and digital affinity to build the experimental stimuli and questionnaire content. This phase focuses on purpose and procedure, not qualitative results. An exploratory approach was chosen to address gaps in category specification and gain a better understanding of consumer knowledge (Følstad et al., 2018). A pilot survey then tested question clarity, survey flow, length and the usability of the visual stimuli (Forza, 2002). Feedback was used to refine wording and visuals. Subsequently, a second, more focused round of exploratory interviews gathered feedback on the revised product images for the experiment with blockchain-based sustainability information.

(3) The online survey experiment randomly assigned participants to a 2x2 between-subjects design to test two factors and their interaction (König & Jucks, 2019): product category (milk versus day cream) x transparency type (blockchain-based transparency versus traditional sustainability label).

All interviews were transcribed and then anonymized. Participants in both interviews and the survey provided voluntary informed consent, understood that participation was optional and that they could withdraw at any time. All procedures followed established human subjects' standards (Oldendick, 2012).

4.2 Sampling

Convenience sampling was used at every stage to collect data efficiently with minimal cost or time, based on availability and accessibility of participants (Golzar et al., 2022). In the exploratory phase, purposive maximum variation within convenience sampling was used to

include interviewees with the same general characteristics but different experiences (Nyimbili & Nyimbili, 2024, p.95). In both interview rounds, five separate interviews were conducted, while the pilot survey in between contained sixteen participants, all with variations in age and gender. For the experimental survey, participants were recruited through personal networks and social media such as WhatsApp, LinkedIn, Facebook and Instagram (Ibarra et al., 2018).

Because non-probability sampling does not provide known inclusion probabilities, results cannot be generalized to the whole population. To increase reach and reduce bias, recruitment was spread across multiple channels. In addition, attention was paid to variation in age, gender and education (Vehovar et al., 2016). Studies show that even smaller samples can provide meaningful insights, especially when there are enough differences between participants (Ackerman et al., 2021).

4.3 Research Instruments

All exploratory in-depth interviews were conducted and transcribed with consent, in person or via WhatsApp audio call, depending on the availability and preference of the participant. The interview guides (Appendix 1 and 3) consisted of open-ended questions. The first round of interviews treated general concepts such as blockchain transparency, greenwashing, trust in labels and product category, while the second round focused on the visual stimuli. The pilot survey (Appendix 2) and main survey (Appendix 4) were programmed in Qualtrics. Both surveys primarily included commonly used 5-point Likert-type items (Clason & Dormody, 1994). Demographics were included to provide context for the analysis (Vehovar et al., 2016; Corsi et al. 2012).

4.4 Research Design and Stimuli Development

Five exploratory in-depth interviews were conducted to better understand consumer behavior and attitudes (Appendix 1). The focus was on beliefs towards sustainability labels, concerns about greenwashing and the potential of blockchain-based transparency. A special aim was to identify product categories where consumers felt that traceability is particularly important and to check familiarity with key terms (greenwashing, blockchain, sustainability labels). The findings from this qualitative pre-study helped to shape the literature review, conceptual framework, structure of the main survey and the experimental design, but were not intended for extensive qualitative analysis. Summarized, animal-based foods, especially milk, plus cosmetics/hygiene were mostly mentioned as categories in which traceability and transparency

matter to consumers. The interviews also confirmed that the questionnaire required clear wording of key terms and that greenwashing was a relevant concern.

Before finalizing the main survey, a pilot survey was conducted with sixteen consumers (Appendix 2). The aim was to test the clarity, logic and length of the questionnaire (Forza, 2002) and check whether the experimental scenarios were clear and easy to understand. At the end of the questionnaire, a feedback section asked whether the survey looked realistic and whether the information felt credible, which was helpful for revising the experimental stimuli. The first version of blockchain scenarios only included a QR code with a short call to action. Several participants asked for more visible information to better judge the added value and credibility. Therefore, the designs were adapted with more relevant content. The pilot phase helped to refine wording, define more specific answer options and improve the visuals. Participants completed the pilot survey as if they were taking part in the main survey, which helped to reveal misunderstandings and test overall flow (Forza, 2002). Because the pilot had sixteen participants, the results cannot be generalized, but pilot surveys play a key role in reducing errors and ensuring the technical validity of the instrument (Antony et al., 2019).

After the pilot survey results, five additional exploratory interviews were conducted to refine the experimental stimuli (Appendix 3). The follow-up interviews focused on the updated stimuli and its realism, clarity and usefulness for purchase decisions. The feedback was used to adjust wording, layout and the amount of detail in the images. These interviews served as a pre-test of the revised visuals and the data were not used for hypothesis testing. The purpose was to improve the quality and credibility of the experimental design and responses were recorded with consent, transcribed and anonymized.

The main survey ran online in Qualtrics from May 7 to May 13, 2025 (Appendix 4). It combined findings from the previous interviews and pilot survey and followed a 2x2 between-subjects experiment. The aim was to test the hypotheses and examine how blockchain-based transparency affects perceived credibility and purchase intention across product categories. The survey started with questions about lifestyle, views on sustainability, trust in sustainability labels and concerns about greenwashing. Section 2 introduced blockchain-based transparency. In section 3, participants were randomly assigned to one of four groups in a 2x2 design: product category (milk versus day cream) x label type (traditional sustainability label versus blockchain-based transparency label). In section 4, follow-up questions were asked according to the scenario they had seen, focusing on purchase intention, perceived credibility,

sustainability perceptions and trust. Finally, respondents answered general questions on both product categories and demographics. In total, 251 responses were collected. After data cleaning, 206 complete and valid responses remained for the analysis.

Based on the literature review and exploratory interviews, animal-based foods (especially milk) and skincare were mentioned as categories where traceability and transparency matter most. To test the effect of blockchain-based transparency independently of brand perception, no real brand was used. Neutral product packages were created that only showed the product name ("Milk" or "Day Cream"). Two versions were designed for each product: one with a traditional sustainability label (EU Organic Certification logo) and one with a blockchain-based transparency cue, visualized as a QR code with the note "Scan for full transparency on this product's journey" (Appendix 4: Section 3). Additional text information on ingredients, origin or logistics (depending on product category) was displayed as a scan result, based on the pilot and follow-up feedback. Apart from the transparency cue, all other elements remained the same (neutral design, no brand, no price) to minimize bias. Participants were randomly assigned to one of four conditions in a 2x2 between-subjects design (product category: milk versus day cream x transparency type: label versus blockchain cue) (Figure 3).

Figure 3. Experiment Scenarios

4.5 Variables Description

Based on the conceptual framework, the analysis includes one independent variable, two dependent variables, one moderator and two mediators.

Independent Variable

The independent variable is the type of transparency, separated into traditional sustainability labels and blockchain-based transparency. Before exposure, participants were asked about sustainability labels and blockchain-based transparency to capture existing beliefs (Petter et al., 2013) (Appendix 4: Q3, Q9, Q10). Participants then were randomly shown a traditional sustainability label or a blockchain-based transparency cue in form of a QR code with short sustainability information.

Dependent Variables

The dependent variables are purchase intention and perceived credibility of the sustainability information. They are used to "measure or assess the effect of the independent variable" (Morgan et al., 2004, p.5). In this study, purchase intention refers to the likelihood that a consumer will choose the presented product based on the sustainability information (Rashid et al., 2009; Shang et al., 2024). This was measured with 5-point Likert scales ranging from 1 (strongly disagree) to 5 (strongly agree) adapted from Spears & Singh (2004), common in studies on purchase intention (Appendix 4: Q21, Q24). For the analysis, unless otherwise declared, Q21 is used.

Perceived credibility refers to the extent to which the sustainability information shown on the product is regarded as believable, trustworthy and accurate (McKnight & Kacmar, 2007) (Appendix 4: Q19, Q20, Q22, Q23). The scale was adapted from Gaziano & McGrath (1986), who applied a similar 5-point structure to evaluate trust-related constructs. Following their approach, all items were scaled so that higher values indicate higher perceived credibility. For the analysis, unless otherwise declared, Q20 is used.

Moderating Variable

Product category as the moderating variable tested whether the effects differ by category. The manipulation used milk (food) versus day cream (skincare). Q26 and Q27 emphasized the product category (Appendix 4).

Mediating Variables

To examine potential mediation, questions on trust in sustainability labels and greenwashing concerns were included. It is assumed that participants already hold certain beliefs about these. The transparency cue (blockchain versus traditional label) serves to activate and make these beliefs salient, shaping perceptions of credibility and purchase intentions. Trust in sustainability

labels was measured using two items asking how much participants trust such labels in general and specifically traditional labels (Appendix 4: Q4, Q5). These items are based on Gorton et al. (2021, p.5) regarding the "trustworthiness of the organic label". Greenwashing Concerns were captured through two items, first on general greenwashing concerns and then specifically how greenwashing risks affect trust sustainability labels (see Appendix 4: Q7, Q8). The questions were inspired by scales on consumer perceptions of greenwashing by Braga Junior et al. (2019).

Other Variables

Demographics were included to provide more context for the analysis (Corsi et al. 2012; Vehovar et al., 2016): gender, age, occupation and income (Appendix 4: Section 5).

Coded and Dummy Variables

In SPSS, coded variables and dummy variables were computed for analysis. A list of these can be found in Appendix 5.

5. Analysis and Results

This chapter includes the analysis and results of the quantitative study. First, the sample was characterized with descriptive statistics. Then, normality of the dependent variables, multicollinearity and outlier detection were checked to ensure validity. Before testing the hypotheses, it was verified whether the experimental manipulation was correctly perceived. After hypotheses testing, additional analyses were conducted to support the findings. All tests, including the PROCESS macro procedure by Hayes (Version 4.2, 2022), were carried out with SPSS (Version 30) at a significance level of five percent ($\alpha = 0.05$). Unless stated otherwise, all survey items are listed in Appendix 4. In this chapter, survey items are referenced with abbreviations (e.g., Q1, Q2) for clarity and brevity.

5.1 Sample Characterization

The dataset from the online survey had 256 responses, of which 50 were incomplete and excluded. The 206 fully completed answers were analyzed on demographics (Appendix 6).

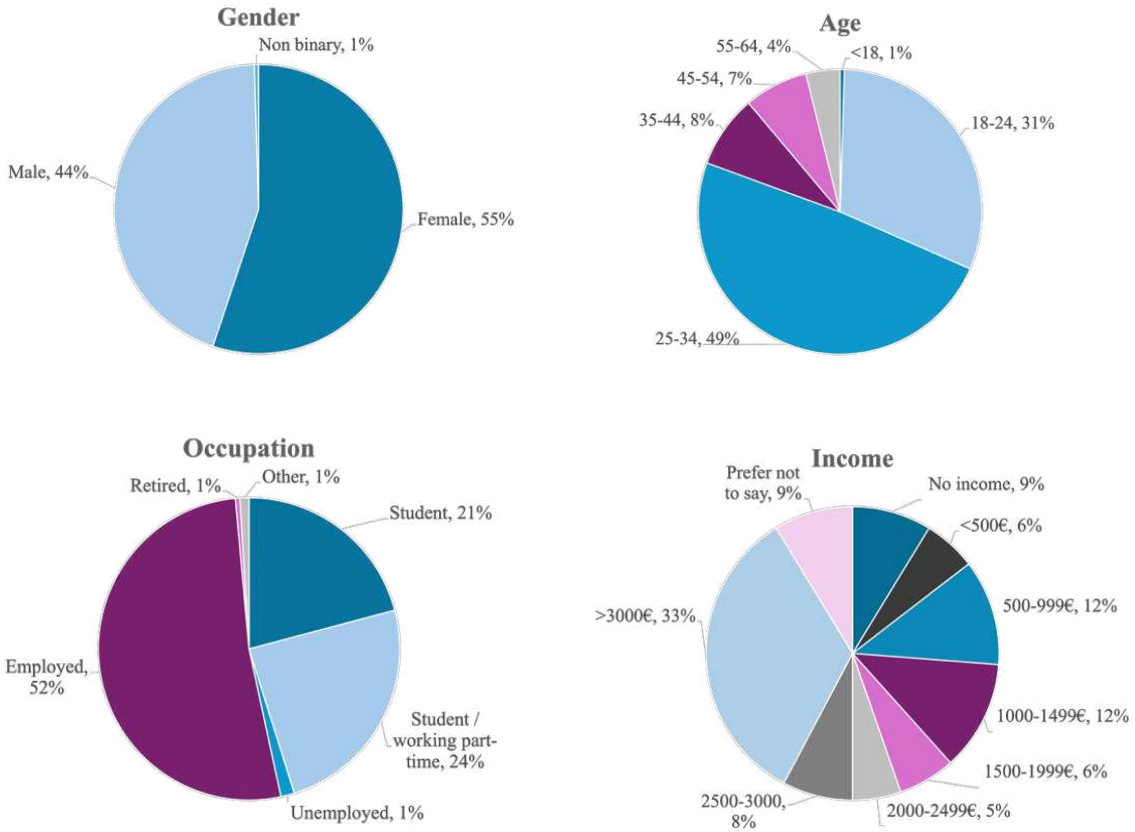


Figure 4. Sample Demographics

The sample consists of 55% female and 44% male participants, indicating a balanced gender distribution. Most respondents were between 18 and 34 years old. About half were employed,

while most others were students. One third earned over 3.000€, while 9% reported no income (see Figure 4).

The sample was then analyzed on sustainable behavior (Appendix 7). When asked about environmental behavior, 58% described their lifestyle as moderately sustainable and 49% said that their supermarket shopping reflect the same level. 29% considered their supermarket purchases slightly sustainable, while 17% viewed them as very sustainable. Trust in sustainability labels was moderate: 28% expressed slight trust, 37% somewhat trust and 28% mostly trust. There is more mistrust than complete trust in labels.

Participants were asked specifically about traditional sustainability labels (Appendix 8). Almost half (48.5%) somewhat agreed that they trust such labels, while 7.8% strongly agreed. The other half (43.7%) either remained neutral, disagreed slightly or strongly. Greenwashing awareness was high: 86% said they heard of the term before and most indicated concerns. Of the 178 respondents who were familiar with greenwashing, 48% somewhat agreed that the risk of greenwashing made it harder to trust sustainability labels and 40% strongly agreed (Appendix 9). About 50% were familiar with blockchain technology. When asked whether blockchain could improve the transparency of product sustainability, most participants responded positively. Around 41% somewhat agreed, 38% mostly agreed and 8% agreed completely (Appendix 10).

5.2 Assumption Checks

While there are several regression assumptions listed by Tabachnick & Fidell (2013), this study concentrated on the three most relevant: normality, multicollinearity and outlier detection. Other assumptions, such as linearity and independence of errors, were considered to be met through the experimental design with random assignment. Homogeneity of variances was tested separately with Levene's test in the ANOVA.

Normality of Dependent Variables

The dependent variables purchase intention and perceived credibility were analyzed for normal distribution. In both cases, the data were approximately symmetric, with most responses at the positive end of the scale (Figure 5).

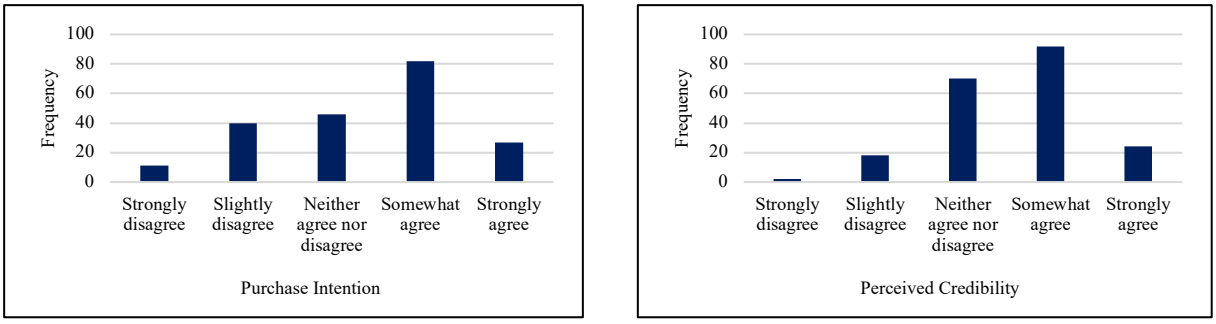


Figure 5. Purchase Intention and Perceived Credibility Distribution

Descriptive statistics, visual checks (histograms and Q-Q diagrams) and formal normality tests (Kolmogorov-Smirnov and Shapiro-Wilk) assessed normality (Appendix 11). The kurtosis values were close to zero and both measures showed negative skewness (Table 1). Negative kurtosis occurs when many cases fall in "the tails of the distribution" (Garson, 2012, p.20).

Descriptive Statistics	**Kurtosis Value**	**Skewness**
Purchase Intention	-.673	-.394
Perceived Credibility	-.012	-.329

Table 1. Kurtosis and Skewness (Normality Test)

A divergence from a perfect normal distribution was indicated by the Shapiro-Wilk test, common for testing normality $N < 2000$ (Garson, 2021), which was significant ($p < .001$) (Appendix 11). With $N = 206$, however, the Shapiro-Wilk is very sensitive, so even small departures appear significant. Given the sample size and the central limit theorem, *t*-tests and regression are robust to this small non-normality, therefore estimates and *p*-values are reliable (Lumley et al., 2002). A graphical tool to assess normality is the Q-Q plot. Garson (2012) states that the Q-Q plot "forms a 45-degree line when the observed values are in conformity with the hypothetical distribution" (p.22). Appendix 11 presents this scenario for both dependent variables, which supports the assumption of normality.

Multicollinearity

The dataset was checked for multicollinearity, defined as a "perfect linear relationship among some or all explanatory variables" (Ali, 2021, p.3). Tolerance, variance inflation factor (VIF) and condition index for three predictors were analyzed: blockchain-based transparency, trust in sustainability labels and greenwashing concerns (Appendix 12). In both models, for purchase intention and perceived credibility, all tolerance values were approximately .97-.99, VIFs

approximately 1.01-1.03 and the maximum condition index was 15.09. In practice, VIF > 5 or > 10 indicates multicollinearity, which is not the case here (Vatcheva et al., 2016; Kim, 2019). Moreover, condition index values between 30 and 100 confirm multicollinearity, which can be denied with 15.09 (Kim, 2019). There is no problematic multicollinearity.

Outlier Detection

A boxplot was created for Q21 to check for extreme outliers. This common method helps to prevent negative influences on the analyses and conclusions (Schwertman et al., 2003). The boxplot showed a relatively symmetrical distribution without extreme values (Appendix 13). Small outliers were identified, but within the common accepted fences of 1.5 and 3.0 (Garson, 2012; Schwertman et al., 2003). Therefore, the data were considered suitable for further parametric analyses and no cases were excluded.

5.3 Manipulation Check

To ensure the success of the manipulation, a Chi-Square-Test was conducted to test whether participants correctly identified the transparency information (Morgan et al., 2004) (Appendix 14). The results showed a significant association between the assigned group and participants' answers to Q15, with Pearson-Chi-Square (2, N = 206) = 183.99, p < .001. Almost all respondents correctly recognized the transparency cue (blockchain: 99%, traditional label: 96%), which indicates that the stimuli were noticed as intended.

Independent-samples t-tests compared the blockchain-based transparency and traditional label groups, as suggested by Morgan et al. (2004) (Appendix 15). Five variables were tested to compare how participants would rate the product depending on whether they saw a blockchain QR code or a traditional label. Participants in the blockchain group perceived the product as more sustainable (M = 3.42) than those in the label group (M = 3.17), t(204) = -1.91, p = .058. While this result was not significant, it shows a positive trend. The blockchain cue also enhanced perceptions of sustainability more strongly (M = 3.66) than the label (M = 3.26), t(204) = -2.87, p = .005. Participants in the blockchain condition further rated the information as more credible (M = 3.82) than the label group (M = 3.32), t(193.86) = -4.37, p < .001. Levene's test was significant (F = 7.49, p = .007), therefore the variances were not equal. Participants also found the information easier to understand in terms of trustworthiness (M = 3.64 versus M = 2.64), t(204) = -7.24, p < .001. For willingness to pay, participants who saw blockchain-based transparency also reported higher values (M = 3.00) compared to the label group (M = 2.71), but this was not significant, t(204) = -1.88, p = .062. Together, the results

show that the manipulation was recognized and effective. Participants exposed to blockchain-based transparency evaluated the product more positively in terms of sustainability perception, credibility and trustworthiness. The findings from the Chi-square and *t*-tests confirm that the experimental manipulation was successful.

5.4 Hypotheses Testing

5.4.1 Effect of Blockchain-Based Transparency (H1, H2)

Impact on Purchase Intention (H1)

To test the first hypothesis, an independent-samples *t*-test assessed differences in purchase intention between participants who saw blockchain-based transparency and those shown a traditional sustainability label (Morgan et al., 2004) (Appendix 16). Participants who saw blockchain-based transparency indicated higher purchase intention (M = 3.57, SD = 1.02) compared to those seeing a traditional label (M = 3.15, SD = 1.14), $t(204) = -2.79$, $p = .006$ (Table 3). Levene's test indicated equal variances ($p = .075$). The effect size, Cohen's $d = 0.39$, 95% CI [0.11, 0.66] indicates a positive but small ($> d = 0.20$) to moderate ($< d = 0.50$) effect (Cohen, 1988, p.40). H1 is supported. The use of blockchain-based transparency had a more positive impact on purchase intention.

Impact on Perceived Credibility (H2)

Hypothesis 2 was tested with an independent-samples *t*-test on perceived credibility of sustainability information (Q20) (Appendix 17). Participants who saw the blockchain-based transparency perceived the information as more credible (M = 3.82, SD = 0.72) than those in the traditional label group (M = 3.32, SD = 0.89), $t(193.86) = -4.37$, $p < .001$, $d = 0.61$ (moderate), 95% CI [0.33, 0.89]. Levene's test indicated unequal variances ($p = .007$). H2 is supported. Blockchain information was perceived as significantly more credible.

5.4.2 Moderating Effect of Product Category (H3, H4)

Moderation on Purchase Intention (H3)

It was tested whether the effect of transparency type on purchase intention differs by product category. Table 2 shows the means. In the blockchain condition, milk was rated higher in purchase intention (M = 3.67) than day cream (M = 3.43). In the traditional label condition, purchase intention remained relatively stable (milk: M = 3.05, day cream: M = 3.31).

Category	Label *M* (*SD*), *n*	Blockchain *M* (*SD*), *n*	ΔM
Milk	3.05 (1.21), 63	3.67 (1.02), 58	+0.62
Day Cream	3.31 (1.00), 39	3.43 (1.03), 46	+0.12

Table 2. Mean Values of Product Category and Transparency Type on Purchase Intention

A moderation analysis with PROCESS Model 1 (Hayes, 2022) (Appendix 18) tested the interaction (Hayes, 2012). The independent variable was transparency type (Label_BC), the moderator was product type (Prod.type) and the dependent variable purchase intention. The overall model was significant ($F(3, 202) = 3.48$; $p = .017$; $R^2 = 0.049$). However, the interaction was not significant ($b = -0.50$; $SE = 0.31$, $t = -1.63$, $p = .106$; 95% CI [-1.10, 0.11], $\Delta R^2 = 0.012$ ($F(1, 202) = 2.64$). This indicates the blockchain effect does not reliably differ between milk and day cream. A positive main effect of blockchain remained (see H1). Although the mean values show a tendency for milk to be higher, H3 is not supported.

Moderation on Perceived Credibility (H4)

This section tested whether product category moderates the effect of transparency type on perceived credibility. Table 3 shows the means. Participants in the blockchain condition rated milk slightly higher in perceived credibility ($M = 3.90$) than day cream ($M = 3.72$). Perceived credibility in the traditional label condition was higher for day cream (milk: $M = 3.27$, day cream: $M = 3.41$).

Category	Label *M* (*SD*), *n*	Blockchain *M* (*SD*), *n*	ΔM
Milk	3.27 (0.92), 63	3.90 (0.69), 58	+0.63
Day Cream	3.41 (0.85), 39	3.72 (0.75), 46	+0.31

Table 3. Mean Values of Product Category and Transparency Type on Perceived Credibility

A moderation analysis with PROCESS Model 1 (Hayes, 2022) (Appendix 19) was conducted. The independent variable was transparency type (Label_BC), the moderator product type (Prod.type) and the dependent variable perceived credibility. The overall model was significant ($F(3, 202) = 7.04$, $p < .001$, $R^2 = 0.095$). However, the interaction was not significant ($b = -0.32$, $SE = 0.23$, $t = -1.39$, $p = .166$, 95% CI [-0.77, 0.13], $\Delta R^2 = 0.009$ (F (1, 202) = 1.93). This indicates that the blockchain effect does not reliably differ between milk and day cream. A positive main effect of blockchain remained (see H2). H4 is not supported.

5.4.3 Mediating Role of Trust in Sustainability Labels (H5, H6)

Mediation on Purchase Intention (H5)

H5-H8 were tested following Baron & Kenny's (1986) procedure of three equations:

> *To test for mediation, one should estimate the three following regression equations: first, regressing the mediator on the independent variable; second, regressing the dependent variable on the independent variable; and third, regressing the dependent variable on both the independent variable and on the mediator. (...) To establish mediation, (...) the independent variable must affect the mediator (...) must be shown to affect the dependent variable in the second equation; and (...) the mediator must affect the dependent variable in the third equation (p.1177).*

For H5, trust in sustainability labels was tested as the mediator.

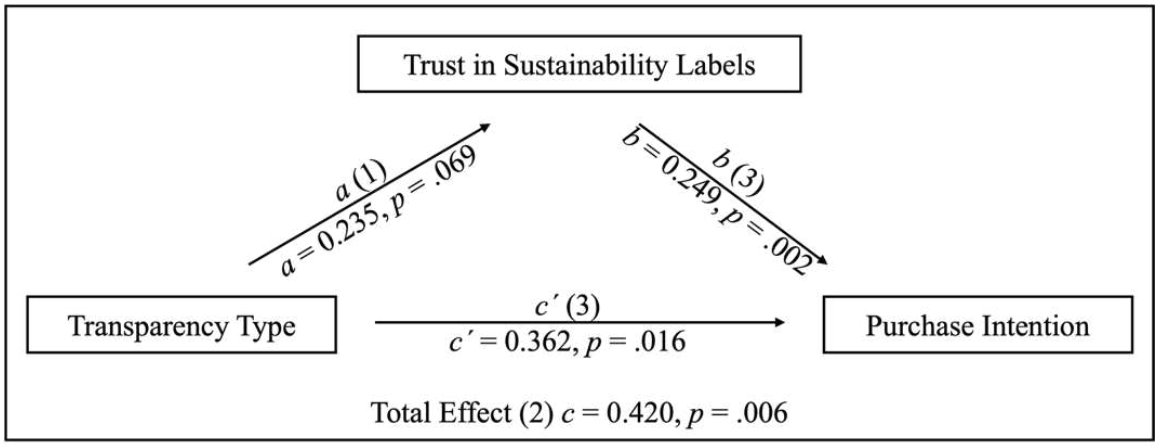


Figure 6. Regression Model of Trust in Sustainability Labels on Purchase Intention

The results (Figure 6 & Appendix 20) show that blockchain-based transparency increased trust marginally (b = 0.235, SE = 0.128, p = .069, R^2 = 0.016, N = 206), therefore path a was not significant. Blockchain-based transparency increased purchase intention (b = 0.420, SE = 0.151, p = .006, R^2 = 0.037, N = 206), meaning that path c was significant. With trust as the mediator in the model, the effect of blockchain-based transparency remained significant and trust also predicted purchase intention (Label_BC: b = 0.362, SE = 0.149, p = .016, N = 206; Trust: b = 0.249, SE = 0.080, p = .002, R^2 = 0.080, N = 206). The direct effect decreased from b = 0.420 to b = 0.362, which indicates that the blockchain effect is slightly smaller when trust is included. However, since path a was not significant and the effect of transparency type on purchase intention remained significant, there is no mediation. Although higher trust is positively related

to purchase intention, it does not mediate the blockchain-based transparency effect. In chapter 5.5, the bootstrapped indirect effect is additionally reported (PROCESS).

Mediation on Perceived Credibility (H6)

The three regression equations by Baron & Kenny (1986) were now tested with perceived credibility as the outcome. For H6, trust in sustainability labels was tested as the mediator.

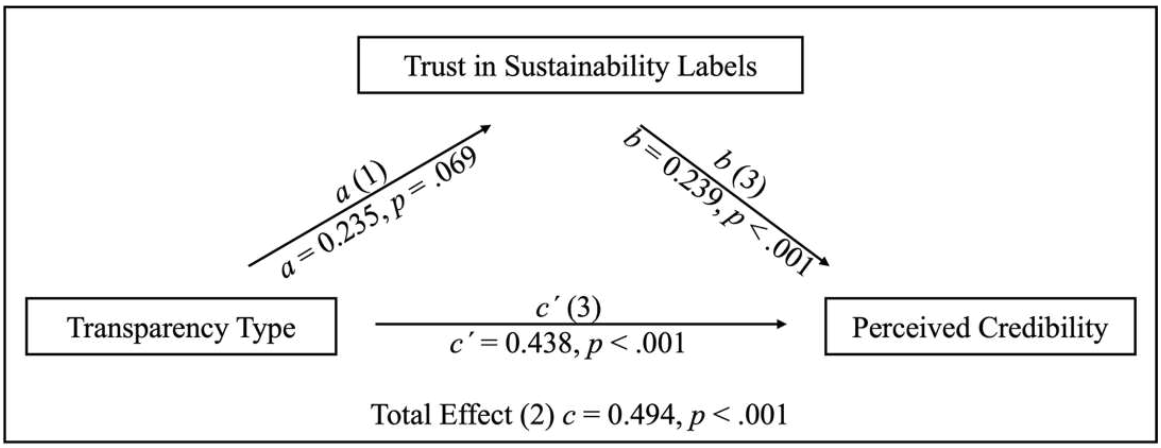


Figure 7. Regression Model of Trust in Sustainability Labels on Perceived Credibility

The results (Figure 7 & Appendix 21) show that blockchain-based transparency increased trust marginally (b = 0.235, SE = 0.128, p = .069, R^2 = 0.016, N = 206), therefore path a was not significant. Blockchain-based transparency increased perceived credibility (b = 0.494, SE = 0.113, p < .001, R^2 = 0.086, N = 206), meaning that path c was significant. With trust as the mediator in the model, the effect of blockchain-based transparency remained significant and trust also predicted perceived credibility (Label_BC: b = 0.438, SE = 0.110, p < .001; trust: b = 0.239, SE = 0.059, p < .001, R^2 = 0.154, N = 206). The direct effect decreased from b = 0.494 to b = 0.438, which indicates that the blockchain effect is slightly smaller when trust is included. However, since path a was not significant and the effect of transparency type on perceived credibility remained significant, there is no mediation. Although higher trust is positively related to perceived credibility, it does not mediate the blockchain-based transparency effect. In chapter 5.5, the bootstrapped indirect effect is additionally reported (PROCESS).

5.4.4 Mediating Role of Greenwashing Concerns (H7, H8)

Mediation on Purchase Intention (H7)

For H7, greenwashing concerns were tested as a mediator between transparency type and purchase intention, following Baron & Kenny (1986).

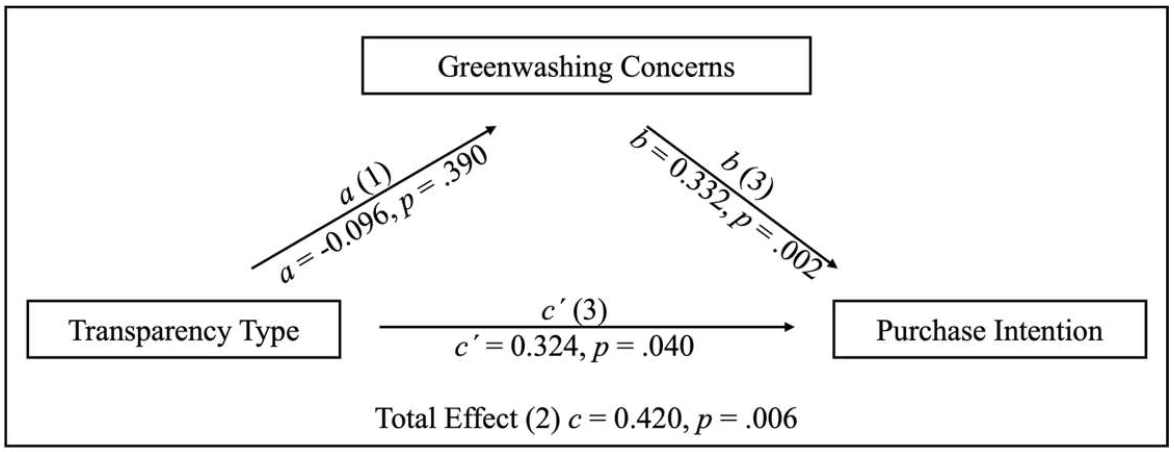


Figure 8. Regression Model of Greenwashing Concerns on Purchase Intention

The results (Figure 8 & Appendix 22) show that blockchain-based transparency was associated with slightly lower greenwashing concerns (b = -0.096, SE = 0.111, p = .390, R^2 = 0.004 with N = 178), therefore path a was not significant. N = 178 because not all respondents were familiar with greenwashing. Blockchain-based transparency increased purchase intention (b = 0.420, SE = 0.151, p = .006, R^2 = 0.037 with N = 206), meaning that path c was significant. With greenwashing concerns as the mediator in the model, the effect of blockchain-based transparency remained significant and greenwashing concerns also predicted purchase intention (Label_BC: b = 0.324, SE = 0.157, p = .040; greenwashing: b = 0.332, SE = 0.106, p = .002, R^2 = 0.070 with N = 178). The direct effect decreased from b = 0.420 to b = 0.324, which indicates that the blockchain effect is slightly smaller when greenwashing concerns are included. However, since path a is not significant and the effect of transparency type on purchase intention remained significant, there is no mediation. Although higher greenwashing concerns are positively related to purchase intention, it does not mediate the blockchain-based transparency effect. In chapter 5.5, the bootstrapped indirect effect is additionally reported (PROCESS).

Mediation on Perceived Credibility (H8)

Greenwashing concerns were tested as a mediator between transparency type and perceived credibility for H8, using the Baron & Kenny (1986) regression equation model.

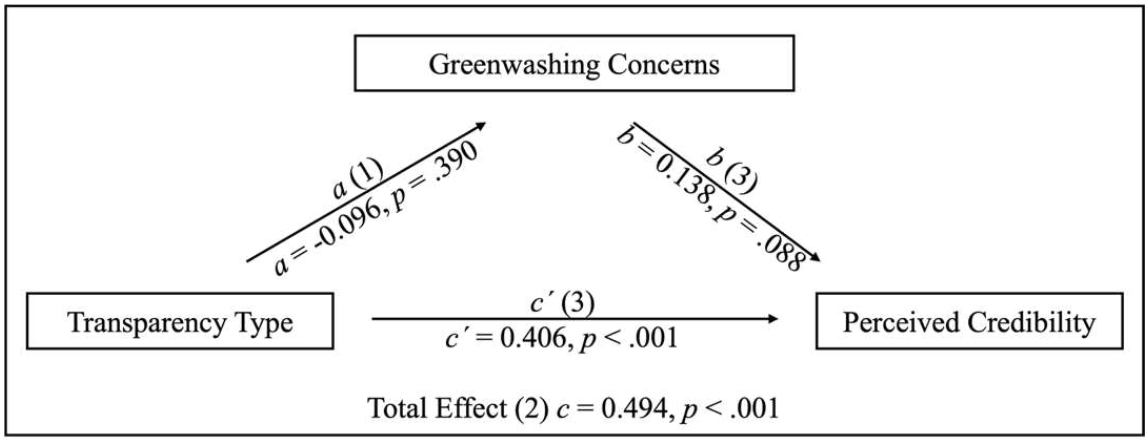


Figure 9. Regression Model of Greenwashing Concerns on Perceived Credibility

The results (Figure 9 & Appendix 23) show that blockchain-based transparency was associated with slightly lower greenwashing concerns (b = -0.096, SE = 0.111, p = .390, R^2 = 0.004 with N = 178), therefore path a was not significant. Blockchain-based transparency increased perceived credibility (b = 0.494, SE = 0.113, p < .001, R^2 = 0.086 with N = 206), meaning that path c was significant. With greenwashing concerns as the mediator in the model, the effect of blockchain-based transparency remained significant and greenwashing concerns did not significantly predict perceived credibility (Label_BC: b = 0.406, SE = 0.119, p < .001; greenwashing: b = 0.138, SE = 0.081, p = .088, R^2 = 0.074 with N = 178). The direct effect decreased from b = 0.494 to b = 0.406, which indicates that the blockchain effect is slightly smaller when greenwashing concerns are included. However, since path a is not significant and the effect of transparency type on perceived credibility remained significant, there is no mediation. Greenwashing concerns were not a significant predictor of perceived credibility, so they do not mediate the blockchain effect in this design. In chapter 5.5, the bootstrapped indirect effect is additionally reported (PROCESS).

5.5 Additional Analyses

Parallel Mediation Analysis on Purchase Intention with PROCESS

A parallel mediation with X = transparency type (Label_BC), M1 = trust in sustainability labels, M2 = greenwashing concerns (GW_Index) and Y = purchase intention was run in PROCESS (Model 4). PROCESS allows for multiple mediators that do not influence each other and typically two or three are tested (Hayes, 2012). 5,000 bootstrap samples and 95% confidence intervals were used (Appendix 24). Blockchain-based transparency increased trust only marginally (b = 0.236, p = .091) and did not reduce greenwashing concerns (b = -0.096, p =

.390). Both mediators predicted purchase intention (trust in sustainability labels $b = 0.285$, $p < .001$; greenwashing concerns $b = 0.373$, $p < .001$). With both mediators, the direct effect of blockchain on purchase intention was $b = 0.261$, $p = .091$. Due to the smaller sample size ($N = 178$) according to missing values on GW_Index, the direct effect appears weaker ($p = .091$), although the effect was significant with the full sample. Bootstrapped indirect effects from blockchain-based transparency were: total = 0.032, 95% CI [-0.09, 0.15]; via trust = 0.067, 95% CI [-0.01, 0.16]; via greenwashing concerns = -0.036, 95% CI [-0.14, 0.04]. Trust and greenwashing concerns are positively related to purchase intention, but blockchain-based transparency did not reliably shift the mediators and all indirect confidence intervals include zero (condition retrieved from Hayes, 2012). Therefore, no significant mediation is supported.

Parallel Mediation Analysis on Perceived Credibility with PROCESS

A parallel mediation with X = transparency type (Label_BC), M1 = trust in sustainability labels, M2 = greenwashing concerns (GW_Index) and Y = perceived credibility was run in PROCESS (Model 4). 5,000 bootstrap samples and 95% confidence intervals were used. Because GW_Index had missing values, the sample size was $N = 178$ (Appendix 25). Blockchain raised trust only marginally ($b = 0.236$, $p = .091$) and did not reduce greenwashing concerns ($b = -0.096$, $p = .390$). Both mediators were positively related to credibility (trust: $b = 0.271$, $p < .001$; greenwashing concerns: $b = 0.177$, $p = .023$). Even with both mediators, blockchain still increased credibility ($b = 0.346$, $p = .003$). Bootstrapped indirect effects were: total = 0.047, 95% CI [-0.04, 0.14]; via trust = 0.064, 95% CI [-0.01, 0.15]; via greenwashing concerns = -0.017, 95% CI [-0.08, 0.02]. Therefore, no significant mediation is supported. The blockchain cue appears to raise credibility mainly through a direct effect.

Correlation Analysis of Key Variables

A Pearson correlation analysis identified how the main variables are related to each other (Kafle, 2023). The results are visualized in Table 4.

	Purchase Intention (Q21)	Perceived Credibility (Q20)	Trust in Labels (Q4)	GW_Index	Label_BC	Prod.Type
Purchase Intention (Q21)	-					
Perceived Credibility (Q20)	.36**	-				
Trust in Labels (Q4)	.23**	.30**	-			
GW_Index	.22**	.11	-.12	-		
Label_BC	.19**	.29**	.13	-.07	-	
Prod.Type	.01	.00	.16*	-.08	.06	-
Note: Values are Pearson correlations (r). **$p < .01$ (two-tailed), *$p < .05$ (two-sided)						

Table 4. Correlation Matrix of Key Variables

As expected, purchase intention correlated with perceived credibility ($r = .36$, $p < .001$). The blockchain cue was positively associated with both (purchase intention: $r = .19$, $p = .006$; credibility: $r = .29$, $p < .001$). Trust correlated positively with purchase intention ($r = .23$) and credibility ($r = .30$; both $p < .001$). Greenwashing concerns correlated with purchase intention ($r = .22$; $p = .003$) but not with credibility ($r = .11$; $p = .148$). Product type did not correlate with outcomes but showed a small correlation with trust ($r = .16$; $p = .019$). Correlations involving greenwashing concerns are $N = 178$, others with $N = 206$. Overall, the results demonstrate important correlations between trust, transparency and how participants judged sustainability information.

One-Way ANOVA (Income)

To see whether purchase intention differs by income, a one-way ANOVA was run (Appendix 26). Levene's test was not significant ($p = .052$), so the equal-variances assumption was treated as met and therefore standard ANOVA procedures were considered appropriate. The ANOVA showed that there was no significant difference in purchase intention across the groups, $F(8, 197) = 0.97$, $p = .464$. Therefore, no post-hoc tests were conducted. The effect size was $\eta^2 = 0.038$, which means only 3.8% of differences in purchase intention can be explained through income. The results suggest that income does not play an important role here.

Two-Way ANOVA (Robustness Check)

To test robustness, a two-way ANOVA was performed with purchase intention as the dependent variable (Appendix 27). Transparency type was significant, $F(1, 202) = 6.03$, $p = .015$, $\eta^2 = 0.029$, which indicates higher purchase intention for blockchain-based transparency. Product category had no effect ($F(1, 202) = 0.01$, $p = .942$) and there was no interaction with transparency type ($F(1, 202) = 2.64$, $p = .106$). Levene's test was not significant based on the

mean (p = .056). The results were therefore considered robust, and support those for H1 and the not significant moderation for H3.

A two-way ANOVA was further conducted with perceived credibility as the dependent variable (Appendix 27). The results showed significance for transparency type ($F(1, 202) = 16.51$, $p < .001$, $\eta^2 = 0.076$), with blockchain-based transparency leading to higher perceived credibility. There was no effect for product category ($F(1, 202) = 0.03$, p = .866), and no interaction was found between transparency type and product category ($F(1, 202) = 1.93$, p = .166). Levene's test based on the mean was significant (p = .035), which indicates unequal variances. Given the nearly equal group sizes (N = 85-121), the ANOVA is considered robust (Tabachnick & Fidell, 2013). These results confirm the t-test for H2 and the not significant moderation for H4.

A Priori Power Analysis (G*Power 3.1)

An a priori power analysis was conducted in G*Power 3.1 to determine the required sample size (Faul et al., 2009). Cohen (1988, p.40) considered d = 0.20 as small and d = 0.50 as medium, therefore a small to medium effect d = 0.35 was chosen. Target power of 0.80 was used (Cohen, 1988). Based on d = 0.35, α = 0.05 and power = 0.80, the required total sample size was N = 260 (Appendix 28). The achieved sample (N = 206) was slightly smaller, so interpretation focuses on effects in the medium range or larger, consistent with the fact that statistical power increases with effect size for fixed α and N (Faul et al., 2009).

5.6 Summary and Overview

The results of this study revealed four main findings. First, blockchain-based transparency significantly increased purchase intention and perceived credibility compared to traditional sustainability labels. Second, product category did not change the effects. For purchase intention, milk was slightly higher than day cream under blockchain, but the interaction was not significant and for credibility there was no reliable interaction. Third, trust in sustainability labels and greenwashing concerns matter, but did not mediate. Trust in sustainability labels was positively related to purchase intention and credibility. Greenwashing concerns were positively related to purchase intention, but not to credibility. In all cases, the indirect effects were not significant. Finally, the patterns are consistent across checks. Correlations show positive links among trust, credibility and the blockchain cue. Additional tests showed that income did not significantly impact purchase intention.

6. Conclusions and Implications

6.1 Main Findings and Conclusions

This thesis investigated the role of blockchain-based transparency (QR cue), compared to traditional sustainability labels, on purchase intention and perceived credibility for unbranded retail products (milk versus day cream). Two rounds of exploratory interviews helped to develop the stimuli and survey questionnaire. For testing with 206 valid responses, SPSS, including the PROCESS macro (Hayes, 2022), was used.

RQ1. Does blockchain-based transparency, compared with a traditional sustainability label, increase (a) purchase intention and (b) the perceived credibility of sustainability information?

Yes, H1 and H2 are supported. Participants exposed to the blockchain cue reported (a) higher purchase intention (M = 3.57 versus 3.15; p = .006; d = 0.39) and (b) higher perceived credibility (M = 3.82 versus 3.32; p < .001; d = 0.61). These findings align with literature showing that consumers often judge information based on heuristics and surface features rather than deep verification (Metzger & Flanagin, 2013). People relied on the blockchain cue more, which makes this transparency type the stronger heuristic in this experiment. Also, source credibility shapes message persuasiveness (Lowry et al., 2013) and, consistent with viewing credibility as a receiver judgment (Rieh & Danielson, 2007), the blockchain cue appears to have functioned as a verifiability signal, increasing perceived credibility and, in turn, purchase intention. It was evident that more concrete product details enhance the effect of a label (Bălan, 2021) and that this study on unbranded products reached similar conclusions of blockchain-based traceability raising purchase intentions (Huang et al., 2025; Treiblmaier & Garaus, 2022). Since the same results were found for unbranded products, transparent information appears to be effective beyond the brand context. Consistent with concerns that overwhelming messages may have a negative impact (Shahrin et al., 2017), the manipulation check indicated that 99% recognized the blockchain condition, which suggests the blockchain scenario was clear rather than overwhelming. In line with Cook et al. (2023), who call for more evidence on consumer segments, a one-way ANOVA indicated that purchase intention did not differ by income, implying the observed effect was not driven by income differences.

RQ2. Does product category (food versus skincare) moderate the relationship between blockchain-based transparency and (a) purchase intention and (b) the perceived credibility of sustainability information?

No, H3 and H4 are not supported. For (a) purchase intention, there was a small trend toward a stronger blockchain effect for milk (M = 3.67) than day cream (M = 3.43), but the interaction was not significant. The effect was also not significant for (b) credibility. These results contribute to the existing literature, as traceability is considered very important for products such as milk (Treiblmaier & Garaus, 2022), whereas skincare often relies on brand awareness (Chu, 2020). The blockchain effect was significant for unbranded products, suggesting that the main advantage derives from the transparency format rather than the product category.

RQ3. Does trust in sustainability labels mediate the effect of blockchain-based transparency on (a) purchase intention and (b) the perceived credibility of sustainability information?

No, H5 and H6 are not supported. Trust was positively related to (a) purchase intention (b = 0.249, p = .002) and (b) perceived credibility (b = 0.239, p <.001), but it did not mediate. This is consistent with research that label trust can function as a heuristic that facilitates credibility judgements (Metzger & Flanagin, 2013; Lowry et al., 2013; Rieh & Danielson, 2007). With trust included, the direct effect of the blockchain cue decreased for (a) purchase intention (from b = 0.420 to b = 0.362) and for (b) perceived credibility (b = 0.494 to b = 0.438), while bootstrapped indirect effects had 95% CIs including zero, indicating no mediation. This is consistent with the study design, as trust was measured as a general belief prior to exposure, while credibility is a situational assessment after exposure. The blockchain cue can therefore act as a verification that affects credibility directly without changing trust in labels (Rieh & Danielson, 2007; Lowry et al., 2013). Referring to Baron & Kenny (1986), blockchain raised trust marginally (b = 0.236, p = .091) and did not reduce the second mediator greenwashing concerns (b = -0.096, p = .390), so the path was not significant and the conditions for mediation were not met. Note that the PROCESS models used a reduced sample (N = 178) due to missing greenwashing awareness, which lowers power and made the direct effect on purchase intention appear weaker than in H1.

RQ4. Do greenwashing concerns mediate the effect of blockchain-based transparency on (a) purchase intention and (b) the perceived credibility of sustainability information?

No, H7 and H8 are not supported. Concerns were positively related to (a) purchase intention (b = 0.332, p = .002) but not (b) perceived credibility (b = 0.138, p = .088). They did not statistically mediate the effect of the blockchain cue. With greenwashing concerns included, the direct effect of the blockchain cue decreased for (a) purchase intention (from b = 0.420 to b = 0.324) and for (b) perceived credibility (b = 0.494 to b = 0.406), while bootstrapped indirect

effects hat 95% CIs including zero, indicating no mediation. This matches the way the study was designed, because concerns were measured before exposure as a general belief, whereas credibility is a judgement after exposure. According to the literature, there is no evidence that greater transparency in blockchain technology leads to fewer greenwashing concerns (Montero-Navarro et al., 2021; Organisation for Economic Co-operation and Development Digital Economy Papers, 2025; Trudel, 2018).

The exploratory interviews guided the study, confirmed the choice of categories and gave feedback on the comprehensibility of the blockchain stimuli. Overall, blockchain-based transparency increased perceived credibility and purchase intention, but the moderating and mediating effects were not significant. The findings address the attitude-behavior gap (Bar Am & Noble, 2023; Park & Lin, 2018) by demonstrating that clearer, verifiable information can move intentions in a positive direction.

6.2 Theoretical Implications

This study confirms that blockchain-based transparency with concrete details can strengthen purchase intention and perceived credibility compared to traditional labels (Huang et al., 2025; Treiblmaier & Garaus, 2022; Bălan, 2021). At the same time, four hypotheses were not supported, opening space for further theory development.

First, product category did not moderate the effects. Theory should explore more product categories beyond dairy and skincare to specify when moderating effects apply. Involvement is an important factor to consider in future studies (Kuenzel & Musters, 2007; Chu, 2020). Because the stimuli were unbranded (to focus on the transparency format), theory should investigate how brand awareness influences blockchain-based transparency and compare branded with unbranded products (building on Sangal et al., 2024). Since trust in sustainability labels and greenwashing concerns were measured as general beliefs prior to the presentation, future work should measure them after the presentation to test H5-H8 more accurately. This helps to determine whether the missing mediation is due to measurement timing or whether blockchain cues have effects independent of general beliefs. Another conclusion is to investigate more blockchain formats. Prior work shows that knowledge and label design shape trust (Cook et al., 2023). Future studies should compare different blockchain scenarios, including depth of detail, third-party verification, ingredient and origin data, plus usability of the QR code cue to identify which information consumers value most (adding to Bălan, 2021; Sangal et al., 2024). Lastly, purchase intention and perceived credibility were measured with

single items and the a priori G*Power analysis for a medium effect ($d = 0.35$; $\alpha = 0.05$; power = 0.80) indicated $N = 260$, whereas this sample was $N = 206$. These features lower power for detecting small indirect effects. Future survey experiments should collect more responses and include multi-item measures.

6.3 Managerial Implications

When planning sustainable communication strategies, retailers and producers should consider the positive effects of blockchain-based transparency. The results of the interviews and previous work show that food and cosmetic products are among the categories where traceability is important (Sangal et al., 2024; Treiblmaier & Garaus, 2022; World Health Organization, 2024). Although no moderating effect by category was found, the results suggest that transparency helps across categories, as dairy showed a higher mean without a significant interaction. In practice, this calls for testing more categories and products in real retail settings. Implementation can, in addition, be slow, because of technical and practical barriers (Puthal et al., 2018; Sander et al., 2018). Firms should address these issues to improve systems (Susnjara & Smalley, 2021), which can include clearer cost calculations or small pilot projects that present information clearly to prevent overload. Furthermore, Jacobs (2020), Raddatz et al. (2023) and Sumpf (2017) list factors from the user's perspective that affect awareness, motivation, and perceived stability of the system. Companies should therefore emphasize the benefits, provide instructions, and design motivating user experiences. The way information is shown matters as well. Cook et al. (2023) show that label design shapes trust. In this study's survey, a simple design with a short call to action to scan the QR code accompanied the blockchain cue and led to higher purchase intention and credibility. Managers should use simple language, present key facts clearly and experiment with different types of blockchain cues other than QR codes. Lastly, consumer groups may respond differently. According to Cook et al. (2023), companies should study specific groups in real store settings and compare designs, the depth of information provided and the framing of messages.

7. Limitations and Further Research

7.1 Limitations

As with any study, there are limitations to consider. The budget was the first and biggest constraint. Research shows that financial incentives can increase participation rates (Singer & Ye, 2012). A larger budget would therefore have made recruitment easier. However, higher participation does not automatically make the sample representative. Time was the second major limitation. A longer survey period would have allowed more responses and provided more scope for field testing and further stimuli. The sample was further demographically limited. Around 80% of participants were aged 18-34. Older target groups were hardly represented. They may use QR codes less or not want to use a smartphone in the supermarket. Regarding demographics, income was collected in broad categories, which means that subtle differences in spending behavior cannot be reliably verified.

Recruitment used convenience sampling through social media. The results therefore do not allow any conclusions about the population. The survey, like the recruitment, was conducted online. It measured intentions and evaluations rather than actual purchasing behavior. A real supermarket setting could cause different responses. The study used neutral, unbranded products and a blockchain design that did not display prices. This isolated the effect of transparency, but limits the transferability to branded products, price contexts and other transparency formats. The measurement of constructs was kept short. This reduces survey fatigue but may limit the accuracy of the measurements. All variables were recorded in the same questionnaire, which can lead to common response tendencies. Randomization mitigates this but does not prevent it completely. Another point concerns the timing of the mediator variables. Trust in labels and greenwashing concerns were measured before exposure. They therefore describe basic beliefs and associations but need to be further investigated for a clear mediation. The dependent variables were measured with one item for efficiency and less ambiguity (Allen et al., 2022). As a result, effects reflect responses to that specific item wording. Single-item DVs are typically less reliable, which can lower observed effects, especially indirect (mediated) effects (Allen et al., 2022). In addition, the mediation analyses used a reduced sample ($N = 178$) due to missing responses, which further lowers power to detect small indirect paths. The achieved $N = 206$ was below the a priori result ($N = 260$ for $d = 0.35$, $\alpha = 0.05$, power = 0.80, see Appendix 28), which also limits sensitivity. Finally, the study did not focus on individual markets and welcomed all nationalities. However, countries, infrastructure and digital habits differ, which may influence the extent to which QR-based transparency is adopted.

7.2 Further Research

Future quantitative studies should set clearer demographic targets. Age groups should be balanced and income measured with finer categories. In this study, income did not explain purchase intention, but finer scales and larger samples could allow a more precise test. Studies should also focus on specific countries. The United States, Sweden and Singapore score highest on the United Nations Conference on Trade and Development's readiness index for frontier technologies such as blockchain. Therefore, adoption may be more feasible in these contexts, although policy and investment still matter (United Nations Conference on Trade and Development, 2023).

Experiments should take place in real supermarket environments or realistic shopping simulations. This would show how people act at the shelf and whether they scan a code, read the page and still choose the product. The current survey was useful but was limited to a hypothetical scenario. Additionally, more product categories should be tested. It is also important to compare branded and unbranded products. Different blockchain designs should be tried, which includes different levels of detail, third-party certificates and clearer QR code information. The goal is to see which combination consumers understand fastest and trust most and whether that changes credibility and purchase intention.

Future studies should also measure mediators after exposure and longer studies could track changes over time. Value would be added if surveys are linked with simple behavioral measures, such as scan rates or sales. Finally, future studies should use multi-item measures for purchase intention and credibility and aim for larger sample sizes to avoid missing data in PROCESS mediation analyses.

Appendices

Appendix 1. In-depth Exploratory Interview Guide with Results

Participants: three female and two male participants, aged 24 to 57 (to capture a variety of perspectives on general knowledge and behavior).

Duration and Location: between seven and twenty minutes, conducted in person or via a WhatsApp call, depending on each participant's availability.

Introduction

Thank you for participating in this interview. I am researching how people perceive sustainable products and new technologies such as blockchain that can help improve transparency and trust. There are no right or wrong answers. I am interested in your personal views and experiences.

Trust in sustainability labels and greenwashing

1. Do you look for sustainability labels on products when shopping? If so, which ones do you trust the most and why?

Result: Most participants pay attention to sustainability labels, especially for imported or critical products. Fairtrade is the most mentioned label.

2. Have you ever been unsure or skeptical about whether a product is as sustainable as the company or packaging claims?

Result: All interviewees have experienced doubts or skepticism about the credibility of sustainability.

3. Have you ever heard of the term greenwashing? (Explanation: when companies provide misleading information about the environmental friendliness of their products.)

Result: Almost everyone has heard of greenwashing and associates it with misleading claims by companies.

4. Have concerns about greenwashing ever influenced your decision to buy something, or your decision not to buy something?

Result: Some participants admitted that greenwashing has influenced their purchase decisions, though others said it had no impact.

Perception of blockchain-based transparency

5. Have you ever heard of blockchain technology?

Explanation: Blockchain is a digital tool that records every step a product takes so that the information cannot be changed later. It helps to make product information more trustworthy.

Result: Only one participant had a detailed understanding of blockchain technology, most needed an explanation.

6. Imagine you could scan a QR code on a product and see verified information about where it came from and how it was made. Would that make the product seem more trustworthy to you?

Result: All interviewees agreed that verified QR-code-based blockchain info would increase product trust.

7. Would you say that this type of information makes sustainability claims more credible?

Result: All participants agreed that verified blockchain information would enhance the credibility of sustainability claims.

8. What kind of information would you need to be sure that a product is truly sustainable and transparent?

Result: Participants want clear but not excessive information. Key points include energy use, origin and transport. Too much info can be overwhelming.

Influence of product category and trust factors

9. In your opinion, for which types of products is transparency important in a supermarket?

Result: Transparency is seen as especially important for animal products and food. Cosmetics and hygiene items are also mentioned.

10. Do you think your trust in sustainability information would change depending on the type of product (e.g. food versus skincare)?

Result: Most trust sustainability info more for food products than for non-food; credibility is product dependent.

11. Would you be more likely to buy a product if it had blockchain-based transparency? Would you be more likely to buy it than a product with a traditional label?

Result: Most participants would prefer blockchain-based transparency, if established and user-friendly.

12. Would you pay a higher price for a product with blockchain-based transparency?

Result: Willingness to pay more exists but limited by personal budget and price difference. A small premium is acceptable.

Conclusion

13. What would have to happen for you to fully trust a blockchain-based transparency system in retail?

Result: Participants want clear, simple access to verified info. Trust depends on independent verification and easy implementation.

14. Would you like to add anything else on this topic or do you have any questions?

Result: Few had additional comments. One asked about future real-world applications of blockchain.

Thank you very much for your participation.

Appendix 2. Pilot-Survey with Results

Participants: sixteen participants of different ages and genders.

For Questions and Response Options from Q1-Q31, see Appendix 4: Main Survey. Evaluation contains Q32-Q41.

Random assignment in the pilot survey:

(1) Dairy product - Traditional Sustainability Label

(2) Skincare product - Traditional Sustainability Label

(3) Skincare product - Blockchain-Based Transparency (QR Code & Label Information)

(4) Dairy product - Blockchain-Based Transparency (QR Code & Label Information)

Each participant will be shown an image of a product from one of these four conditions. (1)(

(1) (2) (3) (4)

Thank you for completing the pre-survey! As part of the testing phase, I would appreciate your feedback to help me improve the final version of this survey.

Please take a moment to answer the following questions about your experience.

Please try to answer based on what you remember from the image (there are no right or wrong answers).

Q32 Which image did you get to see?

- Milk with Blockchain QR-Code
- Milk with EU Organic Certification label
- Skincare product with Blockchain QR-Code
- Skincare product with EU Organic Certification label
- I don’t remember

Result: Milk with Blockchain (x7), Milk with Organic Label (x3), Skincare with Blockchain (x4), Skincare with Organic Label (x2)

Q33 Was the image clear and easy to understand?

X

- Yes
- If no, please explain briefly: __

Result: Yes (x14), No (1): "Was not able to scan the QR Code", No (1): no further comment

Q34 Did the product seem sustainable?

- Yes
- If no, please explain briefly: __

Result: Yes (x13), No (3): reasons included unclear QR info, only one label shown, plastic packaging

Q35 Any quick thoughts or feedback on the image?

Open text field: ___

Result: Mostly positive: 13x "-", other comments included "clear and straightforward information", "love it", "nice aesthetic"

Q36 Did you experience any technical issues (e.g. loading problems, images, layout)?

- No
- If yes, please explain briefly: __

Result: No (x14), Yes (x2) - no specific reasons given

Q37 Was the survey overall easy to understand?

- Yes
- If no, please explain briefly: __

Result: Yes (x14), No (x2) - no specific reasons given

Q38 Were there any questions that felt confusing, illogical, or redundant?

- No
- If yes, please explain briefly: __

Result: No (x11), Yes (x3): Issues mentioned included missing skincare reference, QR info not visible, one unclear skincare question; 2x no answer

Q39 How did you perceive the survey length?

- Too short
- Just right
- Too long

Result: Just right (x16)

Q40 How clear were the instructions and answer options?

- Very clear
- Mostly clear
- Not very clear

Result: Very clear (x10), Mostly clear (x6)

Q41 Do you have any other comments or suggestions?

Open text field: __

Result: No further suggestions (x15), one said “going to be good”

Thank you for your time spent taking this survey.

Your response has been recorded.

Appendix 3. Follow-Up Interview Guide with Results

Participants: two male and three female participants, aged between 23 and 27.

Duration and Location: the conversations lasted between five and ten minutes, conducted in WhatsApp.

Thank you for your time. I am currently testing a product image that displays blockchain-based sustainability information for supermarket products. Blockchain is a digital system that securely documents all steps in a product’s journey, so that the information cannot be changed. I would like to hear your opinion on whether this looks realistic and whether the information displayed would be useful to you as a buyer.

1. Does the display (label + QR code + information) look realistic to you for a product in a supermarket?

Result: Most found the presentation realistic and visually appealing. Some noted that in real life the QR code would usually be placed less prominently. One participant said the term ‘blockchain’ felt unfamiliar, making it seem less authentic at first glance.

2. Is the information behind the QR code understandable and helpful?

Result: All interviewees found the info clear and easy to follow. The visuals and structure were positively highlighted. Some asked for slightly more detail to better understand the logistics chain and storage conditions.

3. Is there any information missing or that you would expect to see?

Result: Most felt the essential info was present. Some would like more transparency on intermediate steps, especially during transport or storage. One wanted farm details (e.g. number of cows), others asked for more verification indicators.

4. Is there anything that doesn't seem genuine or that could be improved?

Result: Overall, the info seemed trustworthy. Some suggested adjusting the timing and positioning of logistics data. The term 'blockchain' was considered technical and unclear to some and one person recommended softening the tech-language presentation.

Appendix 4. Main Survey

Dear Participant,

Thank you for taking the time to participate in this survey. This survey is part of my master's thesis and investigates how people perceive information on product packaging in a shopping context. It will take approximately 6-7 minutes to complete and there are no right or wrong answers, I'm simply interested in your honest opinion.

All responses are anonymous and confidential and will be used solely for academic research purposes. If you have any questions, feel free to contact me at: s-mobermeier@ucp.pt

Please tick the box below to confirm your consent and begin the survey.

- I agree to participate

Section 1

This section includes a few questions about your personal habits and lifestyle. Please remember there are no right or wrong answers.

Q1 How environmentally sustainable would you say your lifestyle is?

- Not sustainable at all
- Slightly sustainable
- Moderately sustainable
- Very sustainable
- Highly sustainable

Q2 When buying products at the supermarket, how sustainable are your choices?

- Not sustainable at all
- Slightly sustainable
- Moderately sustainable
- Very sustainable

- Highly sustainable

Q3 How often do you check for sustainability labels or product-related sustainability information before buying a product?

- Never
- Rarely
- Sometimes
- Often
- Always

Q4 How much do you trust sustainability labels on products?

- Not at all
- Slightly
- Somewhat
- Mostly
- Completely

Q5 To what extent do you agree with the following statement: "I trust traditional sustainability labels such as organic or eco-labels when evaluating a product's sustainability."

- Strongly disagree
- Slightly disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

Q6 Have you heard of the term 'Greenwashing' before?

- No • I'm not sure • Yes

END OF BLOCK IF "NO" / "I'M NOT SURE" IS SELECTED

Q7 How concerned are you personally about greenwashing in sustainability labels or claims on products?

- Not at all concerned
- Slightly concerned
- Moderately concerned
- Very concerned
- Extremely concerned

Q8 To what extent do you agree with the following statement: "The risk of greenwashing makes it harder for me to trust sustainability labels on products."

- Strongly disagree
- Slightly disagree
- Neither agree nor disagree

- Somewhat agree
- Strongly agree

Section 2

The following two questions are about Blockchain-based Transparency.

Blockchain is a digital tool that stores information securely and transparently, and that cannot be changed afterwards. It helps track a product's complete journey from production to the store.

Q9 Have you heard of Blockchain Technology before?

- No
- I'm not sure
- Yes

Q10 Do you think blockchain technology can increase transparency in product sustainability?

- Not at all
- Slightly
- Somewhat
- Mostly
- Completely

Section 3

Now imagine you are shopping in a supermarket and considering buying the following product. Please take a moment to look at the product image carefully. Afterward, you will be asked a few short questions about your impression. You can continue after 10 seconds.

Random assignment:

(1) Dairy product - Traditional Sustainability Label

(2) Skincare product - Traditional Sustainability Label

(3) Dairy product - With Blockchain-Based Transparency (QR Code & Label Information)

(4) Skincare product - With Blockchain-Based Transparency (QR Code & Label Information)

(1)

(2)

(3) (4)

Q15 What type of information was shown on the product?

- QR Code (Blockchain)
- Sustainability Label (e.g., EU Organic)
- I don't know / I didn't notice

Q16 Please indicate your ratings for the following statements:

Q17-Q24 were measured on a 5-point Likert scale with:1 = Strongly disagree, 2 = Slightly disagree, 3 = Neither agree nor disagree, 4 = Somewhat agree, 5 = Strongly agree.

Q17 I buy this type of product frequently.

Q18 I perceive this product as sustainable.

Q19 The information presented on the product enhanced my perception of its sustainability.

Q20 The sustainability information shown on the product is credible.

Q21 The transparency information on the product makes me more likely to purchase it.

Q22 The information shown on the product helped me understand its sustainability impact.

Q23 The way sustainability information was presented made it easy to understand how trustworthy the product really is.

Q24 I am willing to pay more for this product because of the provided transparency.

Section 4

Q25 Which factor influences your purchase decision the most?

- Price • Brand • Sustainability information • Ingredients / Composition
- Innovation • Other:__

Q26 How important is product transparency to you when purchasing dairy products?

- Not at all important
- Slightly important
- Moderately important
- Very important
- Extremely important

Q27 How important is product transparency to you when purchasing skincare products?

- Not at all important
- Slightly important
- Moderately important
- Very important
- Extremely important

Section 5

You are almost done! I would now like to ask you for some information about yourself to better understand the survey results.

Q28 Please indicate your gender.

- Female • Male • Non-binary / third gender • Prefer not to say

Q29 Please indicate your age (in years).

- <18 • 18-24 • 25-34 • 35-44 • 45-54 • 55-64 • >65

Q30 Please indicate your occupation.

- Student • Student and working part-time • Unemployed • Employed
- Retired • Prefer not to answer • Other:__

Q31 Please indicate the amount of your monthly gross income (before taxes and deductions).

- No income • Less than 500€ • 500-999€ • 1000-1499€ • 1500-1999€
- 2000-2499€ • 2500-3000€ • More than 3000€ • Prefer not to say

Thank you for your time spent taking this survey. Your response has been recorded.

Appendix 5. Coded and Dummy Variables

Variable	Coded / Dummy Variable
Exposition to blockchain condition and product category food (milk)	Blockchain_Milk
Exposition to traditional label and product category food (milk)	Label_Milk
Exposition to blockchain condition and product category skincare (day cream)	Blockchain_Skincare
Exposition to traditional label and product category skincare (day cream)	Label_Skincare

Exposition to the text and image, page and countdown summarized	Manipulation_Group: Group 1=blockchain milk, Group 2=label milk, Group 3= blockchain day cream, Group 4= label day cream
Label type (0=label, 1=blockchain)	Label_BC
Product type (1=milk, 2= day cream)	Prod.type
Exposition to blockchain AND milk product =1, otherwise =0	Interaction_Blockchain_Milk
Mean of Q7 and Q8.	GW_Index

Appendix 6. Frequency Statistics - Demographics

Characteristic	Answer Option	Frequency / Percent	
Gender	Female	113 / 54.9	206
	Male	91 / 44.2	
	Non-Binary / Third Gender	1 / 0.5	
	Prefer not to say	1 / 0.5	
Age	<18	1 / 0.5	206
	18-24	64 / 31.1	
	25-34	101 / 49.0	
	35-44	17 / 8.3	
	45-54	15 / 7.3	
	55-64	8 / 3.9	
Occupation	Student	43 / 20.9	206
	Student + working	50 / 24.3	
	Unemployed	3 / 1.5	
	Employed	107 / 51.9	
	Retired	1 / 0.5	
	Other	2 / 1.0	
Income (monthly gross)	No income	18 / 8.7	206
	<500€	12 / 5.8	
	500-999€	24 / 11.7	
	1000-1499€	25 / 12.1	
	1500-1999€	13 / 6.3	
	2000-2499€	11 / 5.3	
	2500-3000€	16 / 7.8	
	>3000€	69 / 33.5	
	Prefer not to say	18 / 8.7	

Appendix 7. Frequency Statistics - Sustainable Behavior

Sustainable Behavior	Answer Option	Frequency / Percent	
Sustainable Lifestyle (Q1)	Not sustainable at all	5 / 2.4	206
	Slightly sustainable	49 / 23.8	
	Moderately sustainable	119 / 57.8	
	Very sustainable	32 / 15.5	
	Highly sustinable	1 / 0.5	
Sustainable Choices (Q2)	Not sustainable at all	9 / 4.4	206
	Slightly sustainable	59 / 28.6	
	Moderately sustainable	101 / 49.0	
	Very sustainable	35 / 17.0	
	Highly sustinable	2 / 1.0	
Attention to Labels (Q3)	Never	23 / 11.2	206
	Rarely	55 / 26.7	
	Sometimes	70 / 34.0	
	Often	54 / 26.2	
	Always	4 / 1.9	
Trust in Labels (Q4)	Not at all	13 / 6.3	206
	Slightly	57 / 27.7	
	Somewhat	76 / 36.9	
	Mostly	57 / 27.7	
	Completely	3 / 1.5	

Appendix 8. Frequency Statistics - Trust in Sustainability Labels Statement

“I trust traditional sustainability labels such as organic or eco-labels when evaluating a product's sustainability.” (Q5)	
	Frequency / Percent
Strongly disagree	7 / 3.4
Slightly disagree	34 / 16.5
Neither agree nor disagree	49 / 23.8
Somewhat agree	100 / 48.5
Strongly agree	16 / 7.8

Appendix 9. Frequency Statistics - Greenwashing

Greenwashing	Answer Option	Frequency / Percent	
Awareness (Q6)	No	16 / 7.8	206
	I'm not sure	12 / 5.8	
	Yes	178 / 86.4	
Concerns (Q7)	Not at all concerned	8 / 3.9	178
	Slightly concerned	40 / 19.4	
	Moderately concerned	57 / 27.7	
	Very concerned	56 / 27.2	
	Extremely concerned	17 / 8.3	
Statement (Q8)	Strongly disagree	1 / 0.5	178
	Slightly disagree	7 / 3.4	
	Neither agree nor disagree	15 / 7.3	
	Somewhat agree	86 / 41.7	
	Strongly agree	69 / 33.5	

Appendix 10. Frequency Statistics - Blockchain

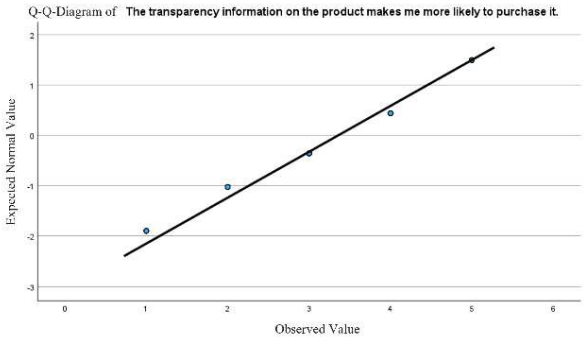
Blockchain	Answer Option	Frequency / Percent	
Awareness (Q9)	No	77 / 37.4	206
	I'm not sure	26 / 12.6	
	Yes	103 / 50.0	
Increasing Transparency (Q10)	Not at all	11 / 5.3	206
	Slightly	15 / 7.3	
	Somewhat	85 / 41.3	
	Mostly	78 / 37.9	
	Completely	17 / 8.3	

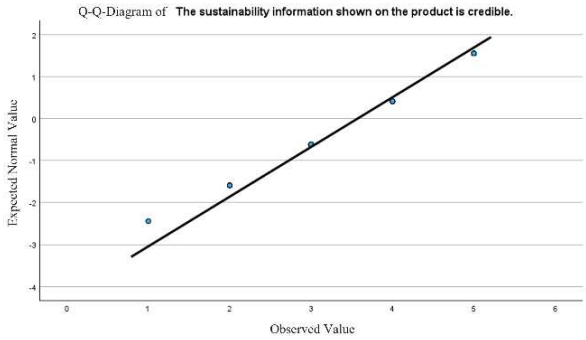
Appendix 11. Normal Distribution of Dependent Variables

Descriptives		Statistics	Standard Error
Purchase Intention (Q21)	*M*	3.36	0.077
	SD	1.099	
	Skew	-0.394	0.169
	Kurtosis	-0.673	0.337
Perceived Credibility (Q20)	*M*	3.57	0.059
	SD	0.845	
	Skew	-0.329	0.169
	Kurtosis	-0.012	0.337

Normality	Kolmogorov-Smirnov*			Shapiro-Wilk		
	Statistics	df	Significance	Statistics	df	Significance
Purchase Intention (Q21)	0.249	206	< .001	0.892	206	< .001
Perceived Credibility (Q20)	0.256	206	< .001	0.873	206	< .001
	*Significance correction according to Lilliefors					

Q-Q Diagrams:





Appendix 12. Multicollinearity

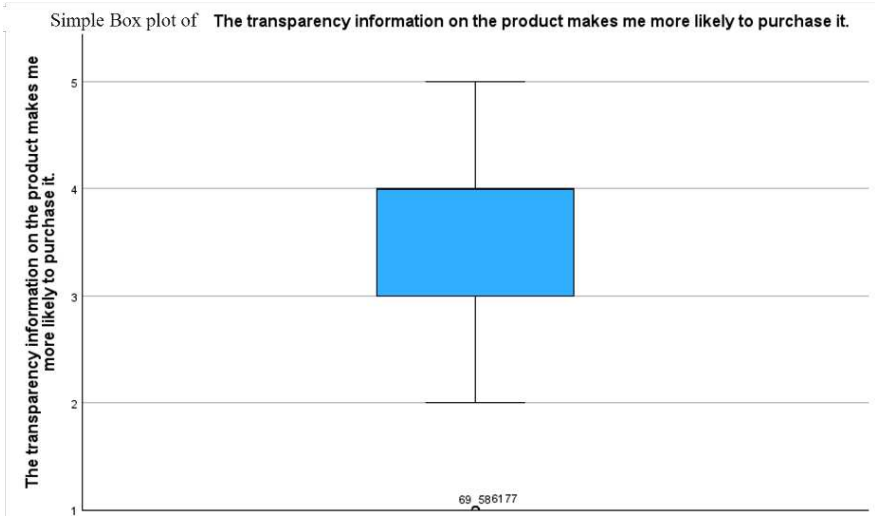
Model Purchase Intention	Collinearity Statistics	
	Tolerance	VIF
Label_BC	0.981	1.019
GW_Index	0.983	1.017
Trust in Labels	0.971	1.030

Condition Index: 15.090

Model Perceived Credibility	Collinearity Statistics	
	Tolerance	VIF
Label_BC	0.981	1.019
GW_Index	0.983	1.017
Trust in Labels	0.971	1.030

Condition Index: 15.090

Appendix 13. Outlier Detection



Appendix 14. Manipulation Check - Chi-Square-Test

Cross Tables	Block-chain	Label	I don't know	Total
Blockchain	99	4	1	104
Label	1	99	2	102
Total	100	103	3	206

Chi-Square-Test	Value	df	Two-sided *p*
Pearson-Chi-Square	183.993*	2	< .001
Valid Cases	206		
*2 cells (33.3%) have an expected frequency of less than 5. The minimum expected frequency is 1.49.			

Appendix 15. Manipulation Check - Independent Samples *t*-Tests

Variable	Blockchain (n = 104) *M*, *SD*	Label (n = 102) *M*, *SD*	*t*(df)	*p*	Cohen's *d*
Sustainable Perception (Q18)	3.42, 0.94	3.17, 0.99	-1.91(204)	.058	-0.27 95% CI [-0.54, 0.01]
Enhanced Sustainable Perception (Q19)	3.66, 1.03	3.26, 0.96	-2.87(204)	.005	-0.40 95% CI [-0.68, -0.12]
Perceived Credibility (Q20)	3.82, 0.72	3.32, 0.89	-4.37(193.86)	< .001	-0.61 95% CI [-0.89, -0.33]
Trustworthiness (Q23)	3.64, 1.00	2.64, 0.99	-7.24(204)	< .001	-1.01 95% CI [-1.30, -0.72]
Willingness to Pay (Q24)	3.00, 1.09	2.71, 1.16	-1.88(204)	.062	-0.26 95% CI [-0.54, 0.01]

Appendix 16. Hypotheses Testing H1 - Independent samples *t*-Test

Variable	Blockchain (n = 104) *M*, *SD*	Label (n = 102) *M*, *SD*	*t*(df)	*p*	Cohen's *d*
Purchase Intention (Q21)	3.57, 1.02	3.15, 1.14	-2.79(204)	.006	-0.39 95% CI [-0.66, -0.11]

Appendix 17. Hypotheses Testing H2 - Independent samples *t*-Test

Variable	Blockchain (n = 104) *M*, *SD*	Label (n = 102) *M*, *SD*	*t*(df)	*p*	Cohen's *d*
Perceived Credibility (Q20)	3.82, 0.72	3.32, 0.89	-4.37(193.86)	< .001	-0.61 95% CI [-0.89, -0.33]

Appendix 18. Hypotheses Testing H3 - Moderation Analysis (PROCESS)

Overall Model	*R*	R^2	*MSE*	*F*	df1	df2	*p*
	0.22	0.049	1.1646	3.48	3	202	.017

Interaction	Predictor	*b*	*SE*	*t*	p	95% CI
	X*W	-0.50	0.31	-1.63	.106	[-1.10, 0.11]

X*W	ΔR^2	*F*	df1	df2	*p*
	0.012	2.64	1	202	.106

Unstandardized coefficients, N = 206, Y: Purchase Intention, X: Label_BC, W: Prod.Type

Appendix 19. Hypotheses Testing H4 - Moderation Analysis (PROCESS)

Overall Model	*R*	R^2	*MSE*	*F*	df1	df2	*p*
	0.31	0.095	0.6562	7.04	3	202	< .001

Interaction	Predictor	*b*	*SE*	*t*	p	95% CI
	X*W	-0.32	0.23	-1.39	.166	[-0.77, 0.13]

X*W	ΔR^2	*F*	df1	df2	*p*
	0.009	1.93	1	202	.166

Unstandardized coefficients, N = 206, Y: Perceived Credibility, X: Label_BC, W: Prod.Type

Appendix 20. Hypotheses Testing H5 - Multiple Linear Regression Analysis

Model (SPSS)	Path	Outcome	Predictor	*b*	*SE*	*t*	*p*	R^2
Regression 1	a	Trust (M)	Blockchain (X)	0.235	0.128	1.83	.069	0.016
Regression 2	c	Purchase Intention (Y)	Blockchain (X)	0.420	0.151	2.79	.006	0.037
Regression 3	b	Purchase Intention (Y)	Trust (M)	0.249	0.080	3.09	.002	0.080
	c′	Purchase Intention (Y)	Blockchain (X)	0.362	0.149	2.43	.016	

Unstandardized coefficients, $N = 206$, $R^2 = 0.080$ (Regression 3) refers to the whole model with X and M

Appendix 21. Hypotheses Testing H6 - Multiple Linear Regression Analysis

Model (SPSS)	Path	Outcome	Predictor	*b*	*SE*	*t*	*p*	R^2
Regression 1	a	Trust (M)	Blockchain (X)	0.235	0.128	1.83	.069	0.016
Regression 2	c	Perceived Credibility (Y)	Blockchain (X)	0.494	0.113	4.37	< .001	0.086
Regression 3	b	Perceived Credibility (Y)	Trust (M)	0.239	0.059	4.034	< .001	0.154
	c′	Perceived Credibility (Y)	Blockchain (X)	0.438	0.110	3.99	< .001	

Unstandardized coefficients, $N = 206$, $R^2 = 0.154$ (Regression 3) refers to the whole model with X and M

Appendix 22. Hypotheses Testing H7 - Multiple Linear Regression Analysis

Model (SPSS)	Path	Outcome	Predictor	*b*	*SE*	*t*	*p*	R^2
Regression 1	a	GW_Index (M)	Blockchain (X)	-0.096	0.111	-0.86	.390	0.004
Regression 2	c	Purchase Intention (Y)	Blockchain (X)	0.420	0.151	2.79	.006	0.037
Regression 3	b	Purchase Intention (Y)	GW_Index (M)	0.332	0.106	3.12	.002	0.070
	c′	Purchase Intention (Y)	Blockchain (X)	0.324	0.157	2.07	.040	

Unstandardized coefficients, $N = 178$ (GW_Index), otherwise $N = 206$, $R^2 = 0.070$ (Regression 3) refers to the whole model with X and M

Appendix 23. Hypotheses Testing H8 - Multiple Linear Regression Analysis

Model (SPSS)	Path	Outcome	Predictor	*b*	*SE*	*t*	*p*	R^2
Regression 1	a	GW_Index (M)	Blockchain (X)	-0.096	0.111	-0.86	.390	0.004
Regression 2	c	Perceived Credibility (Y)	Blockchain (X)	0.494	0.113	4.37	< .001	0.086
Regression 3	b	Perceived Credibility (Y)	GW_Index (M)	0.138	0.081	1.71	.088	0.074
	c′	Perceived Credibility (Y)	Blockchain (X)	0.406	0.119	3.41	< .001	

Unstandardized coefficients, $N = 178$ (GW_Index), otherwise $N = 206$, $R^2 = 0.074$ (Regression 3) refers to the whole model with X and M

Appendix 24. Parallel Mediation Analysis on Purchase Intention (PROCESS)

	R	R^2	*MSE*	*F*	df1	df2	*p*
Trust	0.127	0.016	0.855	2.90	1	176	.091

	Predictor	*b*	*SE*	*t*	*p*	95% CI
	X → M1	0.236	0.139	1.702	.091	[-0.04, 0.51]

	R	R^2	*MSE*	*F*	df1	df2	*p*
GW_Index	0.065	0.004	0.547	0.74	1	176	.390

	Predictor	*b*	*SE*	*t*	*p*	95% CI
	X → M2	-0.096	0.111	-0.862	.390	[-0.31, 0.12]

	R	R^2	*MSE*	*F*	df1	df2	*p*
Purchase Intention	0.360	0.130	1.026	8.60	3	174	< .001

	Predictor	*b*	*SE*	*t*	*p*	95% CI
	X	0.261	0.153	1.700	.091	[-0.04, 0.56]
	M1	0.285	0.083	3.428	< .001	[0.12, 0.45]
	M2	0.373	0.104	3.587	< .001	[0.17, 0.58]

	Effect	*SE*	*t*	*p*	95% CI
Direct Effect X on Y	0.261	0.153	1.700	.091	[-0.04, 0.56]

		Effect	Boot*SE*	Boot 95% CI
Indirect Effect X on Y	TOTAL	0.032	0.059	[-0.09, 0.15]
	Trust	0.067	0.045	[-0.01, 0.16]
	GW_Index	-0.036	0.045	[-0.14, 0.04]

Unstandardized coefficients, $N = 178$, Y: Purchase Intention, M1: Trust, M2: GW_Index, X: Label_BC, Indirect effects are percentile bootstrap estimates based on 5,000 samples, confidence intervals that include zero indicate a nonsignificant indirect effect.

Appendix 25. Mediation Analysis on Perceived Credibility (PROCESS)

	R	R^2	*MSE*	*F*	df1	df2	*p*
Trust	0.127	0.016	0.855	2.90	1	176	.091

	Predictor	*b*	*SE*	*t*	*p*	95% CI
	X → M1	0.236	0.139	1.702	.091	[-0.04, 0.51]

GW_Index	*R*	R^2	*MSE*	*F*	df1	df2	*p*
	0.065	0.004	0.547	0.742	1	176	.390

	Predictor	*b*	*SE*	*t*	*p*	95% CI
	X → M2	-0.096	0.111	-0.862	.390	[-0.31, 0.12]

Perceived Credibility	*R*	R^2	*MSE*	*F*	df1	df2	*p*
	0.406	0.165	0.569	11.48	3	174	< .001

	Predictor	*b*	*SE*	*t*	*p*	95% CI
	X	0.346	0.114	3.033	.003	[0.12, 0.57]
	M1	0.271	0.062	4.37	< .001	[0.15, 0.39]
	M2	0.177	0.77	2.29	.023	[0.02, 0.33]

Direct Effect X on Y	Effect	*SE*	*t*	*p*	95% CI
	0.346	0.114	3.033	.003	[0.12, 0.57]

Indirect Effect X on Y		Effect	Boot*SE*	Boot 95% CI
	TOTAL	0.047	0.045	[-0.04, 0.14]
	Trust	0.06	0.039	[-0.01, 0.15]
	GW_Index	-0.017	0.025	[-0.08, 0.02]

Unstandardized coefficients, $N = 178$, Y: Perceived Credibility, M1: Trust, M2: GW_Index, X: Label_BC, Indirect effects are percentile bootstrap estimates based on 5,000 samples, confidence intervals that include zero indicate a nonsignificant indirect effect.

Appendix 26. One-Way ANOVA (Income)

Statistic	Levene-statistic	df1	df2	*p*
Levene's test (based on *M*)	1.971	8	197	.052

ANOVA	Sum of Squares	df	*M* of Squares	*F*	*p*
Between groups	9.34	8	1.17	0.97	.464
Within groups	238.08	197	1.21		
Total	247.42	205			

ANOVA Effect sizes	Estimation	95% CI
η^2 (eta squared)	0.038	[0.00, 0.61]
ε^2 (epsilon squared)	-0.001	[-0.04, 0.02]
ω^2 (omega, fixed)	-0.001	[-0.04, 0.02]
ω^2 (omega, random)	0.000	[-0.01, 0.00]

Negative but less distorted estimates are retained, not rounded up to zero, Eta-squared and epsilon-squared are estimated based on the fixed effects model.

Appendix 27. Two-Way ANOVA (Robustness Check)

Dependent Variable	Effect	F (1, 202)	p	Partial η^2
Purchase Intention	Transparency Type	6.03	.015	0.029
	Product Category	0.01	.942	0.000
	Interaction	2.64	.106	0.013
Perceived Credibility	Transparency Type	16.51	< .001	0.076
	Product Category	0.03	.866	0.000
	Interaction	1.93	.166	0.009

Purchase Intention:

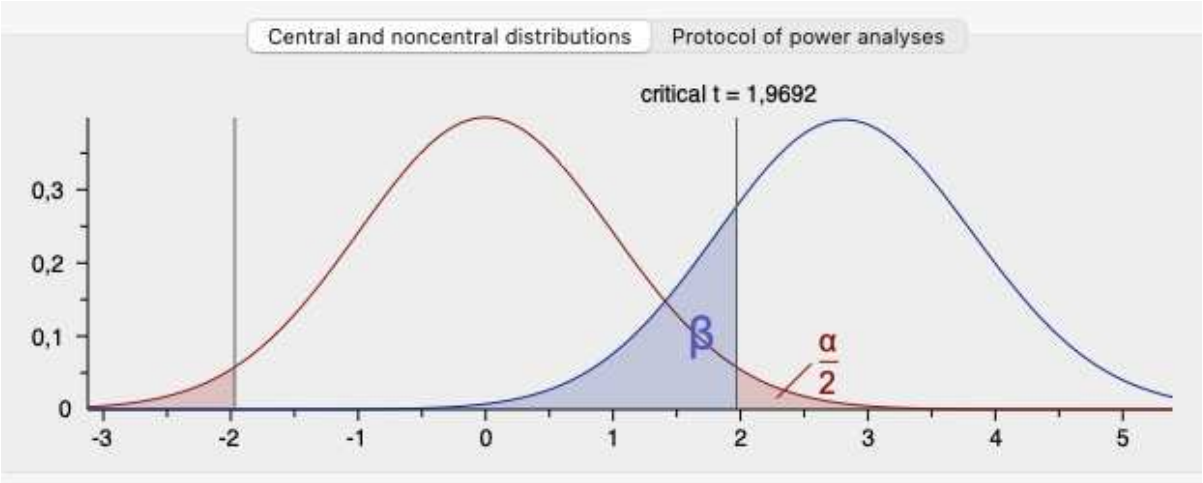
	Levene Statistic	df1	df2	Sig.
Based on Mean	2.559	3	202	.056

Perceived Credibility:

	Levene Statistic	df1	df2	Sig.
Based on Mean	2.925	3	202	.035

Design: Intercept + Label_BC + prod.type + Label_BC*prod.type

Appendix 28. A Priori Power Analysis (G*Power 3.1)



Output Parameters	Noncentrality Parameter	Critical t	Df	Sample Size Group 1	Sample Size Group 2	Total Sample Size	Actual Power
Value	2,8217902	1,9692014	258	130	130	260	0,8027017

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