


## Article

# Sustainability Transparency and Trustworthiness of Traditional and Blockchain Ecolabels: A Comparison of Generations X and Y Consumers

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**Abstract:** Consumers and professionals realize the importance of adopting social and environmental responsibility, but it is not easy for companies to implement transparent sustainability strategies that consumers can trust. Thus, it is often hard for consumers to compare brands to make conscious sustainability decisions. Blockchain technology is proposed as a bridge between ecolabels and industry initiatives as this technology provides the transparency of sustainable business practices. The objective of this study is to examine the effects of effectiveness, knowledge of the sustainability initiative, and trust in claims made by a company in ecolabels (i.e., traditional and blockchain ecolabels) on intention to buy products by comparing Generations X and Y. A total of 200 participants completed the survey. The results indicated that both the trust and knowledge measures were higher for the blockchain label than for the traditional ecolabel for Generation Y. Thus, the companies should determine how to effectively integrate this technology to the mutual benefit of the retailer and consumer by different generations.

**Keywords:** blockchain; sustainability; ecolabel; fashion consumers; stimulus-organism-response model; generations



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## 1. Introduction

Sustainability initiatives have seen relatively little success in the fashion industry as fast fashion, a business model based on quickly changing trends meant to be frequently replaced, has become the norm [1]. Fast fashion has replaced the traditionally two or three season fashion paradigm [1]. However, many consumers and professionals realize the importance of adopting social environmental responsibility [2]. The problem, however, is that it is difficult for consumers to compare diverse brands in the saturated market to make conscious sustainability decisions. Ecolabelling is the current marketing tool used by retail companies to inform consumers of their sustainability initiatives. However, an ineffective ecolabel can result in miscommunication and generally does not build trust between consumers and brands [3,4]. Thus, the new blockchain technology is proposed as a bridge between ecolabels and industry initiatives as this technology provides the transparency of the sustainable business practices. In addition, the blockchain label was compared with traditional ecolabels in this research.

Blockchain refers to an immutable digitally distributed ledger that records sequenced information or transactions [5]. The governance rules written into the code allow “blocks” to be verified without a central trust authority; each block links sequentially to create a “chain” [5]. The transparency, trust, and immutable ledger created by blockchain can lead an unsustainable industry to evolve their business practices and drive social impact. Integrating this technology in the retail landscape can empower consumers, which can

reinforce and motivate consumers to engage in sustainable consumerism [6]. Although past research has found negligible relationships between age and environmental sustainability, generational differences between technology use and adoption exists, with Generations X and Y being heavy adopters and frequent users of technology [7,8]. Thus, this study was specifically focused on these two generations because of their use of technology and contribution to household shopping.

This study aims to investigate consumer interaction with the ecolabels (i.e., traditional and blockchain ecolabels) and the effect it will have on consumers' perceptions of and behaviors towards the company's sustainability initiatives. The objectives of this study are to (1) examine message effectiveness, knowledge of sustainability initiatives, and trust in claims made by the company presented with corresponding information on both traditional and blockchain ecolabels, and (2) investigate how these are related to the consumers' intentions to buy sustainable products as an outcome of sustainability transparency on these ecolabels by comparing Generation X and Generation Y. Understanding the potential impact of blockchain data on consumer perceptions regarding sustainability can support and validate growth in this application of blockchain data. In turn, this application could potentially lead to a revolutionary change in consumer culture.

## 2. Literature Review

### 2.1. Industry Initiatives on Sustainability

The fashion industry is one of the world's largest consumer industries, and concerns are rising over environmental and social conditions, especially with the increased cost of labor, and scarcity of materials and energies as resources [9]. Pulse of the Fashion Industry recently developed a global Pulse score that tracks and measures the sustainability of the fashion sector. This also assigns a performance score based on environmental and social categories [9]. The Pulse was formed by extending the Higg Index, developed by the Sustainable Apparel Coalition, to apply industry-wide goals and identify areas on the value chain that require the most attention. They estimate that the world economy would increase by EUR 160 billion (USD 186 billion) annually by improving the currently low Pulse score. The authors state that fewer, stronger initiatives are necessary, and that broad commitment must be undertaken industry-wide as large scale impact across value chains and geographies is difficult for individual brands to achieve [9]. Solutions are presented with objectives highlighted as efforts of individual companies and collaborative industries.

Another prominent initiative, the Higg Index, is a measurement indicating the environmental and social impact along the supply chain of the specific company being evaluated [10]. Inefficiencies are addressed to drive companies to make improvements in their business models. Transparency is encouraged as sustainability scores produced by the index use consistent measures to evaluate sustainability efforts, allowing consumers to use increased insight to influence their purchases [11]. Tools are offered to determine sustainability during the design, manufacturing, and retail phases. Another important industry initiative of sustainability is Common Objective (CO), a digital platform developed by the Ethical Fashion Group, and this works to pair parts of the supply chain with other sustainable actors. The platform mapped the industry to establish points on the supply chain that require improvement [11]. Companies that participate on the CO platform are assigned weights that indicate their sustainability performance. Increased visibility encourages companies and consumers to make more sustainable choices. CO drew data from over 500 sources to create sustainability dimensions across the triple bottom line (i.e., social, environmental, financial components of sustainability), a framework that measures traditional economic measures with environmental and social dimensions [11,12].

### 2.2. Sustainability in the Apparel Industry

A great deal of research has been conducted regarding sustainability in retail and apparel, beyond the call from industry leaders. Pulse of the Fashion Industry was substantiated by previous research by Jones, Comfort, and Hillier [13]. They labeled leading retailers

with “weak” models of sustainability. Current retailers have been analyzed against the triple bottom line to create a list of key sustainability strategies [14]. These strategies should be kept in mind while retailers create their own sustainability service systems, making sure to update these systems as changes in trends occur, just as other organizational practices are subject to change [15]. Furthermore, retailers should align sustainability with their target consumer to maintain retailer–consumer congruence, as this alignment has a direct impact on success of the initiatives enacted [16].

While there has been relative success in the integration of sustainability initiatives in other markets, success of this integration in the apparel industry has been rather limited. Ritch suggested that the expansion of sustainably produced food would encourage consumers to consider sustainability in other contexts and sought to explore the application of sustainability in fashion consumption [17]. The study found that participants had insufficient knowledge of fashion production, particularly as the retail environment did not bring attention to issues in sustainability, and thus did not find sustainability in the fashion industry relevant [17]. While some sustainability concepts are well-known (such as donating clothing or avoiding child labor), others (such as the benefits of organic fabrics) still need to be disseminated. This dissemination raises awareness and provides consumers with the option of adjusting their purchasing habits to parallel their moral ideology.

### 2.3. Characteristics of Sustainable Consumers

D’Souza’s study created four groups of consumers who have different positions regarding sustainability [3]. The reaction of each of these groups to ecolabelling practices differed, and thus the results can be used to create labels that target each group. The study highlights that labels are substantiated if they are certified from third-party organizations and may be a vital promotional tool if utilized correctly. Accuracy or inaccuracy of label information can impact trust between the brand and consumer. If properly applied, certified ecolabels increase credibility, competitive advantage, and communication [3]. Consumers may adopt conscious consumerism after becoming aware of the effect of their unsustainable habits and more informed about sustainable alternatives, as well as when they are pressured by their peers, impacted by socio-economic crisis, or looking to improve their quality of life [18].

The influence an ecolabel has over the consumer is minimal as ecolabels only apply to a limited number of goods on the market, a plethora of labelling systems are used, and credibility is tarnished as a majority of supply chains have little to no transparency [19]. Consumers have difficulty understanding of sustainability practices in fashion production as the lifecycle of apparel products consists of a complicated, globalized production process [20]. Further challenges arise as a myriad of sustainability labels currently exist, making it very difficult for consumers to apply the intended information towards their purchase decision. Ma, Gam, and Banning found that use of sustainability labels could be improved by increasing awareness of sustainability issues and providing information through a standardized system [20]. Additionally, consumers should be reached by recognizing and marketing to their differences [3]. Generational cohort theory provides a way to understand and market to these differences.

### 2.4. Generational Cohort Theory

Analyzing a group of people by their generation allows researchers to analyze changes in views over time and by life-stage [21]. According to the generational cohort theory, each generation, called as a cohort, behaves differently and shares similar beliefs and values within the cohort [22,23]. Thus, membership in a generational cohort can help explain how formative experiences, such as technological, economic, and social shifts, shape people’s views of the world and can influence behavioral and attitudinal characteristics [21]. However, defining generations is non-exact, and the diversity and complexity of these groups may sway an individual to its bounding generations [21]. For the purposes of this research, the boundaries set by the Pew Research Center were used to define each

generation. Generation X is defined by adults born between 1965 and 1980, with Generation Y, referred to as Millennials, born between 1981 and 1996.

It is crucial for companies to understand their consumers' perceptions as these can be powerful indications for the development of certain products or services [24]. Generation X often takes a comprehensive account of the product or service, evaluating aspects such as quality, price, opinions, and environmental issues; Generation Y, however, is more likely to balance environmental and social impacts with the benefits offered by the product [25,26]. Although Generation Z (ages 7–23; as no endpoint has been assigned, this generation is considered from 1997 to present) is not included in this study, it is important to note that this generation is even more concerned with environmental and social ethics than their predecessors [27]. This generation will be able to leverage their unprecedented digital connection into a shift of the consumer landscape, with their influence extending beyond socioeconomic brackets and demographics [27].

### *2.5. Presentation of Sustainability Initiatives to Consumers*

Koos identified ecolabelling as the most popular promotional material that companies use to draw focus to their environmental claims [28]. Horne worked to present a classification of ecolabels, assessed ecolabel schemes, and discussed the potential of sustainable consumption practices that could be introduced by ecolabelling [29]. The use of hang tags paired with a third-party ecolabel caused consumer attitudes toward the brand positively and buying intentions to increase [20]. Consumers, both sustainable and non-sustainable shoppers, are likely to use sustainability labels if they find the information useful and easy to understand [20]. Analysis found that regulated labels (government sponsored) were favored over other unregulated labels. However, Horne writes that a socially realistic response is required, so the role of ecolabelling must be introduced to garner favor on a wider spectrum [29]. Horne emphasizes that ecolabelling must be combined with government legislation to create endeavors to be shared intentionally and universally [29].

Three factors previously found by D'Souza et al. to be imperative to consumer comprehension of labels were adapted for the measurements used in this study [2]. The first measurement on the model, effectiveness, is concerned with the message accuracy and clarity of labels. Earlier studies found that ecolabels were ineffective as the messages were either presented or interpreted as being misleading [30]. Further, interpretation of messages for a product or company varied depending on the context in which they were presented, again resulting in consumers feeling misled [31]. Mistrust was also produced if a product's content was not clearly labeled [32]. The second measurement, knowledge, identifies a consumer's knowledge of a product's production and general impact on the environment [3]. These characteristics can be misidentified if a consumer does not understand the different types of labels used by companies, specifically as consumers may be unaware of these differences [3]. Moreover, a consumer's knowledge is impacted not only by what they know, but by beliefs held about environmental issues and impacts [2]. The last measurement, trust, analyzes the assurance a consumer places in a company. Consumers are influenced by a company's environmental reputation, and generally distrust environmental advertising and labelling claims [2,3]. Especially, as Generation X consumers have comprehensive understanding about the environmental issues whereas Generation Y consumers tend to balance the environmental and social impacts with the benefits offered by the company or a product, they will have different levels of evaluation for the traditional ecolabel. Therefore, it was hypothesized that:

**Hypothesis 1 (H1).** *There will be a generational difference between Generation X and Generation Y on the (a) effectiveness, (b) knowledge, and (c) trust of the traditional ecolabel.*

### *2.6. Industry Advances: Blockchain*

Advances in technology, particularly Internet of Things (IoT) and blockchain, can provide the apparel industry with revolutionary changes. Blockchain technology presents

data in a “decentralized, transparent, and immutable format” [33] (p. 1). While this technology is relatively new, researchers are confident about its potential applications. An application of blockchain in the fashion apparel manufacturing industry was suggested to evaluate the carbon emission during the product manufacturing process [33]. The provided system evaluates the carbon emission for the fashion apparel manufacturing industry and proposes solutions to reduce emissions throughout the lifecycle of a product.

These studies, in conjunction with industry initiatives, show the need for consistent ecolabelling initiatives across the fashion industry [33]. The objectives as proposed could be implemented industry-wide utilizing blockchain technology, and can serve to validate a company’s sustainability claim by introducing transparency to a retailer’s supply chain. The benchmarks created by each of these firms can be used singularly or combined to create official goals and labels for brands across the industry, which could be further validated by blockchain. Blockchain will make accessing and understanding data easier for the consumer. The resultant consistency across the industry will provide access to information that can be used for true comparisons between brands and products by the consumer. Transparent benchmarks will pressure business to implement environmental and social sustainability programs to maintain a competitive brand. Furthermore, greater consumer engagement will lead to increased conscious consumerism. As blockchain is suggested as an alternative to traditional ecolabels, it is also important to understand how consumers evaluate this innovative way to present sustainability initiatives. Three factors mentioned above, i.e., effectiveness, knowledge, and trust, are important measurements of the effort for sustainability initiatives. Furthermore, it is expected that there will be generation differences for the evaluation of the blockchain label based on the generational cohort theory. Thus, the following hypothesis is proposed:

**Hypothesis 2 (H2).** *There will be a generational difference between Generation X and Generation Y on the (a) effectiveness, (b) knowledge, and (c) trust of the blockchain ecolabel.*

### 2.7. Purchase Intention

The impact of ecolabel or blockchain on purchase intention is important as this provides the measurement for the potential success of the messaging of each respective tool. Past research identified increased consumer empowerment to impact purchase intention positively; consumers may feel empowered by the knowledge that their purchase impacts product design or organizational decision-making [34]. As ecolabels and blockchain are used to inform consumers of a preferable characteristic, consumers voice their approval of the brand by purchasing the product from it. While there is a myriad of potential impacts on purchase intention, this study is focused on the exposure to a specific marketing tool—either the traditional ecolabel or blockchain ecolabel. Previous research has found that media believability, consumers’ trust, and green education are important factors for green marketing, further reinforcing the measures used for this study [35]. Similarly, Wang et al. found that green product knowledge, green trust, and consumer effectiveness can influence green purchase intention, which further influences actual purchase behaviors [36]. Especially, the message effectiveness, knowledge of sustainability initiatives, and trust in claims made by the company can have significant influence on purchase intention of consumers. Furthermore, the actual buying behavior will be closely related to the buying intention of consumers. Thus, this study utilizes purchase intention as blockchain is not currently being applied by retailers or manufacturers in this capacity. Accordingly, the following hypotheses are proposed:

**Hypothesis 3 (H3).** *The (a) effectiveness, (b) knowledge, and (c) trust of a traditional ecolabel will positively affect purchase intention for Generation X.*

**Hypothesis 4 (H4).** *The (a) effectiveness, (b) knowledge, and (c) trust of a blockchain ecolabel will positively affect purchase intention for Generation X.*

**Hypothesis 5 (H5).** *The (a) effectiveness, (b) knowledge, and (c) trust of a traditional ecolabel will positively affect purchase intention for Generation Y.*

**Hypothesis 6 (H6).** *The (a) effectiveness, (b) knowledge, and (c) trust of a blockchain ecolabel will positively affect purchase intention for Generation Y.*

### 3. Theory

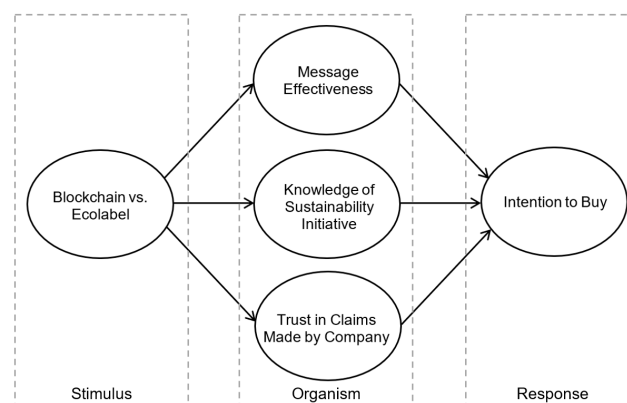
#### 3.1. The Application of the S-O-R Framework

The framework of the Stimulus-Organism-Response (S-O-R) explains how consumer behaviors and/or actions are influenced by cognitive and emotional states based on the stimuli [37]. Stimuli can be environmental and situational factors that arouse emotional and cognitive responses of consumers [38]. For example, salesperson behaviors, the external factor, can be stimulus influencing consumer satisfaction, the internal state of the consumer [39]. Furthermore, this internal state of the consumer affects the purchase behavior and other actions as a response to their feelings and emotions. Applying this S-O-R framework, this study used the traditional ecolabel and blockchain label as external stimuli. The cognitive responses to these external stimuli, including message effectiveness, knowledge of sustainability initiatives, and trust in claims made by the company, were employed to be the organism as the internal states. Furthermore, intention to buy from the company was adopted as the response in the S-O-R framework.

#### 3.2. Conceptual Development

Consumers understand and use ecolabels when the meaning of the label is precise and unambiguous. Furthermore, when consumers are knowledgeable of the label being used, they have a positive opinion of the business in the environment [2]. Recognizing that consumers may be hesitant to trust claims made by a company or may not understand the claims made, it would be beneficial to focus on bridging these gaps to influence the growth of conscious consumerism [2]. The further growth of conscious consumerisms can be achieved by educating the individual to be concerned, sensitive, and interested in environmental issues [40].

A research model (see Figure 1) is proposed to understand the effect of the traditional and blockchain ecolabel data on the three elements of ecolabels, and the resulting impact on consumers' intention to buy compared to the outcome of the traditional ecolabel based on the S-O-R model.



**Figure 1.** The theoretical framework for the study.

### 4. Materials and Methods

A quantitative research method was employed for this study. An online survey was administered, and the panel participants were recruited by Qualtrics. The purposive quota sampling method was used for this study. The data were collected in Spring 2020 with Qualtrics' panel. Qualtrics randomly selected the participants based on the sampling

criteria. In our study, the sampling criteria for participants include consumers who are aged 18 and older, and who made a sustainable purchase within last 3 months. Regarding the sample size, we used the conventional sample size of 100 for each generation as suggested by Cohen et al. [41]. Thus, our sample consisted of a total of 200 respondents, with 99 respondents from Generation X and 101 respondents from Generation Y.

#### 4.1. Stimuli Design

Respondents were given the definition of ecolabels and blockchain as follows:

*“Traditional Ecolabels” are the seals of approval given to products that are deemed to have fewer impacts on the environment than functionally or competitively similar products.*

*“Blockchain Ecolabels” are digital, public ledgers that record online data and transactions. A blockchain label ensures the integrity of data by encrypting, validating, and permanently recording, or updating, transactions. This information is open and accessible to everyone who utilizes the data.*

They were then shown an artificial label and corresponding artificial blockchain data, as shown in Figure 2, and asked to complete the survey. The traditional ecolabel presented the information about the information of the brand using the sustainable 100% recycled polyester materials for their products, whereas the blockchain ecolabel presented the information of the comprehensive transparency of the sustainable supply chain management including information of using the sustainable materials. Both the traditional and blockchain ecolabels were presented in a random order for each participant to remove the order effect and response bias.

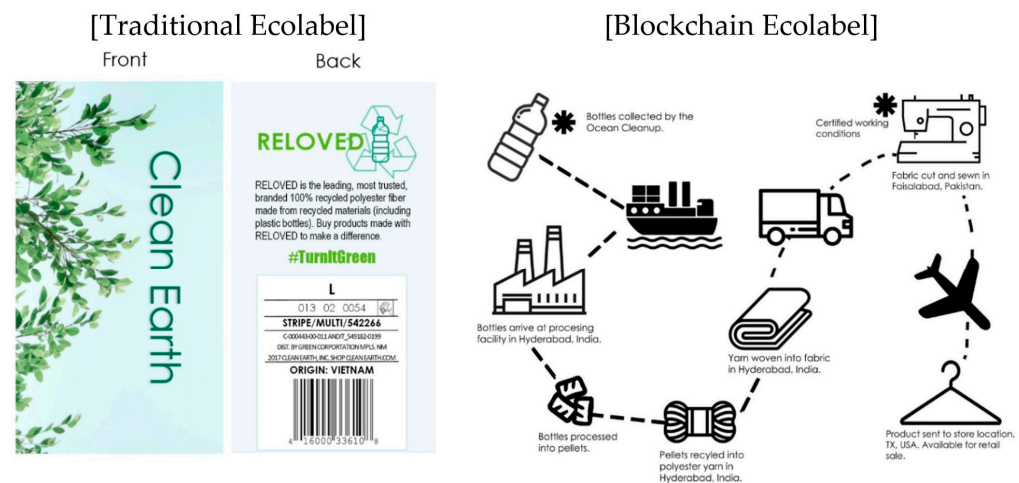


Figure 2. The traditional and blockchain ecolabels shown to respondents.

#### 4.2. Instrument Development

**Effectiveness of the label.** This variable is to measure how accurate and clear the information presented is to the consumer. “The information provided on the label is valuable” and “The information provided on the label was easy to understand” are two questions that were measured on five-point Likert scales anchored with “1 = strongly disagree” and “5 = strongly agree”. The items were adopted from Puto and Wells [42].

**Knowledge of the sustainability initiative.** This variable is to measure knowledge of the ecolabels being used before and after being exposed to the ecolabels (i.e., traditional ecolabel vs. blockchain label) and were adapted from Schlinger [43]. “This is a sustainability initiative I know well enough to talk about” and “I understand this label well enough to evaluate the sustainability initiative” are two questions that were measured on five-point Likert scales anchored with “1 = strongly disagree” and “5 = strongly agree”.

**Trust in claims made by company.** This variable measures the consumer’s trust in the application of the ecolabels presented. “After reading the ecolabel/blockchain label I

am certain of the information provided by the company” and “I attach great importance to honesty from the brands I purchase from” are two questions that were measured on five-point Likert scales anchored with “1 = strongly disagree” and “5 = strongly agree”. The items were adopted from Laurent and Kapferer [44].

*Intention to buy.* This variable measures the consumer’s intention to buy after being exposed to both the traditional ecolabel marketing tool and the blockchain label marketing tool. The questions were adopted from Jain and Srinivasan [45]. “I attach importance to a purchase based on an ecolabel/blockchain label” and “I know for sure that I am making the right purchase when basing my purchase on an ecolabel/blockchain label” are two questions measured on five-point Likert scales anchored with “1 = strongly disagree” and “5 = strongly agree”.

## 5. Results

### 5.1. The Demographic Information

The demographic characteristics of participants are described on Table 1. Out of 244 data, the usable data from a total of 99 Generation X and a total of 101 Generation Y were used for further data analyses. The mean age of Generation X participants was 45 and the mean age of Generation Y participants was 31. The income levels were varied from USD 20,000 or less to USD 90,000 or above for both groups. Regarding the education level, 63.63% of Generation X and 61.38% of Generation Y participants have bachelor’s degree and above. The majority of the ethnicity for both groups are White/Caucasian, 83.84% and 75.25% for Generation X and Generation Y, respectively.

### 5.2. Traditional Ecolabel Perception Differences between Generations X and Y

Hypotheses H1a, H1b, and H1c were tested with a two-tailed *t*-test to determine if there were any significant differences on perceptions about effectiveness (H1a), knowledge (H1b), and trust (H1c) between Generation X and Generation Y individuals for products promoted with the traditional ecolabel. For H1c, there was a significant difference for trust in a company between Generation X and Generation Y,  $t(196) = 2.093$ ,  $p < 0.05$ . Generation X had more trust ( $M_X = 4.16$ ,  $SD = 0.59$ ) in the claims on the traditional ecolabel than Generation Y ( $M_Y = 3.97$ ,  $SD = 0.71$ ) (see Table 2). H1 was partially supported, as only one of the three measures showed an impact on perceptions of the traditional ecolabel. This highlights a deficiency of this ecolabel and the necessity of marketing to the differences between generational cohorts.

### 5.3. Blockchain Ecolabel Perception Differences between Generations X and Y

Hypotheses H2a, H2b, and H2c were tested with a two-tailed *t*-test to determine if there were any significant differences on the impact of effectiveness (H2a), knowledge (H2b), and trust (H2c) between Generation X and Generation Y individuals for products promoted with the blockchain ecolabel. For H2a, there was a significant difference for effectiveness in a company between Generation X and Generation Y ( $t = 2.315$ ,  $p < 0.05$ ). Generation X found the claims of the blockchain more effective ( $M_X = 4.28$ ,  $SD = 0.71$ ) than Generation Y ( $M_Y = 4.02$ ,  $SD = 0.83$ ). (see Table 3). H2b was also significant, with Generation X ( $M_X = 4.19$ ,  $SD = 0.67$ ) considering the blockchain to provide more information than Generation Y ( $M_Y = 3.95$ ,  $SD = 0.76$ ). Additionally, the knowledge gained had a significant difference as Generation X ( $M_X = 4.13$ ,  $SD = 0.72$ ) put more trust in the claims made by a company than Generation Y ( $M_Y = 3.92$ ,  $SD = 0.67$ ) did. Thus, H2 was fully supported, further emphasizing that marketing needs differ between Generation X and Generation Y consumers.



**Table 1.** Demographic characteristics of the respondents.

Characteristics	Frequency/Percentage	
	Generation X (39–54)	Generation Y (23–38)
Age (Mean)		
Number of Respondents	99 N (%)	101 N (%)
Income		
USD 20,000 or less	10 (10.10)	14 (13.86)
USD 20,000–USD 30,000	8 (8.08)	10 (9.90)
USD 30,000–USD 50,000	13 (13.13)	16 (15.84)
USD 50,000–USD 70,000	16 (16.16)	23 (22.77)
USD 70,000–USD 90,000	17 (17.17)	17 (16.83)
USD 90,000 or above	35 (35.35)	20 (19.80)
Education		
Some High School	0 (0)	0 (0)
High School Diploma	5 (5.05)	15 (14.85)
General Education	1 (1.01)	1 (0.99)
Development		
Some College	15 (15.15)	13 (12.87)
Associate’s Degree	15 (15.15)	10 (9.90)
Bachelor’s Degree	45 (45.45)	42 (41.58)
Master’s Degree	16 (16.16)	18 (17.82)
Doctorate Degree	2 (2.02)	2 (1.98)
Race/Ethnicity		
American Indian or Alaskan	1 (1.01)	0 (0)
Native		
Asian	4 (4.04)	6 (5.94)
Black or African American	9 (9.09)	11 (10.89)
Pacific Islander	0 (0)	0 (0)
White	83 (83.84)	76 (75.25)
Hispanic or Latino	1 (1.01)	8 (7.92)
Other	1 (1.01)	0 (0)

**Table 2.** The independent *t*-test results for traditional ecolabel impact (H1a to H1c).

	Generation X		Generation Y		<i>t</i> -Value
	M	SD	M	SD	
Effectiveness	4.06	0.75	3.98	0.83	0.715
Knowledge	4.03	0.73	3.97	0.71	0.717
Trust	4.16	0.59	3.97	0.71	2.093 *

Note: \* indicates  $p < 0.05$ .

**Table 3.** The independent *t*-test results for blockchain ecolabel impact (H2a to H2c).

	Generation X		Generation Y		<i>t</i> -Value
	M	SD	M	SD	
Effectiveness	4.28	0.71	4.02	0.83	2.315 *
Knowledge	4.19	0.67	3.95	0.76	2.270 *
Trust	4.13	0.72	3.93	0.67	2.039 *

Note: \* indicates  $p < 0.05$ .

#### 5.4. The Effects of Traditional Ecolabel Perceptions on Purchase Intention for Generation X

When the data were further analyzed by age, we could see the impacts on each group’s purchase intentions (H3a to H3c). The purchase intention for a product promoted with an ecolabel for Generation X individuals (H3a, b, c) was also significant ( $df = 98$ ,  $R^2 = 0.661$ ,  $F = 61.638$ ). However, the purchase intention for this group was only impacted by knowledge ( $\beta = 0.479$ ,  $p < 0.000$ ) and trust ( $\beta = 0.234$ ,  $p < 0.01$ ). The effectiveness did

not significantly impact products promoted by an ecolabel for Generation X individuals ( $\beta = 0.183, p > 0.05$ ), as seen in Table 4. Thus, H3 was partially supported and a characteristic of the traditional ecolabel which can be improved upon is exposed.

**Table 4.** Traditional ecolabel perception and purchase intention for the Generation X (H3).

	df	R <sup>2</sup>	F	$\beta$	t-Value	Sig.
Purchase Intention	98	0.661	61.638			0.000 ***
Effectiveness				0.183	1.855	0.067
Knowledge				0.479	4.328	0.000 ***
Trust				0.234	2.811	0.006 **

Note: \*\* indicates  $p < 0.01$ , and \*\*\* indicates  $p < 0.001$ .

#### 5.5. The Effects of Blockchain Ecolabel Perceptions on Purchase Intention for Generation X

The data were then analyzed for purchase intention for products promoted with the blockchain ecolabel for each generation. The purchase intention for a product promoted by a blockchain for Generation X individuals (H4a, b, c) was significant ( $df = 98, R^2 = 0.406, F = 21.687$ ). The purchase intention, however, was only affected by H4c, knowledge ( $\beta = 0.482, p < 0.01$ ). Both effectiveness ( $\beta = 0.028, p > 0.05$ ) and trust ( $\beta = 0.170, p > 0.05$ ) did not significantly impact the purchase intention for products promoted with blockchain for Generation X individuals (see Table 5). Thus, H4 was partially supported. Figure 3 illustrates the significant and insignificant path on the relationships among variables for traditional and blockchain ecolabels for Generation X. More importantly, this reveals the strongest aspect of the blockchain ecolabel and immediately identifies the characteristics that need further development to be most impactful for this group (see Figure 3).

**Table 5.** Blockchain ecolabel perception and purchase intention for the Generation X (H4).

	df	R <sup>2</sup>	F	$\beta$	t-Value	Sig.
Purchase Intention	98	0.406	21.687			0.000 ***
Effectiveness				0.028	0.243	0.808
Knowledge				0.482	3.493	0.001 **
Trust				0.170	1.458	0.148

Note: \*\* indicates  $p < 0.01$ , and \*\*\* indicates  $p < 0.001$ .

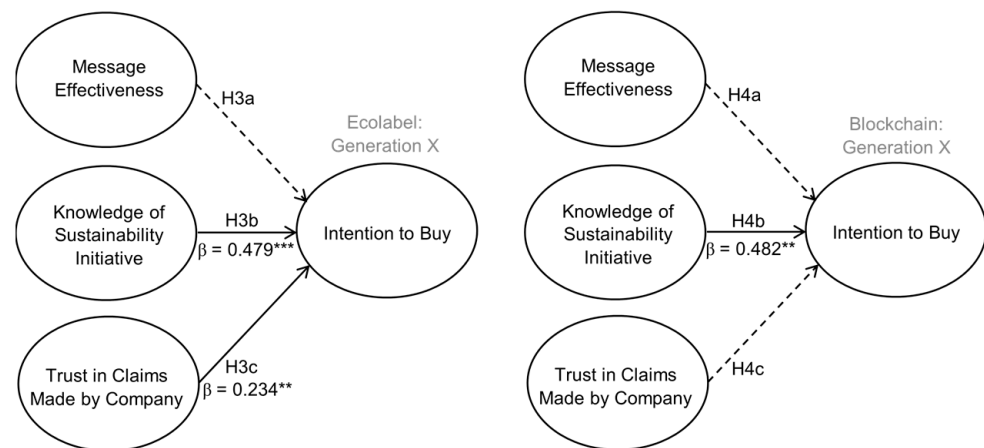
#### 5.6. The Effects of Traditional Ecolabel Perceptions on Purchase Intention for Generation Y

The purchase intention for a product promoted by an ecolabel for Generation Y individuals (H5a, b, c) was significant ( $df = 100, R^2 = 0.523, F = 37.615$ ), and was influenced by all three measures. H5a, effectiveness ( $\beta = 0.334, p < 0.01$ ), knowledge ( $\beta = 0.242, p < 0.05$ ), and trust ( $\beta = 0.274, p < 0.01$ ) impacted Generation Y purchase intentions for products with the traditional ecolabel (see Table 6). Thus, H5 was fully supported, revealing Generation Y's receptiveness to sustainability initiatives promoted through ecolabels.

**Table 6.** Traditional ecolabel perception and purchase intention for the Generation Y (H5).

	df	R <sup>2</sup>	F	$\beta$	t-Value	Sig.
Purchase Intention	100	0.523	37.615			0.000 ***
Effectiveness				0.334	3.540	0.001 **
Knowledge				0.242	2.188	0.031 *
Trust				0.274	2.904	0.005 **

Note: \* indicates  $p < 0.05$ , \*\* indicates  $p < 0.01$ , and \*\*\* indicates  $p < 0.001$ .



**Figure 3.** The effects of ecolabel perceptions on intention to buy for Generation X. \*\* indicates  $p < 0.01$ , and \*\*\* indicates  $p < 0.001$ .

5.7. The Effects of Blockchain Ecolabel Perceptions on Purchase Intention for Generation Y

The purchase intention for a product promoted by a blockchain for Generation Y individuals (H6b, c) was significant ( $df = 100, R^2 = 0.588, F = 46.051$ ). The purchase intention was affected by H6b, knowledge ( $\beta = 0.298, p < 0.01$ ), and H6c, trust ( $\beta = 0.485, p < 0.01$ ). H6a, message effectiveness, did not significantly impact this group ( $\beta = 0.049, p > 0.05$ ), as seen in Table 7. Thus, H6 was partially supported. Figure 4 illustrates the significant and insignificant path on the relationships among variables for traditional and blockchain ecolabels for Generation Y. This further strengthens the claim of Generation Y’s receptiveness; however, this also reveals which attribute can be improved upon.

**Table 7.** Blockchain ecolabel perception and purchase intention for the Generation Y (H6).

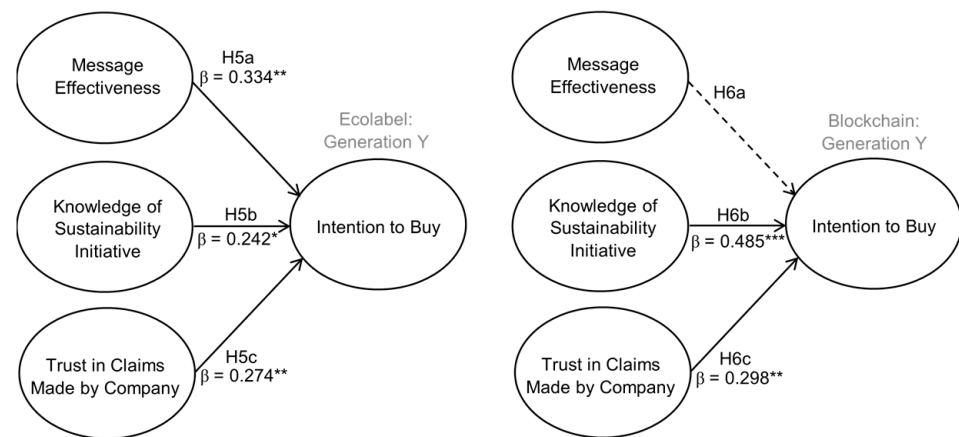
	df	R <sup>2</sup>	F	B	t-Value	Sig.
Purchase Intention	100	0.588	46.051			0.000 ***
Effectiveness				0.049	0.521	0.604
Knowledge				0.485	4.497	0.000 ***
Trust				0.298	3.076	0.003 **

Note: \*\* indicates  $p < 0.01$ , and \*\*\* indicates  $p < 0.001$ .

Additionally, the paired-samples *t*-tests were conducted to compare the mean differences between the traditional ecolabel and blockchain ecolabel for both Generation X and Generation Y. The result revealed a significant difference for Generation X consumers in regard to message effectiveness ( $t = -2.726, p < 0.01$ ) and knowledge of sustainability initiative ( $t = -2.564, p < 0.05$ ). The message effectiveness of the blockchain ecolabel was significantly higher than that of the traditional ecolabel for Generation X consumers ( $M_{\text{traditional\_knowledge}} = 4.06, M_{\text{blockchain\_knowledge}} = 4.27$ ). In addition, the knowledge obtained from the blockchain ecolabel was significantly higher than that of the traditional ecolabel for Generation X consumers ( $M_{\text{traditional\_knowledge}} = 4.02, M_{\text{blockchain\_knowledge}} = 4.20$ ) (see Table 8).

**Table 8.** The paired-samples *t*-test between knowledge for the traditional and blockchain ecolabels for Generation X.

		Paired Difference (Traditional-Blockchain)			95% Confidence Interval of the Difference		t-Value	df	Sig.
		Mean	SD	SE	Lower	Upper			
Pair 1	Effectiveness	-0.216	0.737	0.079	-0.373	-0.058	-2.726	98	0.008
Pair 2	Knowledge	-0.178	0.648	0.069	-0.316	-0.040	-2.564	98	0.012



**Figure 4.** The effects of ecolabel perceptions on intention to buy for Generation Y. \* indicates  $p < 0.05$ , \*\* indicates  $p < 0.01$ , and \*\*\* indicates  $p < 0.001$ .

## 6. Discussion

H1 predicted the perception differences of three metrics including message effectiveness, knowledge of sustainability initiatives, and trust in claims made by the company for the traditional ecolabel between Generation X and Generation Y consumers. Results revealed that there was a significant difference for trust in a company between Generation X and Generation Y. That is, Generation X had more trust in the claims on ecolabels than Generation Y. This result shows that Generation X consumers may build the trust by reading the information on the traditional ecolabel, so that it can be the effective way to deliver the sustainability message to this consumer cohort than Generation Y consumers. H2 predicted the perception differences of three factors including message effectiveness, knowledge of sustainability initiatives, and trust in claims made by the company for the blockchain ecolabel between Generations X and Y. Results revealed that there were significant differences of all three factors, effectiveness, knowledge, and trust between Generation X and Generation Y. Generation X found the claims of the blockchain more effective than Generation Y. In addition, the knowledge gained by the blockchain ecolabel was higher for Generation X than Generation Y. Last but not least, Generation X consumers put more trust in the claims made by a company than Generation Y consumers. This result shows that Generation X consumers may have more comprehensive understanding about the information presented on the blockchain ecolabel, so they evaluate it more positively than Generation Y consumers. Thus, the blockchain ecolabel can be a more effective sustainability communication tool with Generation X consumers [25].

H3 predicted the influence of the perceptions (i.e., effectiveness, knowledge, and trust) for the traditional ecolabel for Generation X. Generation X consumers are found to have a higher purchase intention when they perceive a higher trust and knowledge on the traditional ecolabel. Thus, the traditional ecolabel can be an effective tool to promote the product when it is linked to the trust and sustainability knowledge in claims made by a company. H4 predicted the influence of the perceptions (i.e., effectiveness, knowledge, and trust) for the blockchain ecolabel for Generation X. The results indicated a significant relationship between the blockchain ecolabel's knowledge characteristics on purchase intention. That is, Generation X consumers become more knowledgeable about sustainability issues when using this ecolabel and are more likely to purchase sustainable products from the brand, which supports findings from D'Souza and Ma et al. [3,20]. Generation X consumers may look for more transparent information on the label than Generation Y consumers, which is in line with the finding of Appelbaum et al. [25]. This result also reflects that information available on the blockchain ecolabel was comprehensive, so that this type of ecolabel is effective for Generation X consumers when it provides knowledge of sustainability initiatives of the company.

H5 predicted the influence of perceptions for the traditional ecolabel characteristic (i.e., effectiveness, knowledge, and trust) on Generation Y consumers' purchase intentions. The results indicated that the purchase intention for the sustainable products were influenced by all three variables, including effectiveness, knowledge, and trust for the traditional ecolabel for Generation Y. It shows that the traditional ecolabel is effective to increase the interest in the sustainable products for Generation Y, which is closely linked to effectiveness, trust, and sustainability knowledge in claims made by a company. H6 predicted the influence of the perceptions of the blockchain ecolabel on Generation Y consumers' purchase intentions. The results indicate that trust and knowledge positively influence the perception of the blockchain ecolabel, resulting in increased purchase intention for Generation Y. These characteristics had more significant influence on purchase intention for the blockchain ecolabel than the traditional ecolabel. Therefore, our results further contradict the findings in Wiernik et al.'s study [8] by defining the strengths of each promotional tool for each generation. Especially, the knowledge has the most significant impact on purchase intention for the blockchain ecolabel for Generation Y. Thus, the transparency of the information given in blockchain seems to be more positively related to obtaining sustainability knowledge, which can eventually influence the positive attitude and buying behavior of consumers in the long-term.

Overall, these results supported the literature in that generational differences were found between each promotional tool and its underlying characteristics by supporting the generational cohort theory and the S-O-R model application in our study [8]. With both ecolabels (i.e., traditional and blockchain ecolabels) as the stimuli, this study found that the internal evaluation of these labels (i.e., organism) significantly influenced the consumer's intention to purchase (i.e., response) for both generations. This finding helps one understand the impact of the sustainability tool on a consumer in the retail setting, particularly highlighting the differing needs of sustainability consumers [3]. Furthermore, these relationships contribute to a better understanding of how generational consumers perceive sustainability tools.

## 7. Academic and Practical Implications

This study is the first investigation to apply the blockchain concept for the sustainability ecolabel with its transparent information sharing with consumers, so that the findings of this study provide cardinal implications for sustainability initiatives in the retail industry as well as applications for other fields. Furthermore, this study examined the purchase intention for products with differing promotional tools, the traditional and blockchain ecolabels, for Generation X and Generation Y consumers to determine the underlying impacts to each tool. For Generation X consumers, each ecolabel measure was overall more impactful to their purchase intention than the blockchain measures. As knowledge was the only measure to significantly impact Generation X purchase intentions, retailers should determine how to positively impact the trust and effectiveness to be competitive. Extended exposure to the blockchain may impact these measures as consumers are not currently accustomed to this type of data and may need time to adjust to the information provided. For Generation Y consumers, both the trust and knowledge measures were higher for the blockchain ecolabel than for the traditional ecolabel. Companies should promote this new tool to Generation Y, as they are likely to be the early adopters. However, effectiveness for the blockchain ecolabel did not influence purchase intention, meaning that consumers may need more time/education to understand blockchain to be more relevant/important. Companies might find it beneficial by a) beginning to determine what their consumers find important and b) educating consumers to consider furnished information more relevant.

Blockchain data can impact shoppers as it is backed with more pertinent information that can show the impact of sustainability initiatives on the supply chain, and can increase company transparency. An increase in salience can provide businesses with a new marketing tool that will help differentiate them in a saturated retail market. As consumers try to make conscious decisions based on the effect their purchase will have on the environment

and society, businesses would be compelled to align themselves within the consumer's moral interests. Additionally, businesses working with blockchain data will be able to identify inefficiencies in their supply chain, which can inform the any necessary changes to the business model. Recording the supply chain also provides a great opportunity for business to highlight a specific part of their network or product that may differentiate them from their competitor.

Although blockchain is a powerful tool, blockchain may not immediately be adopted by consumers. As this research shows, companies must determine how to effectively integrate this technology to the mutual benefit of the retailer and consumer. However, like most technology, it is expected that early adopters would initially utilize this data, and the increase in users will be proportional to its popularity with the early adopters. Companies could create an advertising campaign to introduce the technology to a wider population as well as enhance consumer engagement by training all employees to become advocates of the technology and to assist consumers on how to reap the benefits.

## 8. Limitations and Future Research

First, this study was limited to presenting blockchain as a static tool. In reality, users may be able to interact more dynamically with blockchain data provided, such as through an app or website. Additionally, this study was constrained to the United States—expanding geographically may manifest the globalized reach of the apparel industry. As blockchain data become available, it may be useful to conduct a usability test that tracks eye movement, time spent on data points, and the impact of aesthetic layout on receptiveness of data given. In addition, a larger sample size for the multi-group analysis with the structural equation modeling will provide information to generalize the research findings. In addition, further research could be conducted with a wider range of countries as the data in this paper were only collected from the United States. Responsiveness to blockchain data may be impacted by the awareness to environmental or social problems in an area. Future research could also be conducted to determine the differences between demographic groups, such as gender, income, or ethnicity. Research focused on more technologically savvy groups, such as Generation Z, may provide a glimpse into the future of this topic. Lastly, a longitudinal study with a larger sample size could be conducted to identify if blockchain data truly impacts shopper behavior towards more sustainable habits.

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