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Nudging Sustainable Consumption: A Large-Scale Data Analysis of Sustainability Labels for Fashion in German Online Retail

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A transition toward a sustainable way of living is more pressing than ever. One link to achieving this transition is to increase the currently low level of sustainable consumption, and sustainability labeling has been shown to directly influence sustainable purchasing decisions. E-commerce retailers have recently picked up on a means to inform online shoppers about sustainable alternatives by introducing on their websites third-party and private sustainability labels as nudging instruments. However, despite its increasing relevance in practice, research lacks evidence about the availability and credibility of sustainability labeling in online retail. Our study is guided by the question of how online retailers use sustainability labels to communicate information on the sustainability of products to consumers. Our empirical research is based on a large-scale dataset containing sustainability information of nearly 17,000 fashion products of the leading online retailers in Germany Zalando and Otto. The results show that a large number of fashion products are tagged as sustainable, with two-thirds carrying a private label and one-third a third-party verified label. Only 14% of the tagged products, however, present credible third-party verified sustainability labels. This low percentage makes it challenging for consumers to comprehend to what degree a product is sustainable. The wide distribution of private labels indicates that most of the available sustainability information in the selected online shops addresses only single sustainability issues, preventing comparability. Furthermore, label heterogeneity can add to the confusion and uncertainty among consumers. Our practical recommendations support political initiatives that tackle the risk of greenwashing resulting from uncertified and weak sustainability information.

Keywords: sustainable consumption, digital nudging, sustainability labels, E-commerce, large-scale data

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INTRODUCTION

The need for a transition toward a sustainable way of living is more evident and pressing than ever (IPCC, 2021). Private household consumption of goods and services is a key driver of global warming and environmental degradation (Ivanova et al., 2016), as energy and resources are needed to produce, distribute, sell, use, and dispose of products. Sustainable consumption has emerged as an effective means of alleviating these environmental impacts. Although the number of individuals

willing to purchase sustainable products has increased over the last decade, there is little evidence to suggest that sustainable products have reached the market share necessary to significantly reduce the depletion of natural resources and severe damage to the environment. For instance, in Germany, despite high environmental concerns and a positive attitude of consumers toward sustainable products (Statista, 2021), the market share of such products remained confined to 7.9% of the entire market in 2019 (German Environment Agency, 2021).

To enhance sustainable consumption, both researchers and practitioners have been assessing and applying various nudging instruments. According to Thaler and Sunstein (2008, p. 89), a nudge is "any aspect of the choice architecture that alters people's behavior predictably without forbidding any option or significantly changing their economic incentives". Nudges aim to facilitate people's choices without restricting the autonomy of their decisions. Nudging tools include defaults, working with warnings of various kinds, changing layouts and features of different environments, reminding people about their choices, drawing attention to social norms, and using framing to change behavior (Lehner et al., 2016). These instruments could be transferred to online choice environments. In this vein, digital nudging has proven to be an effective design approach for unconscious and automatic everyday decisions that influence individuals' behaviors (Weinmann et al., 2016). In the context of sustainable consumption, nudges intend to facilitate choices that are sustainable (Sunstein and Reisch, 2013; Hansen et al., 2019). Simplification of information can be seen as a form of nudging (Lehner et al., 2016) and plays an important role in consumers' decision-making process. Therefore, the nudging concept provides a valuable theoretical basis for this study.

As a common strategy to simplify information and enhance orientation on sustainable alternatives in purchase situations, sustainability labels have achieved increasing popularity, as apparent, for example, in surveys measuring consumer attitudes toward labeling (European Commission, 2020). Because sustainability labels offer consumers timely, effective, and efficient help in identifying sustainable product alternatives at the point of purchase (Thøgersen et al., 2012), they can directly influence purchasing behavior. In recent years, various sustainability labels requiring an external evaluation were introduced by governments, NGOs, or companies and are referred to as third-party labels. Apart from third-party labels, private labels have recently become popular among companies and retailers (e.g., Conscious Collection by H&M). However, most private labels constitute self-declared environmental claims and often only highlight a single sustainability aspect of a product. Moreover, these labels are often not certified by an independent organization and, therefore, suffer from reliability issues. Prior research showed that few consumers can truly distinguish between different label types and accreditations (Hwang et al., 2015) and have difficulties understanding the meaning of a sustainability label when it is not explicitly communicated (Thøgersen et al., 2010). Thus, a lack of consumer awareness and trust reduces the effectiveness of labels to influence sustainable consumption.

Digitalization and access to technology have transformed consumption patterns and habits tremendously. Online retailers also need to play an active role in nudging consumers toward sustainable consumption. Their position at the interface with consumers in digital distribution channels allows them to provide sustainability information directly at the point of purchase (Bălan, 2020). In our study, we investigate sustainability labeling, as a form of sustainability information used in online retail to nudge sustainable consumer choices. The literature on sustainability marketing and consumer research lacks systematic and comprehensive information on the availability and credibility of sustainability information in online retail. However, easy access to reliable information is crucial to improving existing attempts of consumers and consumer policies to eventually shift online purchasing decisions toward more sustainable consumption behavior. Therefore, our exploratory study is guided by the following research question: How do online retailers use sustainability labels to communicate information on the sustainability of products to consumers?

Addressing our research question requires access to a large-scale dataset, which, in the best case, is not biased toward a single retailer. As there are no publicly available datasets that contain both products and their respective sustainability information, we applied a web scraping approach to collect product data and sustainability information (see e.g., Saurkar et al., 2018) from the online shops of two leading online retailers in Germany: Zalando SE, and Otto GmbH & Co KG. Preliminary research on online search queries within the search engine Ecosia revealed that fashion is the product category users search for most often when shopping online. This finding is in line with previous studies reporting that, in 2020, most sales in German online retail were generated by the textile and accessories segment (Handelsverband Deutschland – HDE e. V, 2021). The fashion industry has become one of the largest and most polluting industries worldwide, producing up to 10% of global CO_2 emissions (Ellen MacArthur Foundation, 2017; Niinimäki et al., 2020), a development that underpins the urgency of a shift toward sustainable consumption practices in fashion. We thus decided to focus our data acquisition and analysis in this study on fashion products.

The rest of this paper is structured as follows. We begin with an in-depth literature review on sustainability labels in general and with a focus on sustainability labels in fashion. We move on to introduce the study design and the two selected online retailers, Zalando and Otto, from whom we collected the data. Then, we proceed to the results of the large-scale data analyses. Finally, we discuss the theoretical contribution and future research that spring from these results as well as practical recommendations.

SUSTAINABILITY LABELS TO NUDGE SUSTAINABLE CONSUMPTION

In scientific literature, the term eco-label is often used to describe labels that offer information about a product's environmental performance. Lately, the term sustainability label has caught on,

referring, in a broader sense, to labels focusing on products' environmental and/or social impacts.

The International Organization for Standardization (ISO) differentiates between label types by applying the ISO 14020 series. This series provides general definitions and principles for three broad types of voluntary ecolabels. Type I refers to third-party verified labels, which are awarded to products that fulfill a set of predetermined environmental requirements based on life cycle considerations within a specific product category (ISO, 2018). In this study, we refer to those labels as third-party labels. Labels issued by governments such as the "Blue Angel" in Germany are also third-party labels. Type II sets a standard for self-declared environmental claims and does not require third-party verification (ISO, 2016). In this study, we refer to those as private labels. Labels that are created by brands for their products, as well as labels created by retailers, are considered private labels. Type III, in contrast, is mainly a standard for reporting products' environmental data between businesses and requires a third-party verification (ISO, 2006) but is not the object of this study.

However, new sustainability labels are constantly being introduced and many of them cannot be directly classified as ISO types (Minkov et al., 2018, 2020), resulting in a wide range of heterogeneous labels. According to the Ecolabel Index, 455 sustainability labels are currently circulating in 199 countries and 25 industry sectors (Ecolabel Index, 2022). The labels address different social and environmental issues and consider different stages of product life cycles. While some labels focus on a single environmental or social issue (e.g., "Carbon Trust"), others cover multiple sustainability aspects [e.g., "Global Organic Textile Standard (GOTS)"]. In some cases, labels even address similar sustainability aspects. For example, the sustainability labels "Fair Wear" and "Fairtrade-textile" set partly identical requirements regarding labor conditions in the textile production phase. However, the requirements a product needs to fulfill to receive a specific label can differ greatly.

With the growing number and heterogeneity of sustainability labels, criticism of the labeling practice has arisen. Concerns about third-party verified labels regularly refer to the labeling process and resources producers need to invest to obtain a label. Certification processes are often bureaucratic and compiling the necessary documentation requires time and expertise (Evans et al., 2015; Buunk and van der Werf, 2019). These factors affect especially smaller enterprises with sustainable products, which might not be able to spare the needed resources and preclude them from gaining access to interested consumer segments (Yenipazarli, 2015). As a result, larger firms tend to benefit from third-party verified labels. Furthermore, an evaluation of the "EU Ecolabel" showed that stakeholders perceive an insufficient market reward, which is mainly considered to be due to a lack of consumer awareness about the "EU Ecolabel" (Evans et al., 2015). In addition to third-party labels, various private companies have introduced their sustainability labels, often as self-declared environmental or social claims highlighting only a single sustainability aspect of a product (Peattie and Crane, 2005).

On the other hand, consumers have limited awareness of sustainability third-party labels, despite their long-time existence in retail environments. The level of visibility and understanding of sustainability labels is low (Annunziata et al., 2019), and the difficulties of consumers in distinguishing between different label types may result in consumer confusion and skepticism (Grunert et al., 2014). These observations also apply to sustainable fashion information: Although sustainability labels for fashion products are relatively extensively available, labels are often not understood or misinterpreted by customers (Straehle et al., 2016; Ritch, 2021).

Furthermore, research has proven the reliability and credibility of labels as important influencing factors for consumer choices. For example, Kumar et al. (2021) analyzed the relationship between green information quality and green brand credibility assessing the responses of 1,282 Indian consumers. Their empirical study assessed the influence of eco-label credibility on the product categories of electronics, cosmetic, and apparel products and found that, for all three categories, eco-label credibility has a moderating effect. Further research analyzed how different label types influence customers' perceptions of label credibility. Some studies found that consumers perceive private labels as less credible than labels that are endorsed by a third-party (Darnall et al., 2018; Gorton et al., 2021). Yet, another study about young consumers in Italy found that a self-declared claim (ISO label type II) had a higher impact on their willingness to pay than third-party labels (Rossi and Rivetti, 2020).

While most studies focus on consumers' perception, use, and knowledge of sustainability labels (see **Appendix A** for an overview of the studies that were evaluated as part of the selective literature review), research is lacking on how online retailers communicate sustainability aspects of a product at the point of purchase, how they provide sustainability information to highlight products as sustainable, and in which way third-party labels or private labels are deployed to support those claims. With an exploratory research design based on large-scale data analysis, we aim at contributing new insights to the limited scientific knowledge about sustainability information in online retail.

METHODS

As a first step, before conducting the large-scale data analysis, we took a closer look at the online shops of the selected fashion retailers Zalando and Otto and assessed how they show sustainability information on products, and if and how they consider sustainability labels. For this evaluation, we examined the sustainability-related information in their online shops. Both retailers use sustainability tags[1] to highlight and filter sustainable products for their customers. The tagged products either carry a private label or a third-party label (see **Figure 1**). However, the labels used in both online shops differ greatly.

Zalando mostly offers fashion products and applies private and third-party certifications. However, it recognizes that some brands do not use sustainability labels and therefore also aims in the future at highlighting sustainability aspects not covered by

[1]Zalando uses the term "flag" (Zalando, 2022).

Example of a sustainability tag

Made with at least 20% innovative leather alternatives

This item does not contain animal leather and was made with at least 20% plant-based materials, such as pineapple, apple or mushrooms. The result? An innovative alternative to animal leather which gives new life to materials that would otherwise go in the trash.

Example of a private label

Example of a third-party label

FIGURE 1 | Different types of sustainability signals for fashion products (from left to right: https://www.otto.de/damen/mode/jeans/?nachhaltigkeit=alle-nachhaltigen-artikel, https://www.zalando.de/about-sustainability/, https://global-standard.org/de).

labels. In addition to 14[2] third-party labels,[3] Zalando displays 17 private labels, which communicate single sustainability aspects of products e.g., "Made with at least 20% innovative leather alternatives" (Zalando, 2022). Those 17 private labels were created by Zalando. It does not consider private labels from other brands.

In contrast, the online retailer Otto offers products from a variety of different categories, including fashion. Like Zalando, Otto uses different sustainability labels to provide additional information about their products' sustainability performances. For the fashion category, Otto lists 46 different labels, ranging from established third-party labels (e.g., "GOTS") to private labels from different brands such as the "Adidas Parley Ocean Plastic" label. Furthermore, Otto lists various labels from producers of the clothing supply chain (e.g., "ECONYL®") (Otto GmbH & Co KG, 2022). In this study, those labels are considered private labels.

For the quantitative large-scale analysis of this study, we implemented a generic scraping system, which is based on the framework Scrapy, the most popular and powerful framework to implement web spiders (Saurkar et al., 2018; Singrodia et al., 2019). Scrapy makes it easy to implement rules for the data researchers are interested in and to reuse and repeat the scraping process. Within our approach, we focused on products marked with a sustainability tag. Manually scrutinizing the selected online shops, we defined a total of 18 product categories, which cover the majority of available products. Due to partial downtime of the websites, or similar errors, we could not scrape all the product information at once. For this reason, we repeated the scraping process six times between January and March 2022 and used the latest version of duplicated products. We found 16,878 unique products. For reproducibility, we published our dataset in tabular form in an open repository (Jäger and Bießmann, 2022). However, in this work, we limit ourselves to three attributes per product: category, online retailer, and sustainability information. An example of the dataset at hand is shown in **Table 1**. Each row in the table represents a single product and each column shows its attributes.

We found ∼85 different statements with information about product sustainability, which we grouped into three types: private label, third-party label, and third-party label that is particularly credible (in line with the common differentiation of sustainability labels as described in Section Sustainability Labels to Nudge Sustainable Consumption). Since we did not analyze the private labels in detail, we refer to them as "private labels", regardless of their original statement.

TABLE 1 | Example of the dataset used for the large-scale evaluation.

Category	Online retailer	Sustainability signal
Sweater	Otto	The Green Button; Made In Green By Oeko Tex
Pants	Otto	Fairtrade Cotton; GOTS Organic; The Green Button
Underwear	Otto	Private Label
Dress	Zalando	Cradle to Cradle - Platin Level
Jacket	Zalando	Organic Content Standard - 100
Shoes	Zalando	Private Label

[2]Zalando deploys nine different third-party labels of which three have multiple levels of certification. If each level of certification is accounted for separately, Zalando uses 14 third-party labels.

[3]Zalando uses the label "Bluesign". However, it deployed its own version that refers to the label's version as "bluesign® products" as well as to "bluesign® APPROVED". Since the label's version differs and only "bluesign® products" fulfils the credibility criteria used in this study, Zalando's own version is not further considered as a third-party label.

However, for the third-party labels, we applied a more elaborated approach. We only considered third-party labels that met strict requirements concerning their credibility based on the evaluation and criteria of Siegelklarheit. Siegelklarheit is a German government initiative that evaluates sustainability labels based on the Sustainability Standards Comparison Tool (SSCT) to inform the public about the reliability and sustainability ambitions of labels in the dimensions of credibility and environmental and social effects. Siegelklarheit ranks labels in all three dimensions on a scale between 0 and 100%. For this study, we assessed labels as "credible" that are highly trustworthy and set high sustainability standards for their products. Therefore, we relied on the Siegelklarheit evaluation and grouped all labels as "credible" that were evaluated and listed by Siegelklarheit by February 2022 and had received at least 50% in Siegelklarheit's credibility score and 50% in its social or environmental dimension. Additionally, labels awarded by the German government were added, such as "The Green Button", which is a government-run meta-label for sustainable textiles.

Our dataset consists of a total of 16,878 fashion products marked with a sustainability tag within the Zalando and Otto online shops. The number of products is roughly equally distributed between Zalando (49%) and Otto (51%). About two-thirds (65%) of the products have a private label and one-third carry (35%) a third-party label (see **Figure 2**). The percentage of private and third-party labels differs between both online retailers. While 27% of Zalando's sustainable tagged products carry a third-party label, 42% of Otto's tagged products have third-party labels. In total, we were able to identify 25 different third-party labels (see **Figure 3**).

RESULTS

Our analysis of third-party labels according to the criteria described above (see Section Method) revealed that only 10 of the initial 25 third-party labels could be categorized as credible (see **Figure 4**). Those 10 credible sustainability labels were found on 14% of the total tagged products (13% at Zalando and 15% at Otto). Some products carried more than one credible third-party label.

In line with Zalando's and Otto's self-description of their labeling approach (see Section Method), our data show substantial differences between the third-party labels detected in both online shops (see **Figure 3**). At Zalando's online shop, 13 third-party labels were found, of which four labels fulfilled the credibility criteria. The "GOTS-Organic" label was most often found (4.57%). But of the four credible third-party labels, only two were found on more than one percent of the products. At Otto's online shop, 20 third-party labels were identified, of which nine were evaluated as credible. A total of eight third-party labels were used by both online shops: "GOTS – Organic," "GOTS – Made with organic materials," "Fairtrade Cotton," "Global Recycled Standard," "Bluesign," "Responsible Down Standard," "Organic Content Standard – 100," "Organic Content Standard – Blended." The three third-party labels "Responsible Down Standard," "Organic Content Standard – 100," and "Organic Content Standard – Blended" were found in both online retailers but did not fulfill the credibility criteria.

The label "Cotton Made in Africa" was the most used third-party label within our dataset. However, it was only deployed by Otto, contributing 11% of the total sustainability-tagged products in its online shop (see **Figure 3**). The label "BioRe" made up 2.46% of the total sustainability-tagged products but did not fulfill the credibility criteria and again, was only deployed by Otto. In contrast, 16 of the 25 detected third-party labels accounted for $<$1% of the total tagged products. Products tagged with the label "GOTS – Organic" accounted for the biggest share of credible sustainability-labeled products in the retailers' online shops (see **Figure 4**). The label "Fairtrade Cotton" was the second most frequently used credible label within our dataset, however, it was still much less common overall. Especially for the scraped product data from Zalando, the label "Fairtrade Cotton" makes up just 0.22% of the tagged products. Among the 10 credible third-party labels, seven were found on fewer than one percent of the total tagged products, including "The Green Button". As an example, the label "Cradle to Cradle – Platinum" accounted for only 0.01% of the total tagged products.

DISCUSSION

In the following, we summarize and discuss our results and their contribution to research on sustainability labeling, nudging theory, and sustainable consumption. In addition to theoretical contributions, our study also allows practical recommendations for online retailers and policymakers dealing with sustainability information to nudge sustainable consumption. We close this section by discussing the limitations of our study and deriving further research opportunities.

Discussion of the Results

The use of sustainability labels is popular in online retail. Scraped data from two of the largest online retailers in Germany revealed that about one-third of fashion products with sustainability information carry third-party labels. Only around 14% of the products have a credible third-party label. The remaining two-thirds have private labels given either by the retailers or by brands. The fact that credible sustainability labels account for only a small share of labels highlights the main finding of our analysis: informed purchase decisions for sustainable products are difficult to make due to a lack of trustworthy, comprehensive, and comparable sustainability information in online shopping. Due to increasing concerns about greenwashing or exaggerated product sustainability claims (e.g., Royne et al., 2011), it seems possible that consumers might question sustainability labeling systems in general and that this potential for skepticism might attenuate the effects of providing information through sustainability labels.

Our study showed that a new type of signaling sustainability information of products represents a valuable approach: sustainability tags. They rely on guided choices and can be both simple text boxes or signs next to a product directing attention to the sustainable aspects of a product. Sustainability tagging is not

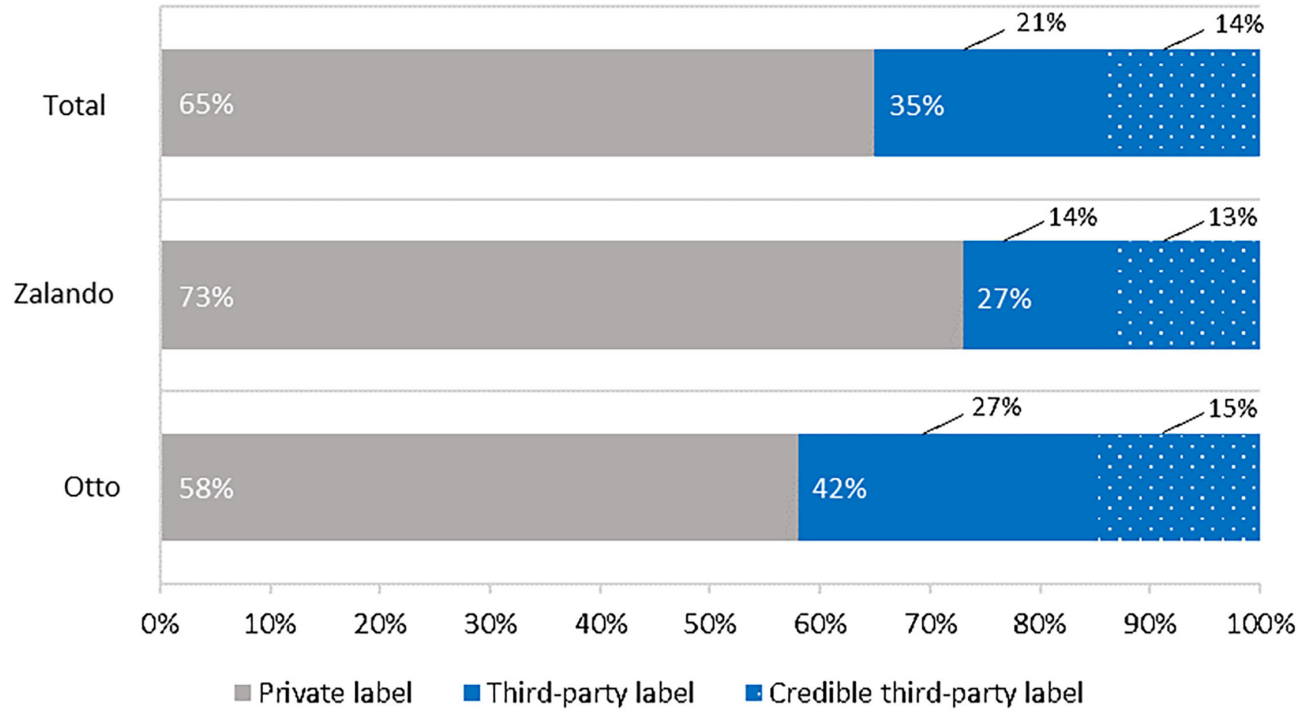
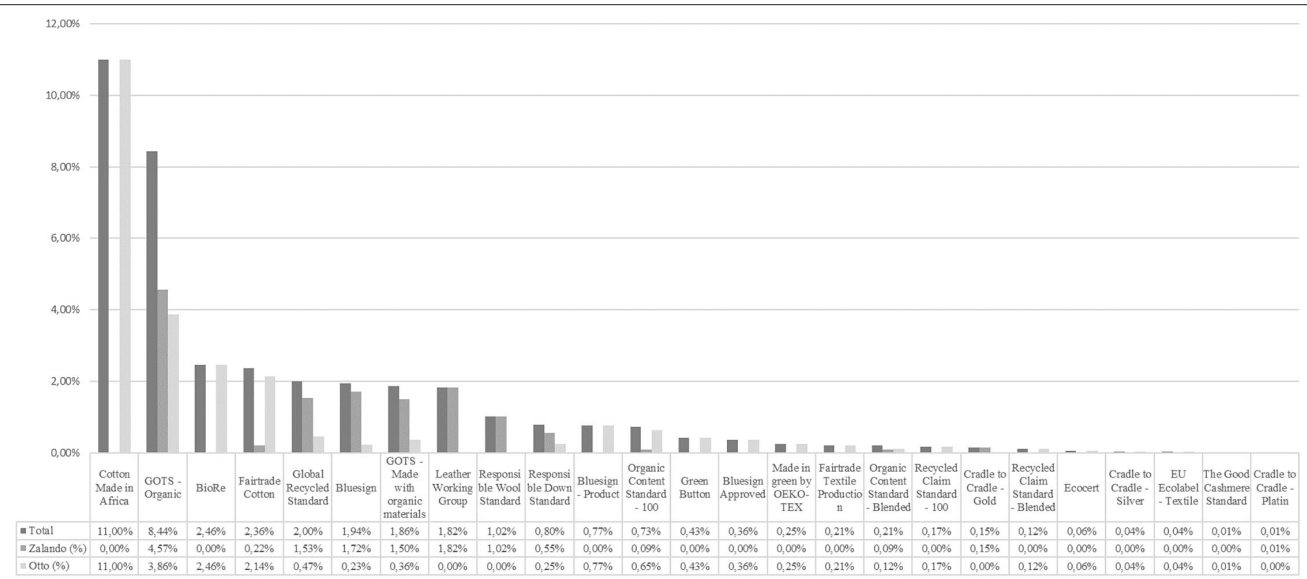


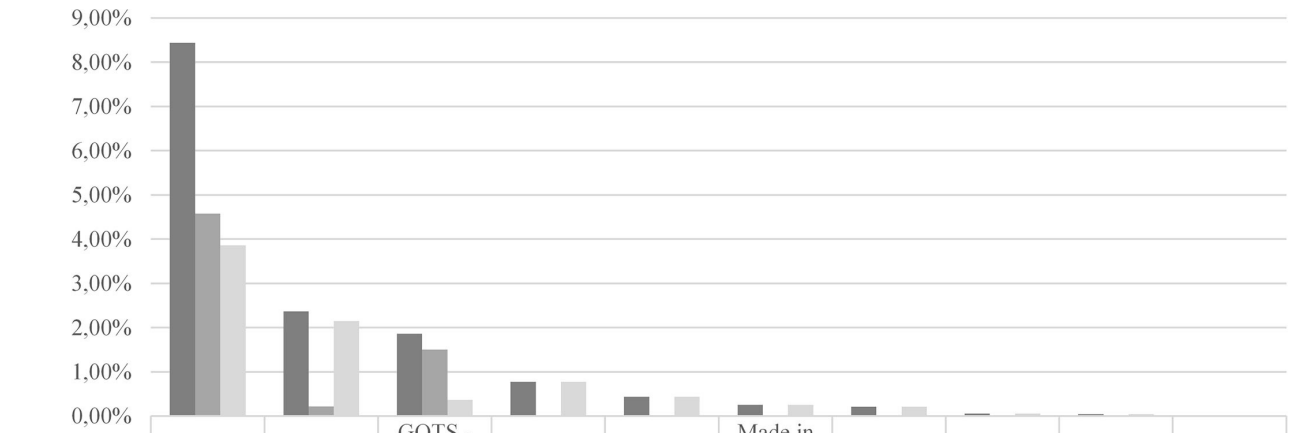
FIGURE 2 | Share of products with private labels and third-party labels.



	Cotton Made in Africa	GOTS - Organic	BioRe	Fairtrade Cotton	Global Recycled Standard	Bluesign	GOTS - Made with organic materials	Leather Working Group	Responsible Wool Standard	Responsible Down Standard	Bluesign - Product	Organic Content Standard - 100	Green Button	Bluesign Approved	Made in green by OEKO-TEX	Fairtrade Textile Production	Organic Content Standard - Blended	Recycled Claim Standard - 100	Cradle to Cradle - Gold	Recycled Claim Standard - Blended	Ecocert	Cradle to Cradle - Silver	EU Ecolabel - Textile	The Good Cashmere Standard	Cradle to Cradle - Platin
Total	11,00%	8,44%	2,46%	2,36%	2,00%	1,94%	1,86%	1,82%	1,02%	0,80%	0,77%	0,73%	0,43%	0,36%	0,25%	0,21%	0,21%	0,17%	0,15%	0,12%	0,06%	0,04%	0,04%	0,01%	0,01%
Zalando (%)	0,00%	4,57%	0,00%	0,22%	1,53%	1,72%	1,50%	1,82%	1,02%	0,55%	0,00%	0,09%	0,00%	0,00%	0,00%	0,00%	0,09%	0,00%	0,15%	0,00%	0,00%	0,00%	0,00%	0,00%	0,01%
Otto (%)	11,00%	3,86%	2,46%	2,14%	0,47%	0,23%	0,36%	0,00%	0,00%	0,25%	0,77%	0,65%	0,43%	0,36%	0,25%	0,21%	0,12%	0,17%	0,00%	0,12%	0,06%	0,04%	0,04%	0,01%	0,00%

FIGURE 3 | Share of products with a third-party label.

to be confused with third-party certification as it is more direct than labels and relies more on a retailer's image and credibility to promote sustainable products to the consumer. Moreover, sustainability tags are inexpensive and easy for retailers to apply in their online shops to nudge sustainable consumer choices. The low threshold of implementing sustainability tags bears the risk of potential greenwashing. However, research has shown that a sustainability tag is even regarded as more important and useful by consumers than a certified third-party label (Sigurdsson et al., 2022). Furthermore, other research on the effectiveness of different label types suggests adding a score to the sustainability tag, e.g., based on the Nutri-Score, since this label version turned



	GOTS - Organic	Fairtrade Cotton	GOTS - Made with organic materials	Bluesign - Product	Green Button	Made in green by OEKO-TEX	Fairtrade Textile Production	Ecocert	EU Ecolabel - Textile	Cradle to Cradle - Platin
Total	8,44%	2,36%	1,86%	0,77%	0,43%	0,25%	0,21%	0,06%	0,04%	0,01%
Zalando (%)	4,57%	0,22%	1,50%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,01%
Otto (%)	3,86%	2,14%	0,36%	0,77%	0,43%	0,25%	0,21%	0,06%	0,04%	0,00%

FIGURE 4 | Share of products with a credible third-party label.

out to be most effective in driving sustainable purchases (De Bauw et al., 2022).

Among the credible third-party labels found on sustainable-tagged products, the "GOTS-Organic" label is more frequently used than others. Because some labels, such as "Cradle to Cradle Platin", can only be found on a negligible number of products, it can be questioned whether they add value for consumers at all or whether they even are an additional cause of consumers' confusion. To tackle the challenge of label heterogeneity and its impact on consumers, previous research recommended the use of meta-labels (e.g., Torma and Thøgersen, 2021). However, our study suggests that a sustainability meta-label for fashion such as "The Green Button" is not yet established in practice since it is carried by <0.5% of the sustainability-tagged products.

Theoretical Contribution

Research on sustainability labeling to influence consumer choices asserts that it offers flexibility and supports personal decision-making by providing broad guidance and product sustainability information. However, there are limits to the information-based approach. The cognitive effort involved in reading the label information may discourage consumers with low levels of knowledge and motivation. Moreover, many consumers want to reduce the amount of time spent on shopping, which limits the likelihood of reading and interpreting label information. In our study, we found many and varied labels in the largest online shops, which provides fragmentary information. This supports the assumption that the label approach does not always help consumers make better choices. It appears that the heterogeneity of labels adds to the sense of confusion and ambiguity among consumers found in previous research (e.g., Hwang et al., 2015; Ritch, 2021). Our results contribute to the research field by highlighting multiple labeling approaches used in practice and how the uncoherent and low requirements could lead to consumers' dissatisfaction and mistrust of sustainability labels. This also shows that theoretical assumptions on the efficiency of sustainability labeling have to consider unique circumstances in online retail and how labels are deployed there. This research supports findings by Ritch (2021) that customers might not understand the sustainability of fashion products communicated through labeling and that this might lead to mistrust of the sustainability claims. Based on findings made in previous research (Thøgersen et al., 2010) that past experiences with ecolabels impact their influence on consumers, our study suggests that the heterogenic use of labels can negatively impact their influence on sustainable consumption.

With our research, we build on the theoretical assumption that sustainability labels can be considered a specific type of nudging, namely simplification of information. This adds to the insight that not only the amount or accessibility of information provided to people matters, but also how this information is presented. Simplification of information means that information is made more straightforward and presented in a way that fits the information processing capabilities and decision-making processes of the individual (Lehner et al., 2016). However, if the current sustainability labeling practice in online retail tends to increase confusion and mistrust, its contribution should be questioned. Perhaps labels should theoretically be understood more as an information provision tool than as a nudging approach (Grüne-Yanoff and Hertwig, 2016).

Although provision, simplification, and framing of information are common nudging instruments to promote sustainable consumption, their impact on individuals' choices seems to vary and to be highly dependent on the context.

Across consumption domains, nudges such as changes to the physical environment and changes to the default option appear to be more effective types of nudges than simplification and framing of information (Lehner et al., 2016). Prior research in online shopping contexts showed that default rules have proven to be an effective nudging instrument in an online food context (Berger et al., 2020) and that descriptive norms can influence the purchase of eco-labeled products (Demarque et al., 2015). Our study supports the need to implement other nudges than simplified information or a combination of nudging instruments to foster sustainable product choices in online retail more effectively. In this vein, previous research showed that a combination of soft measures including information and hard measures to promote sustainable travel is most successful (Lehner et al., 2016).

Practical Recommendations

By displaying information about the sustainability of products using labels, providers of online shops, search engines, or price-comparison websites might provide sustainability-conscious consumers with just the nudge they need to transfer their good intentions into concrete choices.

Our study found that online retailers make frequent use of various labels to nudge sustainability-related shopping decisions. Amongst them, private labels account for the largest share. They can be found on products that either do not meet the requirements of verification organizations or where their producers choose not to undergo third-parties labeling processes due to the high costs, resources, and knowledge needed to obtain the required documents (Evans et al., 2015). The wide distribution of private labels indicates that most of the available sustainability information in the selected online shops lacks a comprehensive evaluation of product sustainability performance and comparability and has often compromised independence. As voluntary initiatives, they are vulnerable to high levels of influence through the brands that fund the schemes or are otherwise involved. Thus, there is a risk that some retailers might use private labels for greenwashing, conveying weak sustainability requirements, or even disseminating false information to consumers. For example, a recently published report identified a concerning lack of accountability and independence across initiatives that offer labeling such as "Cradle to Cradle certified" or the "EU Ecolabel", with no evidence of enforcement or consequences for those who commit to targets but fail to meet them (Changing Markets Foundation, 2022). At the EU level, the issue of greenwashing is currently being tackled by the initiative on substantiating green claims (European Commission, 2022). The legal framework proposed aims at ensuring that companies provide evidence of the environmental footprint of their products using standardized quantification methods.

Another way to highlight sustainable products is through sustainability tags. While they provide a simple orientation for consumers seeking sustainability information, they could also contribute to the dilution of sustainability product information. Therefore, we propose exclusively assigning sustainability tags based on familiar and credible third-party verified labels. Furthermore, due to the lack of coherence among labeling practices of online retailers found in our study, we recommend that policymakers and retailers progress in developing and promoting a sustainability meta-label. This finding is supported by previous studies, which found that consumers are divided in their perception of different label types (e.g., Darnall et al., 2018) and therefore demand a uniform overarching sustainability label.

Limitations of the Study and Future Research Avenues

Although our large-scale analysis offers insightful facts about the availability and credibility of sustainability labels as a form of sustainability information for fashion products in online retail, our approach and the implications that can be derived based on the available data disclose some limitations. First, we did not gather any detailed knowledge on the private labels used by online retailers. Because of that, we suggest as an avenue for future studies more in-depth analysis and discussions of the underlying criteria and verification processes of private labels. Furthermore, more research on consumer perception about the trustworthiness and familiarity of such labels is needed.

Another limitation derives from our relatively narrow approach to evaluating whether a third-party label is credible or not. We applied criteria set based on the external Siegelklarheit evaluation to consider a label credible. This process allows for a transparent and verified label assessment but also limits the categorization to those labels that are assessed by Siegelklarheit. Although we controlled for comprehensiveness, we might have missed certain labels that could have met our criteria for credible labels, for example, the label "BioRe" and the label "Cotton made in Africa". Both labels would probably reach a rather high degree of credibility, but this is only assumed and not secured since Siegelklarheit has not yet assessed them.

Next to the possibly incomplete label selection, our analysis is limited to fashion products marked with a sustainability tag. Sustainable fashion products that are not labeled but meet high ecological or social requirements do not appear in our dataset. Moreover, we only collected data from two German online retailers. Due to these limitations, we are continuously expanding the database to more online shops as well as more product categories and adding more third-party labels to the scraper. Our database is publicly available in an open repository (Jäger and Bießmann, 2022), allowing future research to draw a more complete picture of the current state of sustainability information in online retail.

Furthermore, due to the heterogeneity of labels for fashion products used in online retail, additional research is needed to assess how different label types are perceived by consumers. Besides different label variants, consumer expectations of the sustainability-related topics covered by a label should be investigated in future empirical studies. In this context, it should be analyzed whether consumers perceive a meta-label differently than private or third-party labels. Supporting the ongoing debate about sustainability meta-labels, it would be an interesting research topic to investigate challenges that existing meta-labels face, and how to support better deployment of meta-labels in

online retail. Moreover, the use of sustainability tags has not yet been researched extensively. Studies are needed to assess retailers' different criteria in assigning a sustainability tag, as well as to evaluate a tag's influence on sustainable product choices in online shops.

CONCLUSION

This study is based on a large-scale dataset and provides a detailed insight into online retailers' practice of providing sustainability information on fashion products. Our work offers theoretical contributions and practical recommendations to the fields of sustainability labeling and sustainable consumer research. Although numerous products in Germany's leading online shops are marked as sustainable, only a small proportion of them can be classified as being based on credible information. The high share of private labels, which are not certified by a third party to corroborate their reliability and high sustainability claims, is problematic since those labels may contribute to the heterogeneity and confusion of the "label maze".

For consumers to make sustainable purchasing decisions, they need to have access to actionable and reliable information about sustainable products. Currently, online retailers deploy private labels over third-party labels to nudge sustainable consumption decisions. Thereby, they are risking an increasing consumer rejection of sustainable products through too much, too complex, and too ambiguous sustainability-related information. For a transformation toward sustainable lifestyles, it would be more advantageous to utilize the potential available from reliable third-party verified labels.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

MG: conceptualization, writing—original draft, writing—review and editing, and project administration. SJ: conceptualization, methodology, software, formal analysis, data curation, and writing—original draft. MH: conceptualization, writing—original draft, and writing—review and editing. FB: conceptualization, methodology, resources, data curation, writing—review and editing, supervision, and funding acquisition. RK: conceptualization. TS: conceptualization, resources, writing—review and editing, supervision, and funding acquisition. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

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Conflict of Interest: RK was employed by Ecosia GmbH.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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