

# Clothes consumption and disposal practices: a look at the profile of Brazilian apparel consumers

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## Abstract

**Purpose** – This paper aims to contribute to understanding Brazilian fashion consumer behavior. The subsequent research question is formulated as follows: How are the consumers purchasing new clothes and disposing of used ones, and how is their awareness of sustainable fashion consumption and disposal of used clothes?

**Design/methodology/approach** – An online questionnaire was sent to nearly one thousand e-mails. A database was formed with 182 complete answers to 13 questions concerning consumer behavior toward sustainability, especially clothing acquisition, use and disposal. A multimethod approach was used to analyze the initial attributes, applying descriptive statistics, cluster analysis and data mining.

**Findings** – This survey obtained valuable answers from Brazilian fashion consumers grouped into four clusters. Age and yearly income were more critical in determining the clusters. Only four attributes were chosen by the algorithm to build the trees (age, annual income, yearly spending on clothes and how long the clothes are worn). The consumer's profile may help the fashion industry redirect investments in sustainability. The most critical factor leading to the sustainability of clothing fashion was the duration of the clothes. The study dealt with a limited sample size that was not representative of Brazil's broader population. Despite numerous attempts to seek responses through e-mail, the participant pool was predominantly composed of highly educated individuals.

**Originality/value** – This assessment of Brazilian consumer behavior toward sustainability and fashion presents essential knowledge to understand the relationships among variables affecting the purchase and discharge of clothes.

**Keywords** Apparel supply chain, Clothing purchase, Clothing industry, Consumer diversity, Sustainable fashion, Sustainable living

**Paper type** Research paper

## 1. Introduction

The popularization of fast fashion has highlighted the growth of the textile industry's consumption, and consequently, waste disposal has increased significantly in recent years.

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Fashion consumerism and sustainability have been the subject of extensive research and debate. McNeill and Moore (2015) argue that consumers who prioritize “newness” in fashion show little interest in sustainable fashion, as their focus lies elsewhere. Similarly, Shen *et al.* (2014) suggest that poor quality in eco-fashion products discourages fashion consumers from making sustainable choices. Furthermore, a gap between consumers' positive attitudes toward sustainable fashion and their actual purchasing behavior has been identified by Mandarić *et al.* (2021). These findings highlight the challenges in aligning consumer behavior with sustainable fashion practices.

In addition, Payne *et al.* (2022) emphasize the broader global environmental justice concern posed by fashion systems, particularly in the context of the UN's (United Nations) Sustainable Development Goals (SDGs). Moran *et al.* (2021) stress the need for further investigation into how the fashion industry can link key emissions targets and reduce its climate impact to enhance sustainability. Pringle (2021) reports that as consumer awareness of the harmful impacts of the fashion industry increases, companies are increasingly pressured to develop sustainable practices. Such an initiative might induce a potential shift in consumer expectations and demands, challenging traditional fashion consumerism.

The arguments against fashion consumerism and sustainability underscore the complexities and contradictions within consumer behavior, industry practices and global environmental concerns (Kozłowski *et al.*, 2018). These arguments highlight the need for combined efforts to bridge the gap between consumer attitudes and actual sustainable fashion consumption and the imperative for the fashion industry to align with sustainability goals (Leal Filho *et al.*, 2019).

According to Harris *et al.* (2016), focusing only on sustainability is not enough to change consumer behavior concerning the use of clothes due to three motivations:

- (1) clothing sustainability is very complex,
- (2) consumers are diverse in their ethical concerns, and
- (3) clothing is not an altruistic purchase.

Connell and Kozar (2014) verified the barriers consumers perceive to environmentally sustainable clothes consumption and the correlation between consumers and the fashion market.

Excessive clothing consumption and inappropriate disposal are significant environmental issues in the fashion industry, leading to resource depletion, environmental degradation and increased waste (Lang *et al.*, 2013). Encouraging consumption, fast fashion production advances worldwide, with pieces sold at meager prices and the population, in turn, is unaware of the production processes and has no proper education for conscious consumption and the proper disposal of clothes. According to Leal Filho *et al.* (2019), fast fashion and the culture of “throwing away” make it difficult to take advantage of the environmental and socio-economic advantages of recycling, reusing textiles and reducing waste. Sustainable fashion practices are crucial for mitigating these negative impacts (George *et al.*, 2023).

To understand Brazilian fashion consumer behavior, we seek to answer the following research questions: How are consumers disposing of used clothes, and what is their awareness of sustainable fashion consumption and disposal of used clothes? The current study assesses the various aspects of Brazilian consumer behavior regarding using and disposing of used or unwanted clothes.

The following section presents the theoretical support to ground the approach to identifying the Brazilian fashion consumer profile and how it merges with the circular

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economy concept. Section 3 presents the way data was collected and the data analysis. Section 4 shows the results from the questionnaire and the descriptive statistics, cluster and data mining results. Section 5 discusses and concludes the results, how they fit into the research question and how the findings implicate the circular economy view.

## 2. Theoretical framework

The fast fashion industry has experienced exponential growth over the past two decades, driven by consumer demand for fashionable, affordable clothing. However, this growth has come at a significant environmental cost, including resource depletion, pollution and waste. Consumer attitudes toward these issues vary widely between different generations, from Baby Boomers to Generation Z, influencing their purchasing behaviors and, consequently, the strategies of fast fashion brands. Generation Z, known as the share and like generation, has digital-oriented consumption behavior. According to [Wijaya et al. \(2020\)](#), such behavior is divided into four segments: activities, interests, opinions and values, which together determine the characteristics of the purchasing decision. Gen Z is similar to Gen Y in that it is a continuation. They are people familiar with technology and the virtual world, with Generation Z having a greater preference for social networks and innovation. They are confident and optimistic, classified by free choices ([Wijaya et al., 2020](#)).

Considering the purchasing behaviors of various generations, marketing teams tailor their language to resonate effectively with each demographic group ([Wijaya et al., 2020](#)). Generation Z consumers have greater environmental awareness, formed by ecological awareness, the importance of healthy raw materials and healthy habits ([Su et al., 2019](#)). These consumers demonstrated that they have more values linked to sustainability. Each consumer generation can be identified through their environmental awareness and values, and there has been a growing tendency for consumers to prefer products with this “green” conscience ([Su et al., 2019](#)).

[Domingos et al. \(2022\)](#) found that younger demographics are drawn to the sustainable approach to fashion, focusing on production methods, product longevity and the potential to update or repurpose items. Therefore, millennials and Gen Z prioritize purchasing durable and timeless clothing items. These consumers also tend to use their clothing longer since they value versatile and classic pieces that can be easily mixed and matched while at the same time trying to stay on trend ([Sue et al., 2019](#)).

Advances in research into consumer behavior show that Generation Z is environmentally concerned when purchasing. However, the role that marketing plays in the shopping experience results in shopping pleasure, which can increase impulse purchases among these consumers ([Sudirjo et al., 2023](#)). The layout, discount coupons, the shopping experience and the receipt of these factors by these consumers can lead to irrational and impulse purchases. Although this generation naturally has environmental ethics and preferences for responsible purchases, this action goes against the purchasing behavior generally practiced by these consumers ([Sudirjo et al., 2023](#)).

The Influence of consumer generations on the fast fashion industry underscores the complex interplay between cultural values, economic pressures and environmental sustainability. As Millennials and Generation Z continue to exert their buying power, their ethical and sustainable fashion preferences will likely drive further transformation within the industry. For fast fashion brands, adapting to these shifts is a matter of social responsibility and a strategic imperative for future growth and relevance. While shifting toward more sustainable consumption patterns represents a positive development, the fast fashion industry faces significant challenges reconciling its inherent business model with these emerging consumer demands. The pressure to reduce environmental impact without compromising

profitability or speed to market requires innovative approaches to material sourcing, production processes and waste management.

Along with food, housing and mobility, the textile segment is one of the areas of consumption that causes many environmental, social and economic impacts, including the production of textile waste. [Dahlbo et al. \(2017\)](#) present the recycling and reuse of textiles as essential factors for reducing the use of water, energy and chemicals in producing new ones. On the consumer side, reducing consumption and reusing and reusing parts is also a possible solution.

[Rausch and Kopplin \(2021\)](#) analyze the behavior of clothing consumption and verify that with the well-evidenced growth of the clothing industry, there is a great demand for natural resources, reaching the need of 118 million cubic meters of water for the production of clothes in 2030. That urgent work needs to be done to change consumer behavior. In addition, it is proven that the aesthetic risk consumers perceive impacts satisfaction in the intention-behavior relationship. In contrast, the perceived economic risk has no significant effect on this relationship. Several components affect consumer behavior. Age, income, knowledge about ethical issues and sustainable environmental problems influence care and disposal behavior ([Hervé and Mullet, 2009](#); [Harris et al., 2016](#); [Rausch and Kopplin, 2021](#)).

According to the [European Parliament \(2024\)](#), the region consumes around 26 kg of textile products annually and throws away around 11 kg. Used clothing can be exported outside the EU, but the majority is incinerated or landfilled (87%). Therefore, developed countries export this material without a clear responsibility for managing their waste, favoring a global circular economy, but not necessarily in developing countries ([Liu et al., 2021](#)). In France, it has been considered to reuse the international export of second-hand clothes, which reaches 210 thousand tons/year, equivalent to 60% of the total produced in the country ([Eco TLC, 2016](#)). Such practice is common in India, which imports second-hand clothes from international markets ([Norris, 2015](#)). However, these practices need to be discussed globally from an ethical point of view since most fast fashion leftovers and out-of-season items end up in landfills in developing countries ([Britten, 2022](#); [Rodgers, 2023](#)).

[Cai and Choi \(2020\)](#) present an extensive review of the sustainability activities carried out by companies in the textile and clothing industry, suggesting actions that could fulfill the 12 UN SDGs and proposals for the entire fashion chain. One problem is that new materials such as cotton and crude oil are cheaper than recycled textile fibers ([Dahlbo et al., 2017](#)), which makes it challenging to invest in the reuse of materials despite worldwide calls for sustainability and a circular economy. In addition, challenges include technical problems related to the complexity of clothing ([Cobbing and Vicaire, 2016](#)), limited technologies for recycling various types of fibers ([Zamani, 2014](#)) and immature markets for changes in the segment, as is the case of countries under development.

[Oliveira Neto et al. \(2022\)](#) showed that the fashion industry can be summarized in three main stages: collection (harvest of raw materials), confection (production of clothes) and waste (use and subsequent disposal of clothes), following the linear chain of production and without commitment to sustainability, an issue that is increasingly present in discussions in this business chain, which causes so many impacts on the environment – further affected by the globalization of supply chains and little attention to lifecycle sustainability compared to many other sectors ([Kaur and Anand, 2018](#); [Marques et al., 2020](#)).

Previous studies ([Ciasullo et al., 2017](#); [Brosdahl and Carpenter, 2010](#); [Garcia et al., 2020](#)) highlight the importance of consumer knowledge about the environment and how their actions influence the environment's quality and preservation. However, we did not find updated information on Brazilian consumer behavior toward sustainable actions in fashion use and disposal in the literature. Most found papers address only some aspects of consumer

behavior, which are limited in their understanding of generations. Consumer behavior focuses mainly on the impact of textile production (Butler and Francis, 1997; Kim and Damhorst, 1998; Brosdahl and Carpenter, 2010). When examining patterns across recycling and personal values, McCarthy and Shrum (1994) identified associations where the behaviors are anticipated to be influenced by principles. Values directly influence attitudes about the inconvenience of recycling and the importance of recycling solid waste.

Previous research shows that consumers' attitudes toward sustainable fashion primarily determine their purchasing intentions (Okur and Sarçam, 2018). Subjective norms are also perceived as social pressure to perform or not perform specific behavior. For instance, social media content from eco-activists and sustainable apparel brands influences young adults' subjective norms and intentions to buy sustainable apparel (de Lenne and Vandenbosch, 2017). Core values influence environmental beliefs and perceptions. Sustainability-conscious consumers often hold altruistic and biospheric values, which drive their pro-environmental behaviors (Burton and Eike, 2023). Consumers with solid environmental beliefs will likely engage in sustainable fashion practices (Gomes *et al.*, 2022).

Todeschini *et al.* (2017) synthesize trends and opportunities for innovative and sustainable models in the fashion industry. The three themes emerged, and they were correlated: circular economy, sustainability and reverse logistics to the fabric and clothing chain, as well as to the consumer and their clothing use practices.

### 3. Materials and methods

To fulfill the proposed objectives, we did a literature review of scientific studies, a consumer behavior study focusing on the use and disposal of clothes and qualitative research with specialists. A consumer behavior evaluation was done using the answers to an online questionnaire sent by e-mail.

The survey included 13 questions on sustainable practices, addressing solid waste management, clothing disposal and clothing purchase frequency. The questions included inquiries regarding attitudes toward sustainable fashion, purchasing behaviors, awareness of sustainable fashion brands or barriers to choosing sustainable options (Lundblad and Davies, 2016). Additionally, it featured personal inquiries regarding living conditions, gender, age and income. The target audience was randomly chosen, including fashion consumers, industry experts and the general public of different age groups (Annex 1). The University Ethics Committee approved the questionnaire (protocol number 6.465.079, 2023). More than 500 e-mails were sent, and 182 consumers of different ages and social and educational profiles responded.

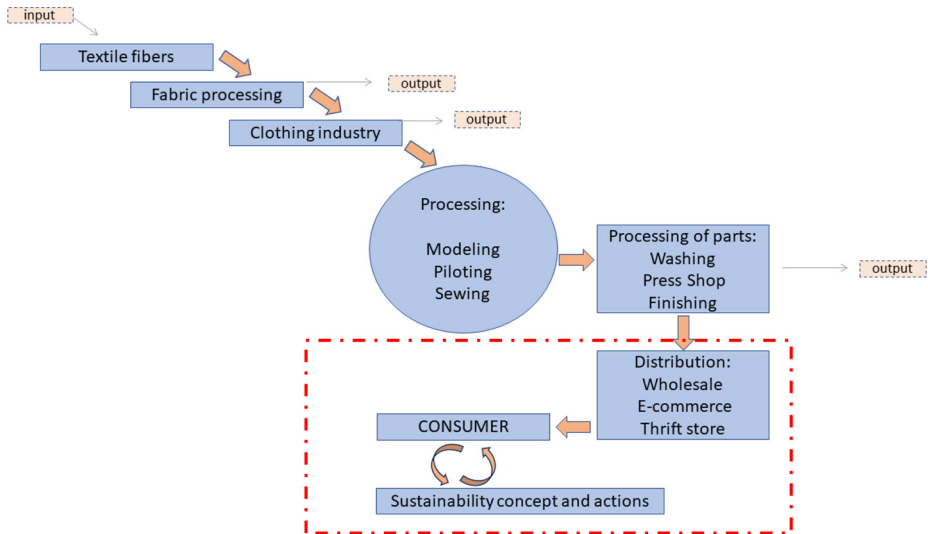
Figure 1 represents the garment production process, and the dotted area represents the study boundaries, which are the distribution of the pieces to commerce (wholesale) and retail through physical stores, e-commerce and thrifty stores and the interaction of the consumer in this process of purchasing, using and discharging the clothes.

#### 3.1 Descriptive statistics

The questionnaire data were organized and processed in an Excell® spreadsheet. The minimum and maximum values were calculated. Since we had quantitative and categorical variables, we had to transform the categorical variables into discretization or range. The RapidMiner version 9.0 was used to process the data.

#### 3.2 Cluster and aggregation analysis

The six nominal categories of attributes were adopted, and to perform the aggregation analysis, we fixed the attribute age. We crossed it with the annual income, how long a piece



Source: The Authors

**Figure 1.** The apparel supply chain and the enhanced section of the present study

of apparel is used, how much the consumer spends on clothing per year, the sex and how many times the consumer purchases clothing. The Aggregate operator was applied using RapidMiner®9.0 (Mierswa and Klinkenberg, 2018), and the attribute Aggregate operator by age was applied. This operator performs the aggregation functions known from Structured Query Language (SQL). This operator provides many functionalities in the same format as the SQL aggregation functions. SQL aggregation functions and “group by” and “having” clauses can be imitated using this operator.

The Aggregate operator creates a new ExampleSet from the input ExampleSet, showing the results of the selected aggregation functions. Many aggregation functions are supported, including Sum, Count, Min, Max, Average and similar functions from the SQL. The functionality of the “group by” clause of SQL can be reproduced using the group by attributes parameter. This operator obtains summary information, such as averages and counts.

### 3.3 Cluster analysis using the aggregate results

The values of the attributes were normalized. Adjust the value range when dealing with attributes of different units and scales needed to be done, and normalization helps compare attributes that vary in size. Of the 13 attributes, only five were used in the cluster analysis. The k-means algorithm (KNN) was applied for cluster calculation, identifying a specified number of clusters ( $k = 4$ ) and assigning each sample to a unique cluster. The determination of similarity between samples was based on a distance measure. The position of the center in the  $n$ -dimensional space, representing the  $n$  attributes of the data set, defines a cluster in the k-means algorithm. To evaluate the clusters, we utilized the Silhouette score K-means to assess the quality of these clusters, which measures how similar an object is to its cluster compared to other clusters. The Silhouette score ranges from  $-1$  to  $1$ , where a high value

indicates that the object is well-matched to its cluster and poorly matched to neighboring clusters. The Davies-Bouldin Index (DBI) method was used to measure cluster validity. DBI is a significant metric for evaluating the quality of clustering algorithms in data analysis, particularly relevant in unsupervised learning. It evaluates how well the clusters are separated and how compact the clusters are internally. A lower DBI value indicates better clustering because it suggests that clusters are dense and well-separated from each other. Since it provides a direct measure of clustering quality, it facilitates decision-making regarding specific data.

### 3.4 Data mining

Data mining was applied to verify the connections among the questionnaire's responses (independent variables-attributes). Data mining is a systematic procedure that retrieves undisclosed information from databases, employing the acquired insights to inform critical decisions by identifying patterns and rules (Hand *et al.*, 2001; Nenonen, 2013). The target variable was whether the consumer was environmentally friendly (Y) or not (N). The target was defined using the concept that environmentally friendly behavior is when consumers hold strong personal norms for environment-friendly behavior (Thøgersen and Ölander, 2003). The software Rapidminer 9.0 (Mierswa and Klinkenberg, 2018) was used to process the data.

The input independent variables (attributes) were the consumer data on their (1) age, (2) sex, (3) home status (if they live alone or within a family), (4) their level of education (scholarly), (5) annual income (US\$), times per year they buy new clothes, (6) the importance of buying clothes from a sustainable company, (7) where they buy their clothes, (8) how long they use the clothes, (9) how much are they willing to pay for sustainable clothes, (10) if their last shopping was from a sustainable industry, (11) how much they know about the industrial production of fabrics for clothing, (12) how clothes should be disposed of for not to pollute the environment and (13) if they are aware how clothes placed in the trash are discarded. This information was discretized, and a nomenclature was adopted to process. The data was pre-processed, and five attributes were employed for the analysis based on the consistency of the answers.

The random forest algorithm was selected for classification with the random trees. The procedure exhibits consistency and sparsity adaptation, implying that the number of relevant features determines its convergence rate and remains unaffected by irrelevant noise variables (Biau, 2010). The method is generally recognized for its accuracy and ability to deal with small sample sizes, high-dimensional feature spaces and complex data structures (Scornet *et al.*, 2014; Schonlau and Zou, 2020). The tree model first indicates the attribute that best discriminates the distribution of the target variable and divides the observations accordingly. The model accuracy was expressed as a percentage, representing the ratio of correct predictions to the total number of predictions made by the model. Cohen's Kappa statistic (K) was used to assess the reliability of classification models by comparing the agreement between the model's predictions and the actual classifications. K is a recognized metric for assessing inter-rater reliability in dichotomous outcomes (Blackman and Koval, 2000).

## 4. Results

A complex interplay of cultural, social and economic factors influences consumers' purchase and disposal behavior in the fashion industry. Understanding these influences is crucial for promoting sustainable fashion practices. We present a descriptive analysis of the results, followed by the cluster analysis and the resulting tree with the root attributes for classifying the sustainability of a segment of Brazilian apparel consumers.

4.1 Descriptive statistics of the questionnaire answers

Table 1 summarizes the descriptive results of the independent variables from the questionnaire's responses.

This survey obtained valuable responses from participants over 40 years old (40%), with a greater number of participants between 25 and 39 years old (49%) and by an age group under or equal to 24 years old (11%). Of the total answers, 27% declared males and 73% females; in both cases, the majority lived in a family. Concerning the respondents' educational attainment, a higher volume of responses was received from individuals with postgraduate degrees (42%), followed by those with undergraduate degrees (26%) and in undergraduate college (25%). A smaller subset of responses came from participants attending high school (7%), reflecting diverse educational backgrounds among the respondents.

Concerning the annual income of the research members, there was a significant number of people who have an annual income of up to two minimum wages (31%), followed by people who have an income of four to ten minimum wages (30%), then people who have an income of two to four minimum wages (21%) and a smaller number of participants with income above ten salaries (18%). Regarding the number of times a person buys clothes per year, the responses were higher for people who buy up to three times/year (35%), followed by people who buy clothes up to 12 times/year (25%) and a smaller number of participants who buy clothes once (15%) and twice a year (14%). While 11% buy clothes more often than 12 times/year.

A considerable number of responses were obtained from respondents who think it is important to buy clothes from companies that care about sustainability (73%), followed by those who do not make a difference between buying from sustainable companies and non-sustainable companies (18%), and a minimal number of participants who do not consider to make the purchases from companies that are not concerned with sustainability (6%) or do not care (3%). Regarding solid waste discharge habits, 47% of the answers said they dispose of

**Table 1.** Summary of the questionnaire responses descriptive results (independent variables (attributes))

Questions from the questionnaire (attributes)	Median	Min	Max
1 Age	32	21	49
2 Annual income (US\$)	8,762.0	2,918.0	58,461.0
3 Times per year to buy new clothes	3	1	12
4 The importance of buying clothes from a sustainable company	–	N (6)	Y (133)
5 How much do you spend yearly on clothes?	371	222.0	745.0
6 How much are you willing to pay more for sustainable clothes? (US\$)	7.5	10.5	22.3
7 Was your last shopping from a sustainable industry?	–	N (39)	Y (77)
8 Do you know what the industrial production of clothing fabrics is?	–	N (5)	Y (78)
9 Do you wear cotton clothes, such as knit shirts and jeans?	–	N (2)	Y (180)
10 Do you wear synthetic clothing like acetate, polyester, acrylic, and nylon?	–	N (9)	Y (118)
11 How long have you used a piece of clothing? (year)	4	1	≥5
12 Do you know how clothes should be disposed of properly so as not to pollute the environment?	–	N (9)	Y (77)
13 Do you know how clothes placed in the trash are discarded?	–	N (3)	Y (125)

**Notes:** N and Y refer to the attribute's number of responses (within parenthesis). The intermediary values refer to the answers "I do not care" and "I do not know"

**Source:** The Authors



all waste in the trash can, which ends up in landfills, while 47% state that they separate solid waste for recycling and 6% do not care about recycling. The most important answers for the remaining attributes were that 43% buy clothes at department stores, while 24% buy used apparel in thrift stores. Sixty-five percent of the responders use synthetic clothing, while 67% do not know that clothes thrown into trash end up in landfills. On the other hand, 21% do not know how fabric production can be a pollutant activity, while 69% do not know how clothes should be discarded.

#### 4.2 Result of cluster analysis

The found DBI was 0.532, suggesting a moderate level of compactness and separation in the clusters identified by the algorithm. Measuring with DBI maximizes inter-cluster distance and, at the same time, tries to minimize the distance between points in a cluster. When the inter-cluster distance is maximal, each cluster's characteristics are small; therefore, the differences between clusters are enhanced. A minimum intra-cluster distance means that each object in the cluster has a high level of similarity (Mughnyanti *et al.*, 2020).

The mean values of the features within each cluster were examined to identify and understand the characteristics of each cluster. The overall Silhouette score (0.202) suggests that the clusters are somewhat separate and distinct, but there might be some overlap.

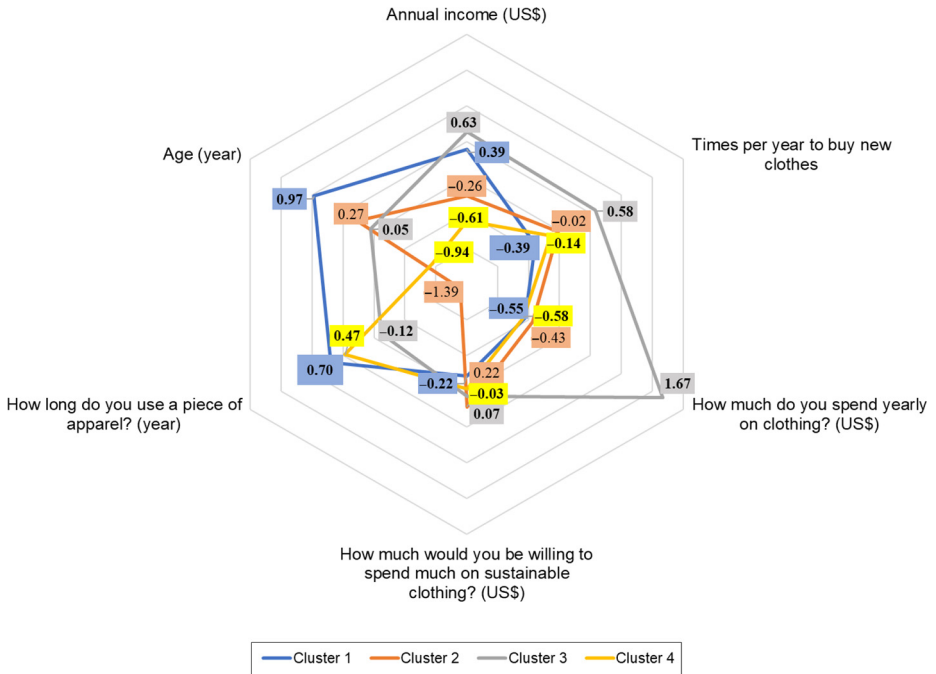
Results point to four clusters showing a minimum intra-cluster distance, indicating that the independent variables have a high level of similarity. Even though the questionnaire had 13 questions, only five attributes were relevant for the cluster analysis after the pre-processing data. Figure 2 shows the score distribution for the six nominal attributes. Table 2 provides insight into what defines each cluster and how they differ.

#### 4.3 Data mining results

The Random forest algorithm was used, which resulted in an accuracy of 97.92 and  $K = 0.952$ . From the total attributes (5) used in the data mining database, the algorithm used only four attributes to assess consumer sustainability (age, annual income, the amount spent yearly on clothes and how long the clothes are worn). Figures 3 and 4 show the tree classification, considering the amount spent yearly on clothing (Figure 3) and annual income (Figure 4) as the primary attribute. The classification follows an "If – then" set of rules starting with the primary attribute and leading to the target, which, in the present study, was whether the apparel consumer was sustainable (Y) or not (N).

In Figure 3, the tree's classification indicates that if the consumer spends more than or equal to US\$296.5 on clothes yearly, then we need to check how long the consumer wears the clothes. If the piece of apparel has been used for over three years, then the consumer is sustainable; otherwise, he/she is not sustainable. One must check the annual income if the amount spent on clothing is less than US\$296.5. If the annual income is more than US\$32148.5, then the consumer is sustainable; otherwise, one must check how long he/she wears the clothes. If the clothes are worn for over three years, then the consumer is sustainable; otherwise, the consumer is not sustainable.

In Figure 4, the tree's classification indicates that if the consumer's annual income is higher than US\$51151.5, then he/she is not sustainable. If the consumer's annual income is less than or equal to US\$51151.5, then one must check the consumer's age. If the age is above 44.75, one must recheck the annual income. If the annual income is less than US\$32148.5, then he/she is sustainable. If the consumer has an annual income above or equal to US\$32148.5, then one must check how long the clothes are worn. A consumer is considered sustainable if the clothing has been worn for over three years; otherwise, the consumer is not sustainable.



Source: The Authors

Figure 2. Clusters and the Silhouette score of normalized attribute values

Despite a widespread understanding among consumers regarding the environmental repercussions of their clothing choices, this knowledge frequently fails to manifest in sustainable consumption and disposal practices. This disconnect can be attributed to various factors, including economic constraints and other competing influences (Rathinamoorthy, 2020).

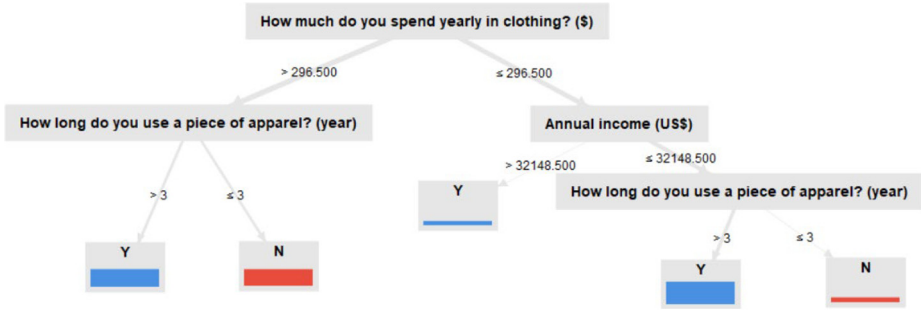
### 5. Discussion

The Influence of age on sustainable habits in apparel consumers is multifaceted and varies across different generational cohorts. We found that older and younger customers tend to be more sustainable (Table 2), indicating the importance of age in clothes' sustainability issues. This finding agrees with the results of Granskog *et al.* (2020), who found that Gen Z (aged 18–23) and Millennials (aged 24–39) intend to adopt more sustainable attitudes toward buying clothes options. In the same direction, Lin and Chen (2022) showed that generational cohorts can moderate the relationship between environmental consciousness and sustainable apparel purchase intentions. Specifically, it demonstrated that younger generations like Gen Z are more inclined toward sustainable fashion choices, including the rental, second-hand and recycled apparel markets. On the other hand, factors such as financial limitations, brand perceptions and personal values significantly influence these decisions (Patwary *et al.*, 2023). This might be why we found that older respondents from Gen X (aged 40–55) surpass the barriers of financial constraints, perceived risks and social acceptance that can afford sustainable purchasing behavior.

**Table 2.** Attributes and the four cluster characteristics

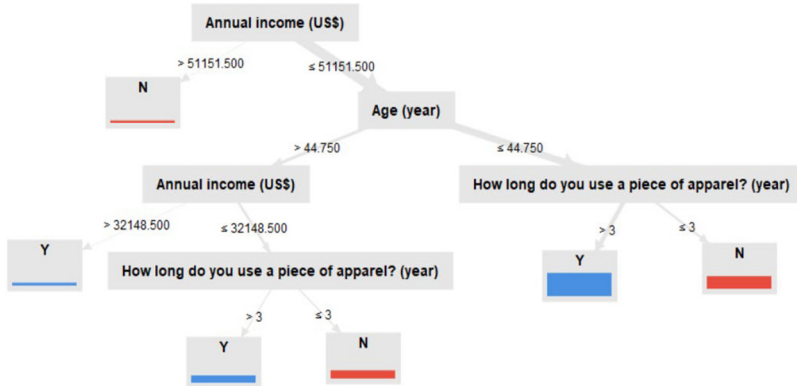
Attribute	Cluster and characteristics			
	1	2	3	4
Age	Members are generally older	It contains a mix of age groups	Members are relatively younger	This cluster tends to be younger
Annual income	This cluster has an above-average annual income	This cluster has a below-average income	Members of this cluster have a relatively higher annual income	Members have a lower annual income
Times per year to buy new clothes	They buy new clothes less frequently	They purchase new clothes at an average rate	They buy new clothes more frequently than average	They buy new clothes slightly less often than average
How much do you spend yearly on clothes?	Their spending on clothing per year is low	Their spending on clothing is slightly below average	Their yearly spending on clothing is significantly higher	Their yearly expenditure on clothing is low
How much are you willing to pay more for sustainable clothes?	They have a lower willingness to spend on sustainable clothing	They show a higher willingness to spend on sustainable clothing	The willingness to spend on sustainable clothing is moderate	The willingness to spend on sustainable clothing is average
How long have you used a piece of clothing?	They tend to wear apparel for a longer duration	They wear their apparel for shorter durations	They wear a piece of apparel for an average duration	They tend to keep their apparel for a long time
Sustainable consumers	Most members are sustainable consumers	This cluster primarily consists of non-sustainable consumers	This cluster has a mix of sustainable and non-sustainable consumers	Most members are sustainable consumers

**Source:** The Authors



Source: The Authors

Figure 3. Random tree for classifying the sustainability of apparel consumers having as primary attribute the yearly amount spent on clothing



Source: The Authors

Figure 4. Random tree for classifying the sustainability of apparel consumers having as primary attribute the consumer annual income

Respondents in cluster 2 had a group that primarily consisted of non-sustainable consumers. The main characteristics were that they were a mixed-age group, wore their clothes for shorter durations and had a below-average income; those features are similar to those reported by McCarthy and Shrum (1994) that the orientation toward sustainable consumption is not necessarily related to income.

Data mining results indicate that only four attributes were relevant for the sustainability classification: age, annual income, yearly spending on clothes and how long the clothes are worn. The most common ground was the gathering on the answer to the question, "How much would you be willing to spend on sustainable clothing?" The answers show a positive aspect mainly related to value. As Kim and Hall (2021) indicated, attracting customers to embrace sustainability requires appealing to individual and collective values, as values significantly influence personal attitudes and social norms.

Another finding was that age plays a significant role in adopting sustainability when buying, using and disposing of clothes (Table 1). Stolz and Bautista (2015) investigated the importance of environmental sustainability in purchasing decisions, the perception of corporate sustainability and the impact of perceived corporate sustainability on sustainable actions. The authors found that older consumers are significantly interested in the environmental impact of their purchases. Perceived price and quality of sustainable products lead them to act in an environmentally sustainable manner.

Positive attitudes and social norms influence sustainable fashion purchasing intentions (Lenne and Vandenbosch, 2017; Okur and Sarçam, 2018). Also, altruistic and biospheric values drive sustainability-conscious behaviors, with personal norms as significant predictors of sustainable fashion consumption (Gomes *et al.*, 2022; Burton and Eike, 2023). Therefore, other than specific generations, personal attitudes, social norms and value-driven beliefs promote sustainable consumption behaviors.

The amount spent yearly on clothes and the annual income were determinant attributes in the first and second trees. Age was the secondary attribute, and the annual income was followed by how long the clothes were worn. However, in both tree results, the most significant attribute was the time the clothes were worn. Some respondents stated they had worn clothes for up to five years (Table 1).

Previous literature (Govindan and Soleimani, 2017; Bukhari *et al.*, 2018; Cai and Choi, 2020) reinforces that reuse, remanufacturing and recycling are ways of reaching sustainability in the clothing industry. In reverse fashion (Cai and Choi, 2020), included in the sector's supply chain, despite the large amount of post-consumer waste, can offer opportunities. Farrant *et al.* (2010) present the sale of second-hand clothes as a reuse action to reduce the environmental impact since it imposes limits on the manufacturing of new clothes. According to Kim and Hall (2021), one must call for individual and collective values to attract customers to adhere to sustainability issues, as value substantially impacts attitude, personal norms and social norms. Attitude, personal norms and social norms on source are found to have positive impacts on participation.

Educating consumers about the environmental impact of their clothing choices and promoting sustainable consumption patterns are critical steps. Sustainable practices include extending the lifecycle of garments through repair, reuse and recycling (Rotimi *et al.*, 2021). Practices like clothing renting and swapping can reduce new purchases and minimize waste. These practices are influenced by fashion leadership, the need for uniqueness and materialism (Lang *et al.*, 2013).

Leal Filho *et al.* (2019) focused their review of the textile chain on identifying and evaluating the advantages of reusing and recycling clothing in the search for potential opportunities and highlighting successful initiatives, especially in technologically advanced areas in countries in Europe. Amicarelli *et al.* (2022) concluded that the production phases are the most responsible for the negative impacts, and in distribution and consumption, there are few studies, especially considering emerging forms of consumption, such as sharing and renting platforms, on which there are available data.

Recycling and reuse, the most appropriate ways to dispose of textile and clothing waste, need the support of institutions that deal with waste pickers, professionals who, despite contributing to the reverse logistics of all product compounds, are people in situations of extreme poverty in the big cities, and need an organization to act together in the search for rights and better living and working conditions. Piontek and Müller (2018) studied whether clothing rental brings more sustainability and ecological benefits than conventional consumption. The authors suggest expanding consumer behavior studies to address circularity in this business chain better. Reuse and recycling must consider the process as a

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whole, such as the replacement rate of the natural product, clean production processes, transport used by the customer and situations that can nullify the benefits of the environmentally correct practice of recycling and reuse.

The interaction between age, annual income, yearly spending on clothes and the lifespan of clothes is complex and influenced by various factors and consumer behaviors. Starting with age, spending patterns on clothing change significantly over a person's lifetime. According to [Foster \(2015\)](#), the average amount spent on clothing does not significantly differ for younger age groups. However, as age increases, there is a noticeable decrease in clothing expenditure. This trend is likely due to a combination of factors, including changes in lifestyle, retirement and a shift in priorities. In terms of annual income, there is a decrease in income with age, which could contribute to the reduced spending on clothing observed in older age groups ([Hervé and Mullet, 2009](#); [Rausch and Kopplin, 2021](#)). The yearly spending on clothes varies across different age groups, following a pattern that seems to correlate with income and life stages. The greatest amount spent on clothing is typically seen in the 35–44 age group, which might correspond to peak earning years and perhaps a focus on professional attire. However, spending declines as people age, likely due to decreased social obligations or a shift in spending priorities ([Harris et al., 2016](#); [Williams and Hodges, 2020](#)).

Finally, the lifespan of clothes is influenced by various factors, including those related to the garment itself, the user, garment use and overall clothing practices. While some factors affecting clothing lifespans, such as income, nationality and age, are less amenable to change, they provide valuable insights into where targeted efforts for extending clothing lifespans can be most effective. Quality management, marketing strategies and consumer education can influence garment prices and fashion attitudes ([Bianchi and Birtwistle, 2010](#); [Laitala and Klepp, 2020](#)).

The interaction of these variables reflects a complex interplay of economic, lifestyle and personal preference factors that evolve throughout an individual's life. As income and age change, so do spending habits and attitudes toward clothing, influencing the amount spent on apparel and the lifespan of the clothes purchased.

We believe the consumer's profile may help the fashion industry redirect investments in sustainability. As the industry attends to consumer demands in manufacturing sustainable clothing, society reaches the UN SDG 12, which is related to responsible production and consumption.

The present study had some limitations. The sample is relatively small considering the population of Brazil (>200 million inhabitants); however, although we tried to send the questionnaire several times by e-mail, the response was limited. Another limitation was that age and scholarly are related to higher yearly income in the present survey. Since we could not separate the effects of income on customer behavior, the issue of younger consumers with less income might be willing to spend less on clothing needs to be addressed in future research.

A limitation of this study is that the survey respondents primarily consisted of individuals with higher education levels and, consequently, higher incomes. Therefore, the findings may not accurately represent the broader Brazilian population or the diverse consumer base in the market. Future studies should seek a more extensive and varied sample of diverse consumers. In addition to having a more concise sample, this mix of consumers from different origins would make the study more robust, portraying a niche of consumers and covering the entire region with its numerous consumers. Conclusions that achieve this higher could demonstrate more complex results.

Further research could investigate the interplay between consumer's recycling creativity and fashion waste management. This would be advantageous for both fashion industry professionals and academics, as current consumer behavior models require revision to understand better and accommodate the desires and requirements of environmentally-conscious consumers. Retailers and manufacturers should implement take-back schemes and recycling programs to promote sustainable disposal practices (Soyer and Dittrich, 2021).

We noticed that the purchase intention from companies with products with higher costs (including the cost of positive environmental actions) concern is assessed, where many responses stated that they prefer to buy environmentally responsible products but are not willing to pay an additional cost. The reported behaviors may not reflect actual practices, as they portray consumers with similar backgrounds. Therefore, there are these limitations between consumption intention and behavior. This might have contributed to the lack of a significant relationship between these two variables (consumption intention and actual behavior). Identifying deficiencies in Brazilian consumer awareness, public policies could be targeted through educational initiatives or social marketing campaigns to enhance sustainable fashion adoption.

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**Table A1.** Nomenclature for the discretization of the categorical and nominal responses

Nomenclature	Digitalization
DNC = do not care	3
DNK = do not know	2
OTC = only in the trash can	1
Y = Yes	1
n = no	0
<i>Education</i>	
G = graduate level	3
PG = post graduate level	2
GI = incomplete graduate level	1
HS = high school level	0
<i>Sex</i>	
0 = female	0
1 = male	1
<i>Recycling habits</i>	
R = recycle	0
IC= I care	1
<i>Living habit</i>	
Acc = accompanied	1
Al = alone	0
<i>Used apparel destination</i>	
DTF = donation to family members and friends	1
DTC = donation to charity	0
<i>Age range</i>	
≥24	0
≥39 ≥ 25	1
≥40	2
<i>Monthly wage* (US\$)</i>	
A = Up to 2 minimum wages => \$ 5,837.00	
B = From 2 to 4 minimum wages (from \$ 5,837.00 to \$11,687.00)	
C = From 4 to 10 minimum wages (from \$11,697.00 to \$ 29,224,00)	
D = From 10 minimum wages (above \$29,224.00)	
<b>Note:</b> *Conversion rate 1US\$= R\$ 5.39 (6 January 2023)	
<b>Source:</b> The Authors	

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