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Combining SWOT with AHP for Analyzing the Adoption of a Circular Economy in the Apparel Industry in Brazil

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Abstract: The Brazilian fashion industry is the country's second-largest generator of direct and indirect jobs. Despite Brazilian design being a world reference mainly for prints and summer-related collections, it is also the second most polluting industry in the country. We investigated the factors that impact adopting a circular economy in the textile industry using an association of a SWOT analysis and the AHP approach. We analyzed the adoption of a circular economy in the apparel industry. The opportunities, strengths, weaknesses, and threats were associated using the evaluators' comparison of the selected SWOT items related to the application of a circular economy in the conventional apparel industry were used as criteria for the AHP approach. The case study used managers from two intimate apparel industries in northeastern Brazil and four academics in Production Engineering. By applying the concepts to the case study, we found that expanding products, upcycling, and increasing sustainability were the three vital criteria for reaching a circular economy in the studied apparel industry.

Keywords: business; fashion industry; sustainability; upcycling

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1. Introduction

Fashion is a global industry worth nearly USD 2.5 trillion and is one of the most polluting industries worldwide. Despite these problems, fashion can make positive changes, reinventing currently harmful systems [1,2]. The Brazilian fashion industry is the country's second-largest generator of jobs, behind only the food and beverage sector. Brazilian design is a world reference mainly for prints and summer-related collections. On the other hand, it is also the second most polluting industry [3]. The concern with non-renewable resources, environmental pollution, and inappropriate disposal of waste materials emerged in sustainable consumer thinking, which demanded a position from the industry. This is one of the reasons many companies in the sector are investing in sustainability in their manufacturing process.

Fashion sustainability has recently become a public debate topic involving different actors and a broad audience. Sustainability is often described as harmonizing environmental, social, and economic aspects for a holistic financial result. There is much concern about the sustainability impacts of the apparel industry, mainly related to the environmental and social impacts [1,4,5]. Sustainable fashion is also about considering apparel from the perspective of many stakeholders—users and producers, all living species, contemporaries, and future inhabitants of the Earth [6]. Sustainable fashion is the responsibility of citizens, the public, and the private sector [7]. Therefore, a link between the supply chain from materials to consumers must be observed. Previous studies [6,8] suggest that studying consumer behavior is critical to approaching the circular economy in business chains. An

actual example of the need for systemized thinking in fashion is the benefits of product-level initiatives, such as replacing one type of fiber with an option that is less harmful to the environment [9].

The environmental impact of fashion also depends on how much and for how long a garment is worn. With the fast-fashion trend, clothes are much less worn than 15 years ago, mainly due to the significant increase in the collections launched by the fashion industry [10]. Typically, an outfit worn daily over the years has less impact than an outfit worn once to be quickly discarded. Previous studies [11,12] have shown that the classic jean's washing and drying process is responsible for almost two-thirds of the energy consumed over the jean's entire life. Likewise, about 80% of the total energy used for underwear production comes from the laundry processes. Thus, wear and tear practices affect clothing life cycles and must be addressed for a more significant systemic impact [13].

Assessing the sustainability of apparel is problematic due to the variety of products and the diversity of supply chain actors. The top fast-fashion retailer features 400 new styles a week online, and fast fashion encourages the rapid consumption and disposal of clothing, with severe consequences for sustainability [5]. A lifecycle assessment has been a tool to assess the sustainability of clothing. Using lifecycle for apparel is challenging due to the variety of products (and materials) and the diversity of supply chain actors globally [14].

Stakeholder involvement is essential for product sustainability assessment methods. Product stakeholders come from the company (consumers, workers, shareholders), the economy (suppliers), the government (government authorities, regulators), and society (non-profit organizations, local communities). The business management of different stakeholder relationships reflects the company's overall success, although understanding and satisfying stakeholder needs is complicated and time-prohibitive [13,15].

More durable materials and products are often promoted as a strategy to increase resourcefulness and sustainability in product groups, including fashion. However, these gains depend on changes in user behavior and consumption patterns, which in fashion, in particular, are influenced by social and experiential dimensions, not just material products [15,16]. The obsolescence of fashion products, driven by aesthetic changes and linked to changes in social preferences, underscores the psychosocial nature of the factors that affect the longevity of fashion apparel. This is reflected by ethnographic evidence showing that clothing that defies obsolescence does so in informal or unintentional ways, rarely due to design planning or material or product qualities [10]. Understanding eco-friendly clothing purchasing behavior requires special efforts compared to other industries. Fashion is one of the most change-intensive consumer product categories and is primarily affected by social components [9].

There are many concepts for the circular economy, but it is most popularly conceptualized as a combination of recycling, reducing, and reusing activities and processes. Its main objective is economic prosperity and environmental quality [17]. The circular economy's use in the process contributes to the chain's sustainability and ensures less environmental impact [18]. Borasino and Fuhrmann-Riebel [19] found that national and international pressure on superstores to adopt sustainability actions can be a competitive advantage and a good economic reason to advocate circularity.

The SWOT (Strengths, Weaknesses, Opportunities, and Threats) methodology is attractive when considering management and innovation processes. The technique has been used to compare project evaluation methods [20] and to assess the financial/economic viability of creating a technological solution for the judiciary system [21]. Biava [22] analyzes the SWOT method as a tool for the feasibility of undertaking a segment and making economic, management, and innovation analyses. Soter et al. [23] used the SWOT methodology to implement sustainable ideas in product design, applying the feasibility assessment of a process and a project [24].

The Analytic Hierarchy Process (AHP) is a multicriteria decision approach developed by [25] and applied to several areas of knowledge [26–29]. The method decomposes the problem into a hierarchy of criteria and sub-criteria that can be subjectively appraised. The method's strength is the possibility to evaluate quantitative and qualitative criteria and alternatives on the equal preference scale. Kim and Park (2019) [30] conducted a SWOT analysis of the textile industry in Uzbekistan using the AHP multicriteria assessment, comparing opportunities, strengths, weaknesses, and threats and, through the evaluators, identified priorities to improve the production process.

In the present study, we investigated the factors that impact adopting a circular economy in the textile industry using an association of a SWOT analysis and the AHP approach. The case study used the judgment of four experts and two managers of intimate apparel industries in a cluster of textile industries to evaluate implementing a circular economy in the businesses.

2. Methods

For the case study, two intimate apparel industries were selected in Piripiri, Northern Piauí state, Brazil. The city has 63,829 inhabitants, with a GDP per capita of USD 2240.73 (conversion rate on 22 September 2022) and an IDHM of 0.635 [31]. A cluster of clothing industries was formed in the city a few years ago, which generated more than USD 4051.56 (conversion rate of 22 September 2022) per year and produced more than 8 million pieces per year, according to a survey carried out by the Support Service for Micro and Small Enterprises [32]. We adopted the group session evaluation, and the AHP was applied to a network [33] of four specialists and two managers of two different intimate apparel industries. Table 1 describes the main characteristics of the evaluators, consisting of four academic specialists and two managers of the selected industries. The participating companies were chosen due to their representativeness for the region's manufacturing cluster, as they generate the most employment and income and have been in operation for the longest time.

Table 1. Description of the evaluators who participated in the study.

	Evaluator	Professional and Commercial Traits
Academic	1	Researcher with extensive experience in the textile and clothing industry.
	2	Professor and researcher with extensive experience in sustainability and cleaner production.
	3	Professor and researcher with academic experience in production engineering.
	4	Teacher and designer with experience in production and factory floors of the clothing industry.
Industrial	5	Manager of Industry A. The company is in the under-garment segment, produces more than 200,000 pieces per month, and has been in the market for 25 years.
	6	Manager of Industry B. The company is in the under-garment segment, produces around 180,000 pieces per month, and has been in the market for 20 years.

The present study used the SWOT methodology to identify the themes associated with adopting a circular economy (Table 2). We also comprised the references supporting the proposed choices.

Table 2. SWOT items related to the application of circular economy in the conventional apparel industry were used as criteria for the AHP approach.

Criteria 1 Strengths	Subcriteria	Criteria 2 Weakness	Subcriteria
- Reduction in generated waste [7,15]; - Younger consumers with a sustainable mindset [13,20]; - The county's companies donate 80% of their waste to craft associations [34]. - Longer usage time of clothing [4,34].	- Sustainability [18]; - Increase the consumers' ground [10,15].	- Production cost [2,7]; - Entrepreneurs do not worry about buying sustainable raw materials [11,35].	- Production cost; - Origin of raw material (Consciousness of raw material sustainability) [18].
Criteria 3 Opportunities	**Subcriteria**	**Criteria 4 Threats**	**Subcriteria**
- Expansion of the offer of products for future generations [5,34]; - Develop another source of income with the popularization of thrift stores [5,35]; - E-commerce increase [9,36]; - Emergence of a new perspective–Upcycling [7,14].	- Market expansion [16]; - Upcycling [10].	- Consumer is not willing to spend more for the product [13,36]; - Cost increase in the production process [7,16]; - Cost investment in marketing changes trends and encourages sustainable consumption [16,20].	- Final product cost [17]; - Marketing cost [20].

Those proposed items described in Table 2 were adopted for the construction and analysis of the scenarios using the Analytic Hierarchy Process (AHP) to analyze the adoption of a circular economy in the apparel industry. The criteria and sub-criteria used are shown in Figure 1.

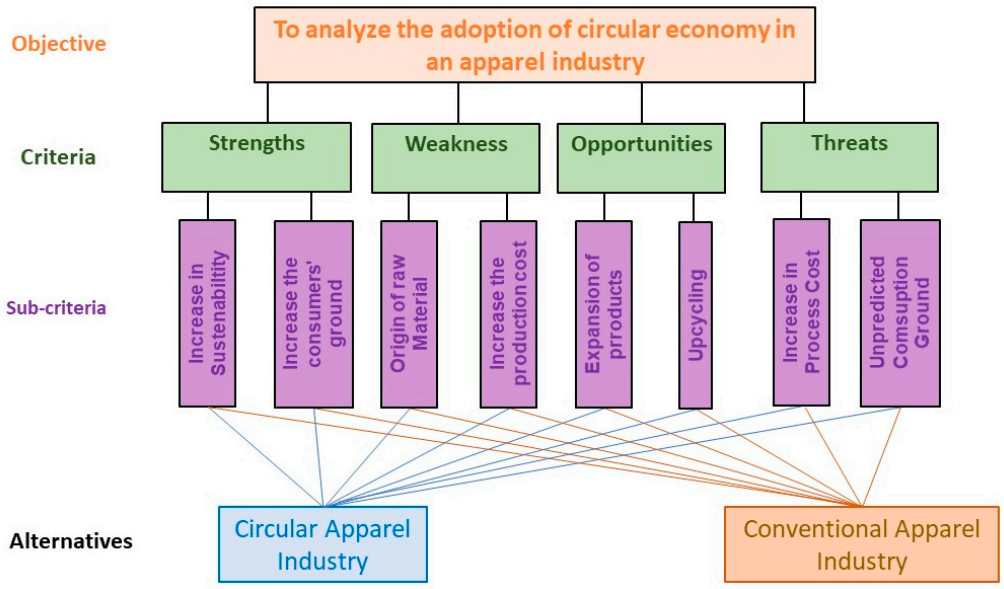

Figure 1. Analytic Hierarchy Process (AHP) schematic for comparing the adoption of circular economy in the apparel industry (case study).

The AHP is a decision-making approach that uses pairwise comparisons to quantify the relative importance of factors in a decision. It is a structured approach that helps decision-makers to break down a complex problem into smaller, more manageable parts and to identify the most important factors to consider. The AHP process consists of four steps: (1) establishing the hierarchical model, which involves identifying the different levels of the decision problem, from the overall goal to the specific criteria and alternatives; (2) conducting pairwise comparisons, as for each level of the hierarchy, the decision-maker compares the relative importance of the factors within that level, using a scale of 1 to 9 (Table 3 shows the scale of importance for the pairwise comparison between the criteria and sub-criteria), where 1 means equal importance, 5 means equal moderate importance, and 9 means much more important; (3) calculating the relative weighted value of factors, as the results of the pairwise comparisons are used to compute the relative weights of the factors. It is completed using a matrix multiplication algorithm, and (4) integrating the relative weighted value in evaluating factors when the relative weights of the factors are then used to evaluate the alternatives, consisting of multiplying the factors' weights by the alternatives' scores on each factor.

Table 3. Fundamental scale of importance [25].

Strength of Importance	Definition
1	Equal importance
2	Weak
3	Moderate importance
4	Moderate plus importance
5	Strong importance
6	Strong plus importance
7	Very strong importance
8	Very, very strong importance
9	Extreme importance

The AHP is a versatile decision-making methodology that can be used to solve various problems. It is particularly well-suited for problems with multiple criteria to consider, and the decision maker's preferences are unclear. Such pairwise comparison of the criteria transforms qualified evaluations into numerical values graded on a numerical scale [25,37].

We analyzed the data using the BPMSG web-based AHP solution for decision-making processes [33]. All evaluators were registered online and gave their preference for each criterion and subcriterion during the pairwise comparison. The software builds up a matrix where the rows and columns represent the components of the same component in the decision hierarchy (Equation (1)).

$$A = \begin{bmatrix} & \text{Criterion 1} \cdots & \text{Criterion n} \\ \text{Criterion 1} & 1 & \text{w1n} \\ \vdots & \cdots & \vdots \\ \text{Criterion n} & \text{wn1} \cdots & 1 \end{bmatrix} \quad (1)$$

where w = weight of importance, and n = position in the matrix.

The weight of component *i* equaled to component j comparative to the component is found using Saaty's scale (Table 3). The weight is then assigned to the (*i*, *j*)th position of the matrix [25] to support comparisons in a limited range with enough sensitivity. The reciprocal of the designated number is assigned to the (*j*, *i*)th position. The weights of the components are calculated by solving for the eigenvector of the pairwise comparison matrix. The pairwise comparisons yield a reciprocal (n, n) matrix, where a*ii* = 1 (diagonal elements) and a*ji* = 1/a*ij*, and the consistency relies on setting a*ji* = 1/a*ij*. The average of the eigenvalues (λ) can be used as a consistency index (CI), shown in Equation (2).

$$CI = (\lambda max - n)/(n - 1) \quad (2)$$

where CI = consistency index, λmax = highest eigenvalue, and n = number of the matrix elements.

The CI is assessed with the average random index (RI) obtained from associated random matrices to determine the error due to inconsistency [25]. We adopted the consistency ratio (CR = CI/RI) to evaluate the reliability of the results. CRmax with a value ≤ 0.1 must be retained for a consistent matrix, or the pairwise comparisons should be revised.

We adopted the following steps for analyzing the results: (1) we grouped the judgment of the academic specialists and the industry's managers separately, and (2) we grouped all evaluators in the same analysis. The schematic of the analysis process is shown in Figure 2.

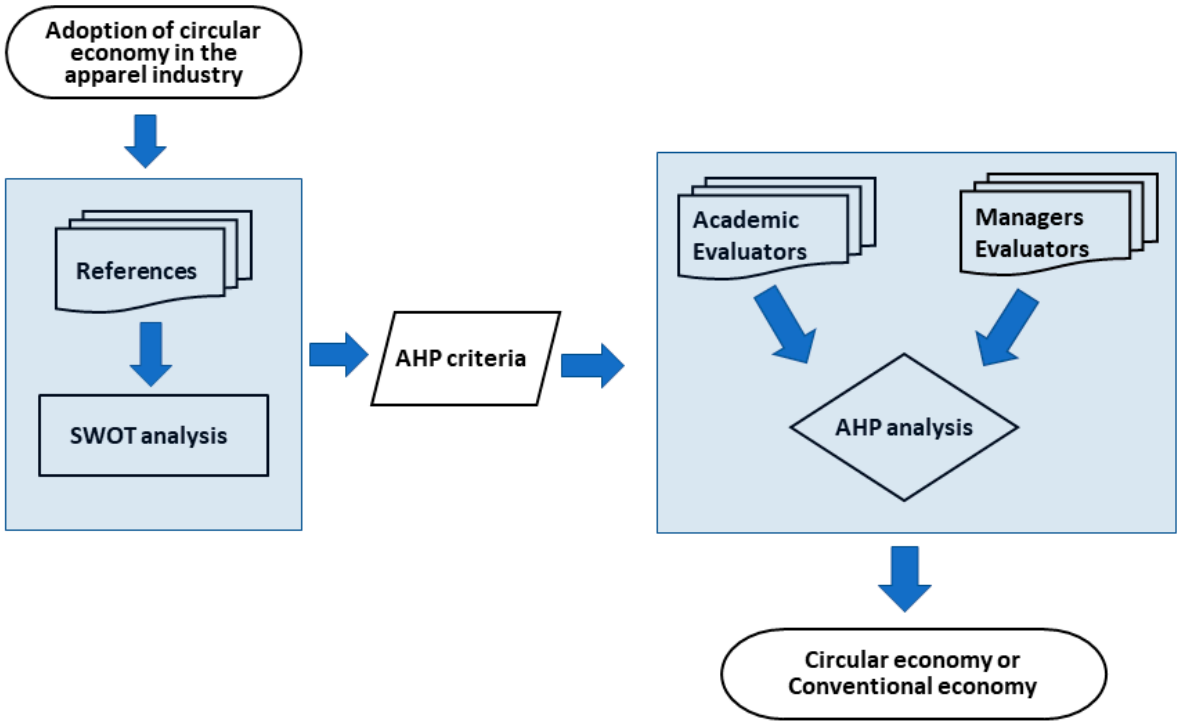

Figure 2. Schematic of the analysis process using the combination of SWOT analysis and the AHP.

3. Results

The results are presented and analyzed by examining the connection between consumers and the types of products they desire, taking into account their generation and individual relevance. We also wanted to learn about their overall perspectives on the benefits and drawbacks of the circular economy practical concepts in this process.

3.1. Academic Evaluators' Judgment

Table 4 shows the overall judgment results from the academic evaluators when comparing the conventional textile industry with a circular one. According to academics, the three priorities for the circular industry are "expansion of products" (31.7%), "upcycling" (29.3%), and "increased sustainability" (15%). The academic view relies on the Opportunities and Strengths of changing from a conventional to a circular economy in the textile sector. The average group consensus was high (83.6%).

Table 4. AHP results from the academic evaluators' judgment when comparing the criteria involved with the conventional textile industry with a circular one.

Goal	Level 1 Criteria (Weight)	Level 2 Criteria (Weight)	Weight (%)	Rank
Comparing the conventional and circular economy	Strengths (0.212)	Increase in sustainability (0.709)	15.0	3rd
		Increase the consumers' ground (0.291)	6.2	
	Weaknesses (0.083)	Origin of raw material (0.496)	4.1	
		Increase in the production cost (0.504)	4.2	
	Opportunities (0.611)	Upcycling (0.480)	29.3	2nd
		Expansion of products (0.520)	31.7	1st
	Threats (0.094)	Increase in the process cost (0.551)	5.2	
		Unpredicted consumption choices (0.449)	4.3	

CRmax = 0.05. We ranked the first three highest weights.

Breaking down the analysis by the level 1 criteria, we analyzed the four results by each node (Strengths, Weaknesses, Opportunities, and Threats). The result of the Strength node had an AHP group consensus low (32.3%) and CRmax = 0.00. The highest priorities of the individual participants were in the criterion "increase in sustainability" (70.9%), followed by "increase in consumers' ground" (29.1%). The result of the Weaknesses node presented an AHP group consensus very low (15.2%) and CRmax = 0.004. The highest priorities of the individual participants were in the criterion "increase in production cost" (50.4%), followed by the "origin of raw material" (49.6%).

The Opportunities node result showed a very low AHP group consensus (16.7%) and CRmax = 0.00. The highest priorities of the individual participants were in the criterion "Expansion of products" (50.4%), followed by "Upcycling" (48.0%). As for the Threats node, the group consensus was very low (16.5%), and the CRmax = 0.006. The highest priorities of the individual participants were in the criterion "increase in production cost" (50.4%), followed by the "unpredicted consumption choice" (44.9%).

3.2. Industry Manager Evaluators' Judgment

The results shown in Table 5 presented CRmax = 0.04 and a very high AHP group consensus (99.4%). The priorities for industries were "expansion of products" (25.7%), "upcycling" (25.7%), and "increase in sustainability" (25.5%). There was a low consensus in the group (43.1%) regarding Opportunities, while in Threats, results show a high consensus (99.1%). Regarding the Weaknesses, there was a consensus of 99.7%, and in terms of Strengths, there was a very high group consensus (99.7%). The overall homogeneity was 63.3%.

Table 5. AHP results from the industry manager evaluators' judgment when comparing the criteria involved with the conventional textile industry with a circular one.

Goal	Level 1 Criteria (Weight)	Level 2 Criteria (Weight)	Weight (%)	Rank
Comparing the conventional and circular economy in the apparel industry	Strengths (0.308)	Increase in sustainability (0.830)	25.5	3rd
		Increase the consumers' ground (0.170)	5.2	
	Weakness (0.124)	Origin of raw material (0.183)	2.3	
		Increase in the production cost (0.817)	10.1	
	Opportunities (0.515)	Upcycling (0.500)	25.7	2nd
		Expansion of products (0.500)	25.8	1st
	Threats (0.053)	Increase in the process cost (0.817)	4.4	
		Unpredicted consumption choices (0.183)	1.0	

CRmax = 0.04. We ranked the first three highest weights.

Breaking down the analysis by the level 1 criteria, we analyzed the four results by each node (Strengths, Weaknesses, Opportunities, and Threats) based on the managers'

responses. The result of the Strength node with an AHP group consensus was very high (99.1%) and CRmax = 0.00. The highest priorities of the individual participants were in the criterion "increase in sustainability" (83.0%), followed by "increase in consumers' ground" (17.0%). The result of the Weaknesses node presented an AHP group consensus very high (99.7%) and CRmax = 0.03. The highest priorities of the individual participants were in the criterion "increase in production cost" (81.7%), followed by the "origin of raw material" (18.3%). The Opportunities node result showed a low AHP group consensus (43.1%) and CRmax = 0.00. The highest priorities of the individual participants were in the criterion "Expansion of products" (50.0%) and "Upcycling" (50.0%). As for the Threats node, the group consensus was very high (99.7%), and the CRmax = 0.01. The highest priorities of the individual participants were in the criterion "increase in production cost" (50.4%), followed by "unpredicted consumption choice" (44.9%). The overall homogeneity was 88.8%.

3.3. Industry Manager and Academic Evaluators' Judgment

Results shown in Table 6 presented CRmax = 0.04 and a very high AHP group consensus (87.1%). The priorities for industries were "expansion of products" (29.6%), "upcycling" (28.1%), and "increase in sustainability" (18.8%). There was a very low consensus in the group (25.2%) regarding Opportunities, while in Threats, results show a very low consensus (30.4%). Regarding the Weaknesses, there was a consensus of 27.7%; in terms of Strengths, there was a very low group consensus (49.1%). The overall homogeneity was 87.1%.

Table 6. AHP results from all evaluators' judgment when comparing the criteria involved with the conventional textile industry with a circular one.

Goal	Level 1 Criteria (Weight)	Level 2 Criteria (Weight)	Weight (%)	Rank
Comparing the conventional and circular economy in the apparel industry	Strengths (0.249)	Increase in sustainability (0.754)	18.8	3rd
		Increase the consumers' ground (0.246)	6.2	
	Weakness (0.099)	Origin of raw material (0.375)	4.0	
		Increase in the production cost (0.625)	4.1	
	Opportunities (0.577)	Upcycling (0.513)	28.1	2nd
		Expansion of products (0.487)	29.5	1st
	Threats (0.075.0)	Increase in the process cost (0.653)	5.1	
		Unpredicted consumption choices (0.347)	4.2	

CRmax = 0.04. We ranked the first three highest weights.

By the "Increase in consumers' ground" (24.6%), the result of the Weaknesses node presented an AHP group consensus very low (27.7%) and CRmax = 0.00. The highest priorities of the individual participants were in the criterion "increase in production cost" (62.5%), followed by the "origin of raw material" (37.5%). The Opportunities node result showed a low AHP group consensus (25.2%) and CRmax = 0.00. The highest priorities of the individual participants were in the criterion "Expansion of products" (51.3%) and "Upcycling" (48.7%). As for the Threats node, the group consensus was very low (30.4%), and the CRmax = 0.00. The highest priorities of the individual participants were in the criterion "increase in production cost" (65.3%), followed by the "unpredicted consumption choice" (34.7%). The overall homogeneity was 87.1%.

3.4. Overall Evaluation

Figure 3 shows the cumulative weights of the AHP level 2 criteria. Both academic and industry managers chose the criteria "increase in sustainability", "upcycling", and "expansion of products" as the main criteria facing the drive toward a circular economy in the apparel industry. The other criteria were not as relevant as those, although the "increase in production cost" weight was considered higher for the industry managers.

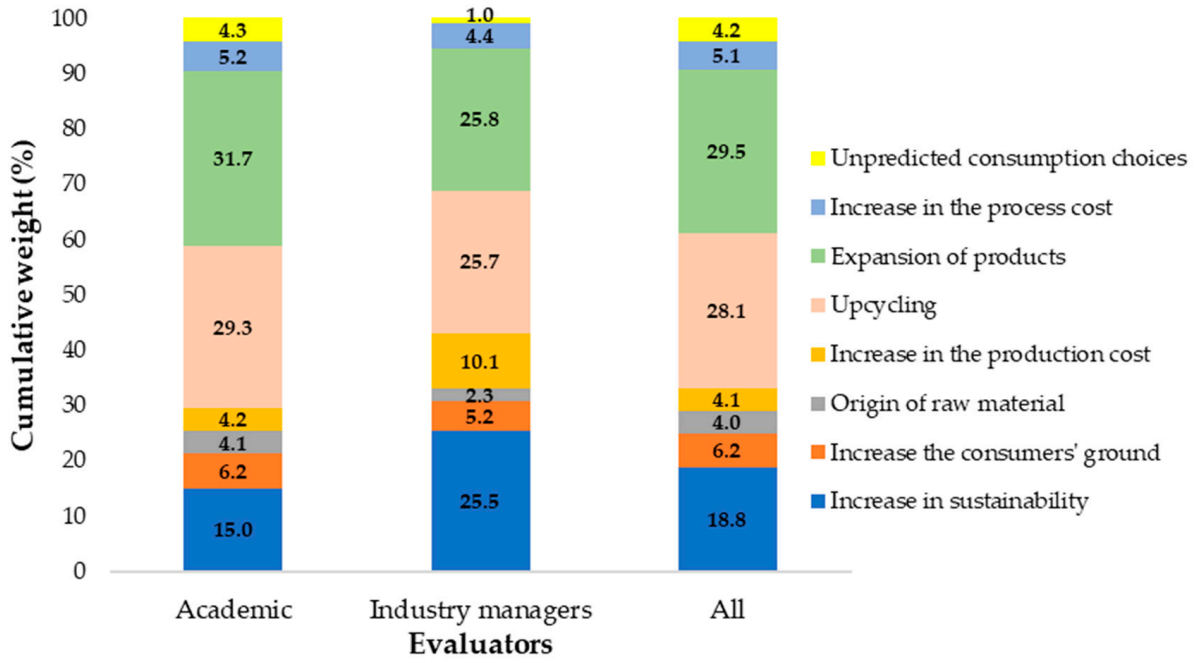

Figure 3. The cumulative weight of the AHP level 2 criteria of all evaluators.

In Figure 4, we present the AHP level 1 criterion of the academics and industry managers, and all are added together in the concept of a multicriteria network analysis. Both criteria considered as the criterion Opportunities in AHP level 1 ("expansion of products" and "upcycling") were considered the most important by the evaluators to adopt a circular economy. Following those, the criterion "increase in sustainability" was selected by the evaluators.

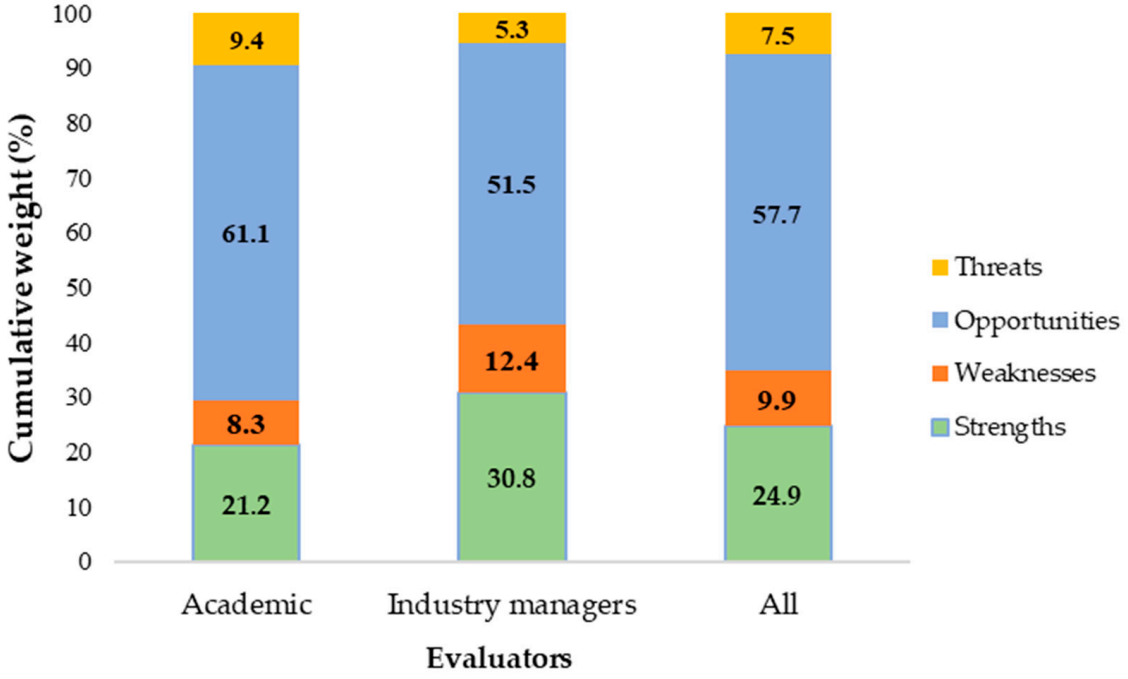

Figure 4. The cumulative weight of the AHP level 1 criteria of all evaluators.

3.5. Cluster Analysis

The consensus threshold for clustering was determined as 87.50%. Figure 5 shows the average of priorities over the clusters. There are ten companies in the manufacturing cluster used and the two selected in the present study are more representative, considering the number of employees and parts produced per month, justifying the companies chosen to be part of the research.

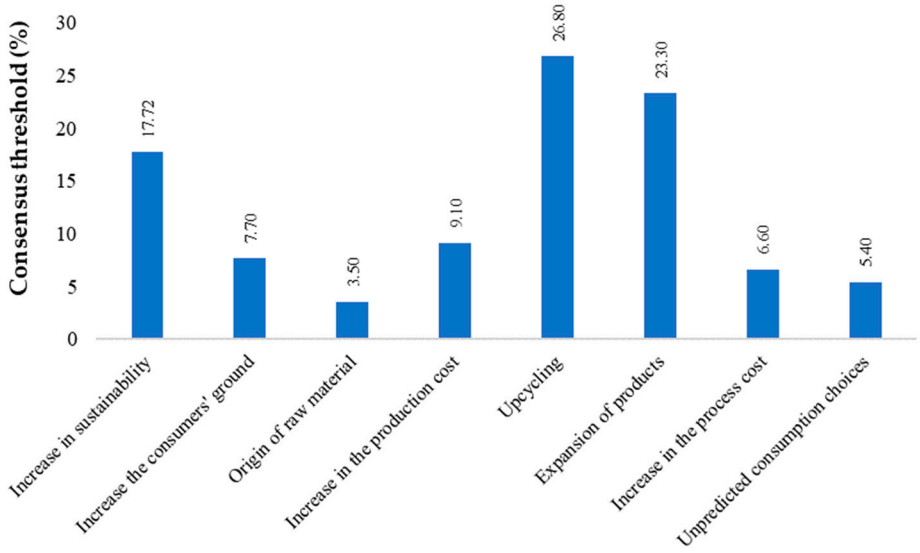

Figure 5. Priorities on the consensus thresholds over the selected clusters.

We found two clusters (C1 and C2). Cluster C1 had a high homogeneity (84.10%), aggregating 67.0% of the participants (4). The other cluster (C2) had only two participants. In C1, the highest agreement was in the "Expansion of products" (30.70%), followed by the increase in sustainability (23.80%) and upcycling (15.50%). In C2, the highest agreement was in upcycling (49.50%), followed by increased consumers grounds (14.00%) and unpredicted consumption choices (13.70%).

4. Discussion and Conclusions

Our analyses were made between Strengths, Opportunities, Threats, and Weaknesses, compared with the vision of academics and company representatives participating in the evaluation. There was a considerable consensus between the two companies because they are present in the same market and are manufacturers of the same type of product, which leads to a very similar vision [38]. However, when grouping the respondents, two clusters appeared: one with two company representatives and two academics and another with two academics. Such scope might be due to the similar background of those two last academics, which slightly differed from the age and background of the remaining respondents.

The results showed that the factors that impact the adoption of a circular economy in the textile sector are related to three topics: upcycling, expansion of products, and increase in sustainability. After applying this method, it can be stated that there is an opportunity for the textile and clothing sector to create and expand upcycling products.

We believe that the contribution of this study to the sector is represented in the results connected between opportunities and strengths. As opportunities, creating new products and upcycling should become a reality with the change of generations. In Brazil, population growth is expected to stop in 2047 [39], and the country is heading towards having a large elderly population; in the 2060s, it is predicted to reach around 34% of the total population [39,40].

As it is estimated that knowledge and behavioral changes occur from generation to generation, the young population gives greater importance to sustainability and tends to

have more sustainable behavior, which should support these opportunities in the short term, compatible with the weight in the strengths encountered by academics and sector representatives surveyed: increase in sustainability (0.754) and increase the consumers' ground (0.246). This assessment assumes that although population growth with a greater knowledge and appreciation of sustainability has been in the background, it should soon gain significant importance. However, to achieve this, the population must be better educated about the separation and disposal of clothes, as it is this material that will be reused by the industry to manufacture new fabrics as raw material for new clothes, increasing upcycling and, thus, increasing the cycle of product life, which coincides with sustainable thinking capable of bringing circularity to the industry. Another opportunity is the charitable organizations that recycle and reuse textiles [2,41–44], which can be fruitful in advancing the circular economy approach in this sector.

However, these positive points can be disregarded by companies since one of the threats encountered is the unpredictability of consumer choices, which must be considered in decisions that can put the company at risk. Furthermore, all this process change will incur increased costs, which companies would only consider when they are sure of sustainable consumer behavior.

With the increase in the number of people interested in sustainability, the opportunities resulting from this study include: the expansion of products (0.500), and upcycling should become a real possibility to be considered by the industry as a more conscious population will demand new positions from companies from which they consume products. This increase in demand can also make the circularity of the chain possible, as it will make the product profitable. The weaknesses highlighted by the study are: the rise in production costs and the origin of the materials used, which are less industrialized and polluting. This is one of the industry's essential challenges, as the current study corroborates.

Since the product expansion was not related to specific materials, it did not allow the evaluation of whether the expansion was related to recyclable materials. Although the requirement for more natural and less industrialized materials increases the cost of production [10], the increased demand for differentiated products should make circularity profitable. The expansion of products suggested by the research results with academics agrees with previous results [7] when examining the textile industry in Uzbekistan. The foremost opportunity presented by the authors is to manufacture cotton and export textile products with greater added value. Such difficulties could be solved with investments and strategic alliances with foreign companies. A previous study [36] performed a SWOT analysis of the textile industry in Pakistan, which presented some issues with marketing and production despite having abundant labor and raw materials.

Despite the different concepts [7,36], the present results on product improvement, creation of new materials, and upcycling and downcycling, both recycling of discarded fabric and clothing components that can be reused, suggest the same focus; technology would play a decisive role in the suggested operations, which would also contribute to reducing the high price of raw materials, which one of the weaknesses of this industry in both countries Brazil and Uzbekistan.

Sinha et al. [45] present fashion remanufacturing as a strategy for replacing materials in the production process, reducing fashion waste, and contributing to the reverse logistics of supplies and, thus, facing the barriers to opportunities for the growth future of this sustainable business. Similarly, other authors [7] state that recycling is a point to be deepened among companies. Despite agreeing that recycling is still the best environmental and socioeconomic option for textile and clothing waste [43] compared with the incineration process, the authors found no significant financial advantage, hence the difficulty of implementing incineration. Higher prices discourage these actions. There are blocks to recycling despite the possible opportunities created by chemical processing for textiles currently considered worthless and destined for incineration or landfill [7,41].

Zanirato and Rotondaro [38] understand consumption habits as a great social and cultural construction driven by behavioral changes, which will contribute to future con-

sumers. We also agree with previous authors [38,46] that a generation is formed by people born in the same period who share experiences and events, receiving life influences related to labor, social, economic, and technological impacts, and consumption. Therefore, there is an increasing influence of the environment on consumer behavior. The consumption of the new generations is focused on the product's characteristics: material, quality, and finish [1,8]. Although the last generation consumed 66% more than the previous ones, the present generation tends to research more before buying, which is directly linked to the purchase decision [8].

Although we found essential elements to increase the circularity of the studied chain, one of the limitations is the number of industry representatives, which is concentrated in a cluster in a Brazilian state in a region where the GDP is relatively low. In this sense, future studies should focus on making the samples more comprehensive, whether in specific fashion segments in Brazil or other countries, to improve the understanding of how much consumer behavior can interfere with industrial production. This knowledge can provide companies with important information for the decision process on whether or not to adopt new processes and materials, as they will be able to consider the demands of consumers that are more aligned with sustainable processes.

We explored the feasibility of implementing the circular economy in the clothing production process, focusing on the distribution stage until it reaches the consumer. We analyzed the factors that impact adopting a circular economy in a cluster of textile industries in northeastern Brazil. We adopted an association of a SWOT analysis and the AHP approach to the case study and the judgment of four experts and two managers of the intimate apparel industry to evaluate applying a circular economy in the businesses. We conclude that the factors that impact adopting a circular economy in the textile industry are directly related to upcycling, product expansion, and increased sustainability in the production process.

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References

1. Kozlowski, A.; Searcy, C.; Bardecki, M. The reDesign canvas: Fashion design as a tool for sustainability. *J. Clean. Prod.* **2018**, *183*, 194–207. [CrossRef]
2. Clarke-Sather, A.; Cobb, K. Onshoring fashion: Worker sustainability impacts of global and local apparel production. *J. Clean. Prod.* **2019**, *208*, 1206–1218. [CrossRef]
3. ABIT-Associação Brasileira da Indústria Têxtil e de Confecção. Available online: https://www.abit.org.br/cont/dados-economia (accessed on 10 October 2022).
4. Ciasullo, M.V.; Maione, G.; Torre, C.; Troisi, O. What about sustainability? An empirical analysis of consumers' purchasing behavior in fashion context. *Sustainability* **2017**, *9*, 1617. [CrossRef]
5. Shrivastava, A.; Jain, G.; Kamble, S.S.; Belhadi, A. Sustainability through online renting clothing: Circular fashion fueled by instagram micro-celebrities. *J. Clean Prod.* **2021**, *278*, 123772. [CrossRef]
6. Piontek, F.M.; Müller, M. Literature reviews: Life cycle assessment in the context of product-service systems and the textile industry. *Procedia CIRP* **2018**, *69*, 758–763. [CrossRef]
7. Park, Y.J.; Kim, J. Is Factor Investing Sustainable after Price Impact Costs? The Capacity of Factor Investing in Korea. *Sustainability* **2019**, *11*, 4797. [CrossRef]

8. Ghinea, C.; Ghiuta, O.A. Household food waste generation: Young consumers behaviour, habits and attitudes. *IJEST* **2019**, *16*, 2185–2200. [CrossRef]
9. Da Giau, A.; Macchion, L. Sustainability practices and web-based communication: An analysis of the Italian fashion industry. *J. Fash. Mark.* **2016**, *20*, 72–88. [CrossRef]
10. Garcia-Torres, S.; Rey-Garcia, M.; Albareda-Vivo, L. Effective disclosure in the fast-fashion industry: From sustainability reporting to action. *Sustainability* **2017**, *9*, 2256. [CrossRef]
11. Choudhury, A.K.R. Environmental impacts of denim washing. In *The Textile Institute Book Series, Sustainability in Denim*; Woodhead Publishing: Sawston, UK, 2017; pp. 49–81. ISBN 9780081020432. [CrossRef]
12. Luo, Y.; Wu, X.; Ding, X. Carbon and water footprints assessment of cotton jeans using the method based on modularity: A full life cycle perspective. *J. Clean Prod.* **2022**, *332*, 130042. [CrossRef]
13. Turunen, L.L.M.; Halme, M. Communicating actionable sustainability information to consumers: The Shades of Green instrument for fashion. *J. Clean Prod.* **2021**, *297*, 126605. [CrossRef]
14. Nayak, S.S.; Panda, T.K.; Kumar, A.; Jakhar, S.; Luthra, S.; Garza-Reyes, J.A.; Kazancoglu, I. Social and environmental sustainability model on consumers' altruism, green purchase intention, green brand loyalty and evangelism. *J. Clear Prod.* **2020**, *243*, 118575.
15. Zhang, Q.; Ikram, M.; Ferasso, M.; Sroufe, R. Assessing green technology indicators for cleaner production and sustainable investments in a developing country context. *J. Clean Prod.* **2021**, *322*, 129090.
16. Gwilt, A.; Niinimäki, K.; Peters, G.; Dahlbo, H.; Perry, P.; Rissanen, T. The environmental price of fast fashion. *Nat. Rev. Earth Environ.* **2020**, *1*, 189–200.
17. Kirchherr, J.; Piscicelli, L.; Bour, R.; Kostense-Smit, E.; Muller, J.; Huibrechtse-Truijens, A.; Hekkert, M. Barriers to the circular economy: Evidence from the European Union (EU). *Ecol. Econ.* **2018**, *150*, 264–272. [CrossRef]
18. Korhonen, J.; Nuur, C.; Feldmann, A.; Birkie, S.E. Circular economy as an essentially contested concept. *J. Clean Prod.* **2018**, *175*, 544–552. [CrossRef]
19. Borasino, E.; Fuhrmann-Riebel, H. New kids on the recycling block: The role of supermarkets and bodegas for sustainable consumer behaviour in Lima. In *Circular Economy and Sustainability*; Springer: Berlin/Heidelberg, Germany, 2021; pp. 1–25.
20. Gruber, M. An evolutionary perspective on adoption-diffusion theory. *J. Bus. Res.* **2020**, *116*, 535–541. [CrossRef]
21. Gadelha, S. *Biopolítica, Governamentalidade e Educação: Introdução e Conexões, a Partir de Michel Foucault*; AutênticaEd: São Paulo, Brazil, 2016; 240p.
22. Biava, J.D.O. A Metodologia Canvas e Suas Variações Para o Desenvolvimento do Empreendedorismo. 2017. Available online: http://repositorio.unesc.net/bitstream/1/5617/1/J%C3%B4nata%20de%20Oliveira%20Biava.pdf (accessed on 10 March 2023).
23. Sóter, C.M.D.A. O Fator Verde no Design Thinking Canvas: Estudo Inicial da Adaptabilidade da Metodologia Frente aos Desafios Sustentáveis. 2016. Available online: https://repositorio.ufpe.br/bitstream/123456789/23544/4/TESE%20Clarissa%20Menezes%20Azevedo%20Soter.pdf (accessed on 15 March 2023).
24. Valle, R.A.B.; Souza, R.G.; Rosenhead, J.; Salhofer, S.P.; Lins, M.P.E. Definition of sustainability impact categories based on stakeholder perspectives. *J. Clean Prod.* **2015**, *105*, 41–51.
25. Saaty, T.L. *The Analytic Hierarchy Process*; McGrawHill International: New York, NY, USA, 1980; 287p.
26. Du, Y.; Zheng, Y.; Wu, G.; Tang, Y. Decision-making method of heavy-duty machine tool remanufacturing based on AHP-entropy weight and extension theory. *J. Clean Prod.* **2020**, *252*, 119607. [CrossRef]
27. Bathrinath, S.; Bhalaji, R.K.A.; Saravanasankar, S. Risk analysis in textile industries using AHP-TOPSIS. *Mater. Today Proc.* **2021**, *45*, 1257–1263. [CrossRef]
28. Brandão, L.; de Alencar Nääs, I.; Neto, P.L.D.O.C. Sustainable development of gem production: An application of the Analytical Hierarchy Process. *IJAHP* **2021**, *13*. [CrossRef]
29. Nejad, M.C.; Mansour, S.; Karamipour, A. An AHP-based multicriteria model for assessment of the social sustainability of technology management process: A case study in banking industry. *Technol. Soc.* **2021**, *65*, 101602. [CrossRef]
30. Kim, Y.-J.; Park, J. A Sustainable Development Strategy for the Uzbekistan Textile Industry: The Results of a SWOT-AHP Analysis. *Sustainability* **2019**, *11*, 4613. [CrossRef]
31. Instituto Brasileiro de Geografia e Estatística. Available online: https://censo2021.ibge.gov.br/panorama/?utm_source=ibge&utm_medium=home&utm_campaign=portal (accessed on 10 October 2022).
32. Caloête, E.Q.M.; Westin, D.G. *SEBRAE—The Brazilian Micro and Small Businesses Support Service-Design in Brazil: Report 2014*; Sebrae: Brasília, Brazil, 2014.
33. Goepel, K.D. Implementation of an Online Software Tool for the Analytic Hierarchy Process (AHP-OS). *IJAHP* **2018**, *10*, 469–487. [CrossRef]
34. Johnstone, L.; Lindh, C. Sustainably sustaining (online) fashion consumption: Using influencers to promote sustainable (un)planned behaviour in Europe's millennials. *J. Retail. Consum. Serv.* **2022**, *64*, 102775. [CrossRef]
35. Edwards-Jones, G.; Davies, B.; Hussain, S.S. *Ecological Economics: An Introduction*; John Wiley & Sons: Hoboken, NJ, USA, 2009; 276p.
36. Kanat, S.; Abbasi, S.A.; Peerzada, M.H.; Atilgan, T. SWOT analysis of Pakistan's textile and clothing industry. *Ind. Textila* **2018**, *69*, 502.
37. Ishizaka, A.; Labib, A. Review of the main developments in the analytic hierarchy process. *Expert Syst. Appl.* **2011**, *38*, 14336–14345. [CrossRef]

38. Zanirato, S.H.; Rotondaro, T. Consumo, um dos dilemas da sustentabilidade. *Estud. Av.* **2016**, *30*, 77–92. [CrossRef]
39. IBGE. Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Statistics)—Aplicações e Outros Recursos. 2022. Available online: https://censo2022.ibge.gov.br/panorama/recursos.html (accessed on 12 September 2023).
40. Cunha, M.B. O censo demográfico de 2023 e seus possíveis reflexos nas bibliotecas brasileiras. *Rev. Ibero-am. Ciênc. Inf.* **2023**, *16*, 307–310.
41. Leal Filho, W.; Shiel, C.; Paço, A.; Mifsud, M.; Ávila, L.V.; Brandli, L.L.; Molthan-Hill, P.; Pace, P.; Azeiteiro, U.M.; Vargas, V.R.; et al. Sustainable Development Goals and sustainability teaching at universities: Falling behind or getting ahead of the pack. *J. Clean Prod.* **2019**, *232*, 285–294. [CrossRef]
42. Garcia, S.; de Alencar Nääs, I.; de Oliveira Costa Neto, P.L.; dos Reis, J.G.M.; Pólvora, V.N.; de Lima, L.A.; Martinez, A.A.G.; Lessa, V.S. Sustainability in fabric chains and garments for a circular economy. In Proceedings of the IFIP International Conference on Advances in Production Management Systems, Novi Sad, Serbia, 30 August 2020.
43. Bianchi, C.; Birtwistle, G. Sell, give away, or donate: An exploratory study of fashion clothing disposal behaviour in two countries. *Int. Rev. Retail. Distrib. Consum. Res.* **2010**, *20*, 353–368. [CrossRef]
44. Kim, A.J.; Johnson, K.K. Power of consumers using social media: Examining the influences of brand-related user-generated content on Facebook. *Comput. Hum. Behav.* **2016**, *58*, 98–108. [CrossRef]
45. Sinha, P.; Muthu, S.S.; Dissanayake, G. *Remanufactured Fashion*; Springer: Singapore, 2016; 82p.
46. Smola, W.K.; Sutton, C.D. Generational differences: Revisiting generational work values for the new millennium. *J. Organ. Behav.* **2002**, *23*, 363–382. [CrossRef]