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Fashion Product Development Using Cap Waste: A Study Focused on Impacting Sustainability in Brazil

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Abstract

New practices seek to prolong the life cycle of parts destined for disposal faced with adversities and concerns about the environment's development. The concern with the degradation of the environment means that there is a growing number of consumers who seek to purchase products from companies that are concerned with sustainability. At the level of Seridó, in the Brazilian state of Rio Grande do Norte (Northeast of the country), we have the cap industry as the central point of the Local Productive Arrangement (LPA) textile in the region. And although the Seridó cap industry is expanding, the factories must implement more sustainable means to eliminate waste from manufacturing caps. In an attempt to restore an environmental balance, professionals and scholars in the field of fashion have been testing different strategies for changes in the production cycle, and one of them is upcycling, which is a method of reusing material. In this context, this paper aims to present a proposal for a product that uses waste from the local cap industry to reduce the impacts generated in nature by waste from the manufacturing process, using their leavings in product designs. In such a way, it is expected that this work can contribute to reducing environmental impacts, making it possible to establish a more conscious fashion, thus reducing the damage to the fashion industry.

Keywords: Cap industry, sustainability, upcycling, fashion consumption, slow fashion.

Introduction

Among the various sectors that make up the production chain, the fashion industry is one of the fastest growing and standing out. Companies in this sector have been generating a large volume of production of clothing and accessories to always offer innovations to the

market. This situation brings great impacts, both economic and environmental. According to Digitale Têxtil (2020), the fashion industry is the second most polluting in the world due to the use of low-quality, insoluble dyes or products based on heavy metals, in addition to the emission of toxic gases into the atmosphere.

In Brazil, the disposal of parts that still have a useful life is recurrent. According to PET - Sanitary and Environmental Engineering (2019), the disposal of textile waste represents about 175 thousand tons/per year, where only 36 thousand tons are reused. The cap industry factories in Seridó (Region in Northeast Brazil) produce around 40,000 pieces per day, according to FIERN (2019), and in this production, there is excess waste that is not used in the making and is improperly discarded in nature.

One of the rising consumption trends in the 21st century is sustainable consumption, as more and more consumers are now concerned about environmental factors and the ethical positioning of the companies they consume. These people are concerned with everything from the quality of life of the people involved in production to the impact the product can have on the environment. According to a 2020 survey conducted jointly by GlobeScan and Akatu, seven out of ten consumers expect brands not to be involved in actions that could harm the planet.

In this current context, some brands are standing out for anticipating and positioning themselves in a sustainable and socially responsible way. Currently, the brand or industry that does not offer products to its consumers with the premise of a sustainable network may lose strength in the market because, according to a study carried out by Veja Magazine (2021), consumers are demanding that companies adopt sustainable practices and social inclusion.

Thus, the present study proposes the development of a Fashion product that uses the waste generated by the local cap production industry. Therefore, this study proposes an alternative to mitigate the environmental impacts in the Seridó region (Caicó/Rio Grande do Norte). In this circumstance, we emphasize the need to reuse waste discarded by creating products, promoting the Circular Economy.

Theoretical framework

The negative effects that can and are caused on the environment by the fashion industry are of great concern to society; some of these effects are river pollution, extraction of non-renewable raw materials, emission of gases into the atmosphere and especially the improper disposal of parts. Due to these factors, sustainable practices must be used to mitigate the damage caused to the planet.

Sustainability in the fashion industry is linked to several terms influencing how consumers think about production and consumption processes, such as conscious, ethical, and eco-fashion (Fletcher, 2008; Fletcher and Grose, 2011). Sustainability is based on its definition of three points: economic, environmental and social. Therefore, to balance the three aspects, for example, a product cannot be considered sustainable if it does not have a low environmental impact, low economic cost and is manufactured using slave labour (Anicet and Rüthschilling, 2013).

In the Seridó region of Rio Grande do Norte (RN), according to the last census carried out by SINDIBONÉS (Union of Caps and Hats Industries of the State of Rio Grande do Norte) in 2019, there were 54 cap manufacturers in the city of Caicó. The cap industry factories are responsible for generating employment and income for several families in the production centre of Caicó (Ribeiro, 2021). Therefore, it is possible to see how much the cap industry is of great importance for the municipality and region with the generation of employment, the collection of taxes and contribute to the social and economic growth of the region.

The growing demand in the segment of caps in local commerce stimulated the increase in the production of factories in the cap industry (Lins, 2011). Bearing this in mind, with this increase in production comes an increase in waste that is disposed of incorrectly, harming the environment, and it is necessary for factories to apply sustainable ways to dispose of this waste, ensuring an attempt to re-establish an environmental balance and reduce the pollution that occurs in the city of Caicó (Rio Grande do Norte/Brazil)

Slow fashion is a movement that emerges as an alternative to fast fashion to have a production with less environmental impact (Solino, Teixeira, and Dantas, 2020). However, it is a reaction to the pace at which changes occur to strengthen individuals' connections with their clothes and with the producers while including values of community, sustainability and diversity (Ferronato and Franzato, 2015). As an alternative to the use of incorrectly disposed waste, there are upcycling techniques, which are a sustainable alternative and aim to rewind the product's life cycle, rescuing discarded or unused material (Schulte *et al*., 2013). The pieces and products created from discarded waste have original and exclusive characteristics, making them unique because, according to Mirella Rodrigues, in upcycling, you can work with creativity all the time (Aguilera, 2019).

Patchwork is an alternative upcycling technique in developing fashion products, contributing to sustainability (Farias, 2017), which makes it possible to unite fabric scraps to create one. This technique makes it possible to apply fabrics to pieces or assemble various pieces of fabric, enhancing the designer's manual work and adding differential value to the product (Farias, 2017).

With this, it is possible to produce innovative, original and creative fashion products from waste incorrectly disposed of by cap industries in Caicó. Using the upcycling technique, the patchwork, where these discarded scraps will be joined together and united uniformly, placing a differentiated design and adding value to the piece. In addition, this development technique will contribute positively to the environment by collecting this waste. In this way, it is possible to understand that it is feasible to create pieces with scraps from the waste left over from the production of caps, reusing all the raw material and reducing the negative impacts that are caused to the environment in the region.

Methodology

This work is classified, regarding the nature of the research, as applied, for having its point of purpose in the resolution of concrete problems, applying the knowledge acquired through the theory to the needs of society (Gil, 2008). The methodology used to verify the objective will be exploratory, to develop and contribute with a new vision on a certain subject, presenting it completely, in this case, researching the development of ecologically oriented products (Gil, 2008). Due to the nature of its approach, the research is intended to be qualitative-quantitative, as it will deal with subjective stages of management and product development, and quantitative when interpreting the usability test data (Guerra, 2006; Muratovsky, 2016).

Concerning technical procedures, this is experimental research where Design Science Research methods will be used, in which it foresees the elaboration of an artefact as a mechanism for developing solutions to a problem and for the very understanding of the nature of the problem (Santos *et al.*, 2018). The method is configured from steps, also called cycles, where a) Cycle of Relevance comprises the contextualization of the research in the real environment studied, identifying opportunities; b) Cycle of Rigor concerns the phase of uniting scientific bases through literature reviews with the needs of the research project; and, c) Design Cycle, the stage where products will be developed and later tested with users (Hevner and Chatterjee, 2010).

For the development of the clothing product, the method proposed by Baxter (2011) was adopted, with 4 steps that will guide the process:

• **Step 1- Immersion:** In this phase, the definition of the target public, also called the consumer, was sought;
• **Stage 2 – Conceptual Project:** At this point, the aesthetic aspects of the product are developed, observing fashion information;

• **Step 3 – Definition of Materials and Technologies:** In this step, the raw material, materials and technologies used in the construction of the part are selected;

• **Step 4 – Usability Test:** At this point, the technique is evaluated, its construction, the appearance of the part and, finally, its functionality.

Product development

The delimited target audience for the product was people of the male, female and non-binary genders aged 15 to 26 who are part of generation Z, as it is possible to understand that, given the observed environmental transformations, generation Z acts quite differently regarding their actions as consumers and what they expect from brands when compared to other generations. They are demanding consumers, frantic and attentive to fashion trends and behaviour (Ceretta e Froemming, 2011).

According to Frings (2012), as this generation was born during ecological disasters and uncertainties about the future, they care about the planet's health and the environment. This group values transparency, social engagement, sustainability, politics and the environment.

This generation has great economic power; in Brazil alone, there are about 40 million young people (Holtz, 2019). Generation Z has a total world income of 7 trillion dollars, and these potential consumers are expected to reach 33 trillion dollars in 2031, which will represent 27% of the world's total income, having a higher income than the generation that came before them in the same bracket age. However, this group tends to be more responsible with their expenses because they grew up in a period of political and financial turmoil, which directly impacts purchase intention (NEGÓCIOS SC, 2021).

To reach Generation Z, brands need to pay attention to social, environmental and political metrics, about 80% of generation Z consider this when making purchases. Because of this, our target audience is aimed at middle-class young people who live in medium and large cities, both in the interior of the states and in capitals, who frequently access the internet, who usually spend between R$100 and R$300 on a piece of clothing and who have the habit of buying from online.

About the Fashion content, When analyzing our target audience and fashion trends that are in the spotlight, it was decided to use a trend that is becoming successful among the young people of generation Z; this trend is the patchwork, which emerged as a way of upcycling. Patchwork is a technique in which leftover fabrics are used and arranged harmoniously; it has apparent stitching, irregular shapes and, above all, comfort, according to Silvana de Castro

(2018). This trend has been showing on catwalks and streets for a while with looks full of personality and style. When using patchwork, each outfit becomes original and unique, as the combination of fabrics is unlikely to be identical.

Patchwork as a fashion trend appeared during the 20th century, between the 1920s and 1940s. In times of war and the Great Depression, this technique was used, reusing scraps to cover holes in clothes. In 1960, hippies popularized patchwork as something fashionable, and the combination and harmony of fabrics came to be seen as a style trick (Figure 1). In the 90s, this process invaded the catwalks.

The garments had different colours and textures, as well as the apparent stitching, showing the junction of different fabrics. From the 2000s, patchwork became viral and a landmark of the time, conveying the definition of chaos and the breaking of patterns (Figure 1). According to the fashion magazine Elle (2021), after the pandemic and quarantine imposed by covid-19, from the beginning of 2020, people began to look for new ways to innovate clothing items while at home, and with that patchwork made a comeback due to its ease of production and comfort. Several looks made by joining patchwork invaded social networks and brought the technique back to the 2021 trends.

Figure 1 – Patchwork in fashion over the decades

Patchwork has been appearing on catwalks worldwide, in fashion shows, and on the streets for some time now. The technique brings a proposal of sustainability and conscious consumption to the products, seeking to assign a new purpose to materials that would otherwise be discarded and adding value to leftover fabrics and pieces of clothing that are no longer used. With this trend, it is possible to bet on several possibilities, including applications with fabrics of different colours, prints and jeans (Figure 2). One of the styles that can be used is the application with plain pieces, which mix different fabrics. This proposal is quite common in blouses and dresses.

Another patchwork version that made a big impact on the catwalks and in the 2021 fashion weeks was jeans. The pieces in this model are composed of jeans with different washes and fabric colours. Monochrome looks emerged and became a trend in 2020 as they are practical and stylish pieces. By inserting this into the patchwork, pieces can be made using patchwork with the same fabrics and a combination of similar tones and colours. In oversized or street-style looks, patchwork with checkered patches is ideal, as it is possible to combine the pattern with plain fabrics (Figure 2). In Brazil, it is common to use this composition in male and female pieces for the June festivities.

Figure 2 – Patchwork: clothes with a patchwork effect are in fashion

In this way, we have seen that this patchwork trend combines perfectly with the type of material we will use since the basis of our products will be a textile waste, usually forming leftover fabric from the cap industry. When analyzing how these products would be made and

which trends would be used, we considered that patchwork would be ideal, as it is a trend that has returned to the present day and that, based on it, innovative and unique pieces are made. The modelling of the pieces would be made with daring cuts that will bring confidence to those who use the product, arriving at the idea of the look to be made (Figure 3).

When analyzing the way our products will be made using the patchwork technique, the design principles defined were harmony, as the product has fabrics of colours, textures and shapes that can relate and interact with each other, and repetition, where the patchwork of the patchwork is repeated, either regularly or irregularly.

In this way, another element that was analyzed was the lines since, in the modelling, contours and cutouts divide areas and define the product's shape. In addition to this visual element, there is also the element of texture, where it is possible to perceive and feel the meaning of the weaves in the fabric and the arrangement of the patches; the more textures, volume and rigidity, the fabric has, the more attention it will draw to the place.

Our product will cater to the target audience based on the shopping preferences of generation Z, where people opt for products that have sustainable ideas and benefit the environment. In this way, we seek to bring confidence to the consumer when using daring and exclusive pieces.

Our first step was to visit a cap industry and collect their waste to define the materials and technologies. Then we separated the waste that could be useful and used in clothing and accessories, highlighting them by size and separating the different textures of fabrics and colours. Soon after, we made a development map of the possibilities of the waste that we separated. Within that, sketches were developed with ideas about the trends of each season, and finally, we started the production of the prototypes, where the waste was cut into geometric shapes to organize them harmonically. We gathered these scraps according to the model of the piece, sewing them in the straight sewing machine.

Figure 3 – Sketch with all the parts developed

The prototypes tried on by one of our target consumers, consisting of a bucket hat, a side bag, a skirt with a side zipper and a top with a front cutout, was developed and created with waste from the cap industry in the region (Figure 4). Our consumer who tested the usability of the garments reported some problems: the top was a little tight under the arm when wearing the blouse, and she reported difficulty putting the top on and closing it alone, as the zipper is located behind the garment. However, she reports that the piece brings a lot of originality and presence with a more modern air.

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Figure 4 – Final product photoshoot

Product evaluation

It was evaluated that the waste discarded from the caps industry had a new point of view, thus having a new utility being reused to make fashion products; in this way, it is shown that it is possible to reuse these wastes using creativity and thus, causing a less impact on the environment with discarded waste.

During the construction of the work, some impasses were observed in the prototype, one of the first being the modelling, where we had to change some details, such as the cut being only on the front and no longer on the sides of the top (Figure 5), to solve this problem we had to redo another modelling with the record in the proper place and just like that, we move on with the modelling.

Then, right after the construction of the mould, we had difficulty with the fabric because the fabrics from which we collected frayed and ended up deforming the piece when sewing since they are residues of different sizes and textures, as I understand it, to solve it, we had than cutting waste with patterns into straighter shapes such as squares and rectangles, so when the piece went to sewing, it was easier to fix when the fabric frayed again.

Figure 5 – First prototype of the top and usability test

Right after the problem was solved, another impasse arose with the zipper of the top, where it was not opening and closing correctly (Figure 5) and finally, the lining of the pieces had to be in cotton and also in jeans, but for pieces with a greater structure, Madrid or Seville taffeta can be used, and for pieces with a tighter fit to the body, satin with elastane or helanca mesh can be used, in this way, once the waste was fraying the safest way we found was to place a thicker fabric as a lining to prevent the garments from wearing out due to friction, however, even with this adjustment, the garment did not have the right fit for it, precisely because the fabrics are challenging and the lining is thicker than ideal. In this way, how the shred occurs can reduce the useful life of the piece when washing; therefore, greater care is needed when washing the piece.

After overcoming all these impasses, we understood that to develop these prototypes, we would need to study the types of fabrics that could be reused among waste from the hat industry. So, after doing this research or thinking about some finish that holds the fabric together without fraying, it is possible to think of waste from the hat industry as a real raw material for fashion products.

Despite the obstacles faced, we believe that it is possible to work with waste from the cap industry to contribute to the balance of the environment by giving a new direction to the leftovers that would go to waste and that now can be transformed into new fashion products using the patchwork technique. With that, we believe that this market will gain more strength and space every day, where people will be more aware of the products they consume.

Final Consideration

It was understood and analyzed during the project and construction of the parts that the waste from the cap industry factories had a new perspective and purpose of use, reusing to create new fashion products, thus demonstrating that it is possible to reuse all raw materials without the need for improper disposal that causes environmental pollution in the region.

Our purpose was to create fashion products that were produced from improperly discarded waste, thus contributing to the improvement of the region's environment. These products are aimed at young people, present in generation Z, who would like creative, innovative and modern pieces, thus reflecting their personality.

In this way, the upcycling trend and technique for creating our pieces, the patchwork, was defined. For the improvement of the environment as it serves as a sustainable production alternative.

Fashion presents what is happening in the world, reflects our wishes and solves issues that we want to conquer, such as a more sustainable world with less pollution. Analyzing it this way, using patchwork combinations in clothes is much more than rescuing a trend; it is a form of expression and solution to society's current problems.

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