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# Using the analytic hierarchy process for selecting prototypes in the development process of fashion garment products

**Isabel Cristina Moretti*, Aldo Braghini Junior and João Carlos Colmenero**

*Programa de Pós-Graduação em Engenharia de Produção, Universidade Tecnológica Federal do Paraná, Av. Monteiro Lobato, s/n, 84016-210, Ponta Grossa, Paraná, Brazil. *Author for correspondence. E-mail: isabelmoretti@utfpr.edu.br*

**ABSTRACT.** To remain in the market, the process of development of fashion garment products produces a large quantity of products. During this process, the prototypes are made, evaluated and selected to compose the collection, thus the designers use some criteria to select them. For a designer, this process of selection is a complex decision-making, because they need to combine several criteria to attend a very specific target audience. Within this context, the main objective of this study was to propose a model for the selection of prototypes in the development process of fashion garment products, based on a multi-criteria tool, the Analytical Hierarchy Process (AHP). The model was developed based on literature, and the criteria used were: part acceptance, cost, design and production. Then, the developed tool was applied to a real case study and proved to be efficient, thereby enabling a structured modeling of the problem considering the multiple criteria and uncertainty.

**Keywords:** analytic hierarchy method, decision-making, multi-criteria tool, product and process development, clothing.

## Utilização do método de análise hierárquica para seleção de protótipos no processo de desenvolvimento de produto do vestuário

**RESUMO.** Para se manter no mercado, o processo de desenvolvimento de produtos do vestuário de moda desenvolve uma grande quantidades de produtos. Durante esse processo, os protótipos são desenvolvidos, avaliados e selecionados para compor a coleção, e, para a avaliação dos protótipos, os designers utilizam critérios para selecioná-los. Para o designer, esse processo de seleção é um complexo processo de tomada de decisão no qual é necessário combinar diversos critérios para um público-alvo específico. O objetivo principal deste trabalho é a proposta de um modelo para seleção de protótipos para o processo de desenvolvimento de produto do vestuário, baseada em uma ferramenta multicritério: o Método de Análise Hierárquica (AHP). O modelo foi desenvolvido com base na literatura, e os critérios utilizados foram: aceitação da peça, custo, design e produção. Em seguida, foi aplicado a um estudo de caso real, o qual foi eficiente, permitindo, assim, uma modelagem estruturada do problema, considerando os diversos critérios e incertezas.

**Palavras-chave:** método de análise hierárquica, tomada de decisão, ferramenta multicritério, desenvolvimento de produto, vestuário.

## Introduction

The fashion industry is a highly competitive market. It is based both in business talent as intuition and creativity (Lin & Twu, 2012). The successful fashion designer has to consider the consumer's needs and, then, create a unique product (Aktuglu, 2001). The effective management of the apparel industry depends on anticipating consumer needs and desires who need to respond with innovation, with products well designed and executed properly (May-Plumlee, & Little, 2006). In addition, the product development process contributes to maintaining the profitability and flexibility of textile and clothing companies (Bandinelli, Rinaldi, Rossi, & Terzi, 2013; Senanayake & Little, 2010).

The development of fashion garment products has some peculiarities. According to May-Plumlee and Little (1998), the main one is that the industry's products are developed in seasonal lines (collections) rather than individual products. A line of clothing may be formed by different groups of products that should be administered simultaneously with the process. In the fashion industry, the development of products is a dynamic process characterized by a high seasonal demand, which depends on the seasonal nature of fashion products. The entire process runs at least two times per year, one time for each season and with short time-to-market (Bandinelli et al., 2013). Furthermore, the traditional seasons are less and less visible than they were before, with frequent changes in season, such as color, shape, texture, label, etc. (Hines & Bruce, 2007).

This seasonally feature requires a very fast pace of the process, therefore the process needs to be fast and effective. Due to this feature, a company develops a large quantity of products, producing prototypes, which are assessed to form the collection. During the evaluation of prototypes, designers use criteria such as price, consumption of raw materials, difficulty level of production, quality, and other attributes valued by consumers, as wearability and appearance. However, the analysis is performed in a subjective way, qualitative, and involves several people who analyze piece by piece without a benchmark. For the designer, the evaluation and selection process of the prototypes is a complex decision-making process to combine several criteria for a specific target audience.

According to Lamb and Kallal (1992), the prototypes are judged on their success in meeting the functional, expressive and aesthetic needs previously specified for the product, and for this judgment, both subjective and objective measures are used. Prototypes can be approved, disposed of a collection or modified as a result of the evaluation (Lamb & Kallal, 1992).

Hence, there is a need for an effective tool in this evaluation process of several prototypes simultaneously, still allowing a decision-making by consensus of several participants. The purpose of this study is the use a multi-criteria tool, the AHP (Analytic Hierarchy Process) to enable this process of decision-making regarding the prototypes. The multi-criteria methods act as tools for making decisions to measure the subjectivity of the analysis problem, by incorporating the desired goals through value judgments, thus promoting the understanding of the problem and providing solutions for decision-making (Tzeng & Huang, 2011).

The AHP leads the decision-making process through defined relevant criteria and subsequent evaluation to keep, delete or change the prototypes during product development process. This methodology allows the evaluation of objective and subjective criteria; it organizes the decision variables in successive levels of importance and examines the interrelationship between the parts, simplifying the decision-making process (Sule, 2001).

Thereby, the main objective of this research is to build a model for the selection of prototypes during the development of clothing products, based on multi-criteria AHP tool. The study is presented as follows: Section 2 presents the literature review. The methodology is described in Section 3. The methodology is applied to a group of garment products, described in Section 4, followed by conclusions in Section 5.

## Evaluation criteria in clothing products

Fashion is a global business that mixes aesthetic, technology and business, making this industry so special and fascinating. However, fashion is constantly changing. The traditional seasons, spring, summer, autumn and winter are less and less visible than they were before, but they are still apparent, with frequent changes in season, such as color, shape, texture, label, etc. This makes the forecasting, planning and marketing of the whole process very risky and complex (Hines & Bruce, 2007).

New collections of clothing and accessories are created to meet a target consumer demand. Therefore, for the products meets the requirements of consumers and present a consistent design with the desires of the same, it is necessary to structure the product development process (PDP). It is through this process that the market information will be transformed into product characteristics.

The design process generally includes the steps involved in generating ideas and concepts for the development of the final product prototype. It is a multidisciplinary science that requires teamwork and collaboration between the various corporate functions (Hines & Bruce, 2007). The ideas are turned into reality through the product development process. It is a set of sequential activities and tasks that reflect the customer needs in product planning (Suh, Carroll & Cassill, 2010). Models describing the process of garment product development are briefly explained through five stages: idea generation, design, prototyping, evaluation and design refinement, and production planning (Watkins, 1988; Gaskill, 1992; Lamb & Kallal, 1992; Wickett, Gaskill, & Damhorst, 1999; Carroll & Kincade, 2007) as shown in Figure 1.

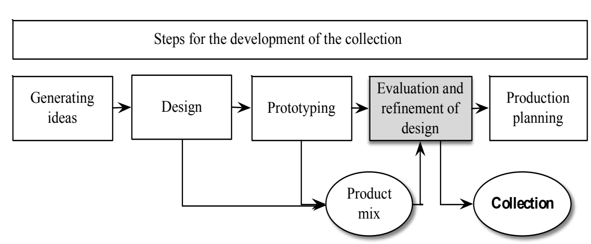


**Figure 1.** Stages of product development processes.

Research into the product development process is intended to increase the effectiveness of product development and reliability of their actions and decisions (Regan, Kincade, & Sheldon, 1998). During the product development process, designers, engineers and all professionals must make several decisions taking into account diverse criteria.

May-Plumlee and Little (2001) analyzed the criteria that the consumer takes into account in the purchase decision process. According to the authors, the evaluation criteria used by consumers to make a purchase vary, and the criteria used in deciding a purchase may be different from those used in the decision of another purchase. The company needs to develop products that will be chosen from competing products by understanding the best set of evaluation criteria used by the consumer in making a purchasing decision (May-Plumlee & Little, 2001).

May-Plumlee and Little (2001) proposed twenty-five analysis studies of evaluation criteria for men, women and clothing products for children, and they identified thirteen criteria for products used by consumers:

-Extrinsic criteria - brand / label, price and;

-Intrinsic criteria - color, style / design / uniqueness, manufacturing, care in construction, durability / sizing, fashion ability, quality, appearance / attractiveness, comfort.

Most of these criteria are intrinsic (inherent to the product), except for the price and brand that are extrinsic (added by the manufacturer or retailer). Intrinsic criteria are directly affected by the design and development decisions. Thus, understanding the consumer's preference for the particular product can facilitate the design and development of the product (May-Plumlee & Little, 2001).

Another study conducted by Hsu and Burns (2002) investigated the importance of the evaluation criteria for the purchase of a specific clothing item. The importance weights of 12 evaluation criteria were measured: the fabric, comfort, size / shape, quality, manufacturer location, color, how pleasant it was to others, brand, fitness for wear, price, style and coordination with other clothing. As a result, the criterion of size/fit was found to be the most important. Studies like this demonstrate that focus on consumer decision-making process can provide important information for traders in their development of product development and marketing strategies (Hsu & Burns, 2002).

Already Jang, Dickerson and Hawley (2005), conducted a study to identify criteria for garment products performance measures. Studies of information on the product development process were raised to explore performance measures for apparel products, and the following criteria were identified:

- Customer acceptance measures

- Sales: Consumer sales, Seasonal Sale, Weekly Sale, Longevity, Growth, Customer satisfaction, Market share

- Financial measures: Retail Profitability, Measure at the product level, Product value for the consumer, Adaptability, Excitation, Line style mix, Cost efficiency

- Company level measures: Contribution to the business / company, Brand building

The measuring of garment product performance is more based on quantitative ways. The clothing product performance is primarily measured by customer acceptance measures and financial measures of performance, i.e. sales and profitability (Jang et al., 2005).

Goncu and Bayazit (2007) conducted a study proposing a tool to select a fashion trend scheme for a specific consumer target. They developed a comprehensive list of AHP selection criteria and applied it into a system of decision support for making better decisions in fashion trends.

These studies provide important information on the criteria that companies use to evaluate fashion apparel products, in relation to the performance of the collection, or the process of purchasing decision-making of the final consumer.

This information formed the basis for the survey of criteria that can be used by designers, engineers and managers to evaluate prototypes during product development process to form the collection. The development of prototypes is a way to turn product concepts into working models which can be used to check the feedbacks from engineers and managers (Zhang, Vonderembse, & Cao, 2009). Therefore, prototyping is essential for product development because it allows participants to assess the product, thereby overcoming the uncertainty in the conceptualization of the product (Zhang et al., 2009). In addition, with the development of the prototype, new product information emerged and corrective actions can be taken at low cost and time. For this reason, rapid prototyping is defended as a mechanism to increase the product development and maximize experimentation in product design (Iansiti, 1995).

According to Tran, Hsuan and Mahnke (2011), the evaluation stage of prototype is an intermediate point of innovation in the evaluation process of the fashion garment product development. Furthermore, the use of prototypes is an effective way to present products, test and evaluate the style carried out for the apparel development process, thus allowing adjustments for the products (May-Plumlee & Little, 2006).

## Material and methods

### Analytical Hierarchy Process - AHP

The Analytic Hierarchy Process (AHP) is designed to structure a decision-making process in a scenario affected by several independent factors. It aims to help managers to set priorities and make the best decision when qualitative and quantitative aspects need to be considered (Saaty, 2000). Beyond that, the AHP developed by Saaty (1980) is a quantitative technique that facilitates the structuring of a complex multi-attribute problem, and provides an objective methodology for deciding between a set of solution strategies to resolve this problem.

Accordingly to Bottero, Comino and Riggio (2011), the AHP methodology was accepted by the international scientific community as an effective and flexible multi-criteria decision-making tool for dealing with complex decision problems. Thereby, several studies apply the AHP for decision-making of various types of problems (Senthil, Srirangacharyulu, & Ramesh, 2014; Büyüközkan, Çifçi, & Güleryüz, 2011; Çalisçkan, Kursuncu; Kurbanoglu, & Güven, 2013; Unal & Guner, 2009).

The AHP has several advantages as the search for consistency in judgments, and ease of use. It also allows users to structure complex problems in the form of a hierarchy, or a set of integrated levels (Büyüközkan et al., 2011). It enables modeling subjective processes of decision-making based on various criteria in a hierarchical system (Tzeng & Huang, 2011).

The first analysis step is to subdivide the decision-making problem at several levels, forming a hierarchy with unidirectional hierarchical relationships between them. The decomposition is performed from the top to the bottom, from the goal, proceed by the criteria and sub-criteria, and then to the final alternatives (Bottero et al., 2011).

According to Saaty (1980) the AHP is generally developed by the following steps:

- Development of the relative importance of the criteria using expert opinion by analysis of paired data.
- Development of a weighting algorithm through each of the criteria.
- Perform similar analysis to the alternative solution strategies for each of the criteria.
- Develop a single overall score for each alternative solution strategies. The final logic is that one can sort and rank the alternative solution strategies through the final score and choose the best.

In order to compare a set of $n$ criteria according to their relative importance weights, the comparison matrix in peers is used (Tzeng & Huang, 2011) and can be represented as:

$$A = \begin{bmatrix} a_{11} & \cdots & a_{1j} & \cdots & a_{1n} \\ \vdots & & \vdots & & \vdots \\ a_{i1} & \cdots & a_{ij} & \cdots & a_{in} \\ \vdots & & \vdots & & \\ a_{1n} & \cdots & a_{nj} & \cdots & a_{nn} \end{bmatrix}, a_{ii} = 1, a_{ij} = 1/a_{ji}, a_{ji} \neq 0 \quad (1)$$

where the criteria are indicated by $a_1, a_2, ..., a_n$. The relative importance of the two criteria is assessed through a scale, with numbers indicating how much more or less important a dominant element is than another element, regarding the criterion to which it is compared (Wong & Li, 2008). The values have relative importance and are determined on a 9-point scale, called 'Primary Scale of Saaty' (Saaty, 2000), as shown on the Table 1:

**Table 1.** Fundamental Scale of Saaty.

| Value | Significance and Description |
|---|---|
| 1 | Equal importance. The alternatives are the same or equivalent in importance in the criteria and there are no significant differences between them. |
| 3 | Slightly more important. The alternative has little advantage in the analyzed criterion. |
| 5 | More importante. More relevant alternative in the analyzed criteria, indisputable importance. |
| 7 | Much more importante. Alternative far above from the other in significance. |
| 9 | Absolute importance. The alternative is irrelevant in view of the importance of this. |
| 2,4,6,8 | Intermediate values. When the comparison is required. |
| Reciprocal | Reciprocal reverse comparison |

After the comparison, matrices are created with the relative weighting of the elements at each level, with respect to an element in the adjacent upper level, they are calculated as the components of the normalized vector itself, associated with higher value of their own comparison matrix (Bottero et al., 2011).

The comparative weights are derived by finding the eigenvector $w$ within its respective $\lambda_{max}$ ,which meets $Aw = \lambda_{max} w$, where $\lambda_{max}$ is the largest eigenvalue of the matrix A.

Here, the eigenvector w with its respective $\lambda_{max}$ is found for the condition $(A - \lambda_{max} I)w = 0$.

To ensure the consistency of subjective perception and the accuracy of the comparative weights, the Consistency Index (CI) and the Consistency Ratio (CR) are calculated; Saaty (1980) defined the Consistency Index (CI) as:

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

where $n$ is the number of criteria. The value of CI should be less than 0.1 for reliable results. Therefore, with Equation (2), Saaty (1980) defined the Consistency Ratio (CR) as:

$$CR = CI/RI \quad (3)$$

where RI is the consistency index of a reciprocal matrix, randomly generated from the 9-point scale. The RI is determined for different sizes of matrices, and its value is 1.25 for a 6x6 matrix. The CR is a measure of how a particular matrix compared itself with a purely random matrix in terms of the consistency index. The CR also should be below to 0.1 for a reliable result (Wong & Li, 2008). Larger CR values require the decision maker to review their judgments (Bottero et al., 2011).

Then, the compounds weights are determined by the aggregation of the weights along the hierarchy. This is done following a path from the top of the hierarchy down to each of the alternatives to the lowest level, and multiplying the weight along each path segment. The result of this aggregation is a normalized eigenvector of the total weights of the options (Saaty, 2003).

## Results and discussion

### Model development

The purpose of this work is to develop a model, utilizing the AHP, which enables the decision-making process through defined relevant criteria and subsequent evaluation to keep, delete or change the prototypes during product development process. This first step is carried out by the definition of decision criteria for the selection of the prototypes, then, the construction of the hierarchical structure, and finally the analysis of the criteria and sub-criteria, where the comparison of these is performed for the definition of the weights.

### Definition of the criteria

The criteria relevant to the assessment of garment parts were widely discussed in the literature. So based on the literature and validation of industrial experts, the assessment criteria and sub-criteria were defined and shown in Table 2.

**Table 2.** Criteria and sub-criteria for the selection of clothing prototypes.

| Criteria | Sub-criteria | Description | References |
|---|---|---|---|
| Part acceptance | Wearability | Comfort and adequacy of the part in relation to the body. | Hsu & Burns, (2002), Goncu & Bayazit (2007). |
| | Part quality | Good looking of the part, textile and finishing in accordingly. | Hsu & Burns, (2002), Goncu & Bayazit (2007). |
| | Attractiveness | Ability of the part to draw consumers' attention. | Jang et al. (2005). |
| Cost | | Cost of the part. | Hsu & Burns (2002), Jang et al. (2005), May-Plumlee & Little, (2001). |
| Design | Adequacy to the collection | Adequacy of the part to the characteristics of the annual collection. | Jang et al. (2005), Goncu & Bayazit (2007). |
| | Adequacy to the brand | Adequacy of the collection regarding the characteristics of the brand and target audience. | Hsu & Burns, (2002), May-Plumlee & Little, (2001), Jang et al. (2005). |
| | Versatility | Ability of the part of being utilized in several circumstances and with different compositions. | Hsu & Burns, (2002). |
| Production | Ease of production | Degree of Ease of production influence on costs and production time. | May-Plumlee & Little, (2001). |
| | Part durability in the collection | Time that the part remains in the collection influences the amount to be produced. | Goncu & Bayazit (2007). |

### The hierarchy Decision Model

This step is the definition of hierarchical structure, built of four levels, as shown in Figure 2. The upper level is the overall goal. To build the structure, the criteria were applied in the second and sub-criteria on the third level. The lower level denotes the prototype alternatives.

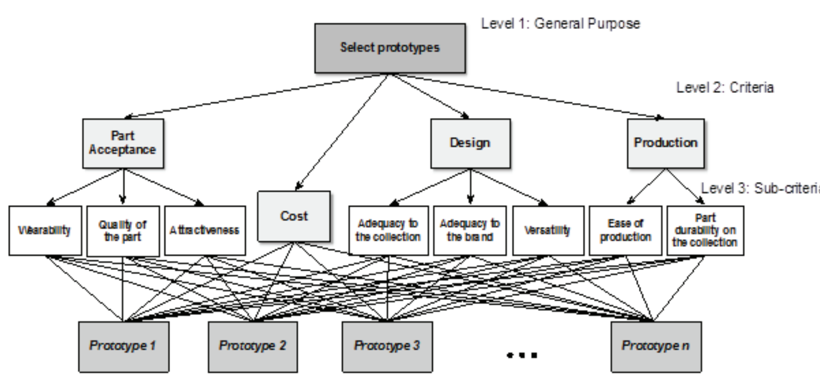


**Figure 2.** Scheme of the hierarchical structure.

### Evaluation of criteria weights

After the determination of decision hierarchy, a comparison matrix in pairs was constructed (Equation 1), to set the level of the criteria and sub-criteria using the scale given in Table 1. The criteria weights are calculated as shown in Table 3 and sub-criteria weights (Part Acceptance criteria, Design and Production) as shown in Tables 4, 5 and 6, in which the CR values are below 0.1 (Equation 3). The cost criterion has no sub-criteria and their weight is defined objectively according to the cost of each prototype, variable for each different situation of tool application.

**Table 3.** Comparison matrix of the general criteria in pairs.

| Criterion | Part acceptance | Cost | Design | Production | Weight |
|---|---|---|---|---|---|
| Part Acceptance | 1 | 1 | 1/2 | 2 | 0.226 |
| Cost | 1 | 1 | 1 | 1 | 0.239 |
| Design | 2 | 1 | 1 | 4 | 0.394 |
| Production | 1/2 | 1 | 1/4 | 1 | 0.141 |

**Table 4.** Comparison matrix of the criteria in pairs 'Part Acceptance'.

| Criterion | Wearability | Part quality | Attractiveness | Weight |
|---|---|---|---|---|
| Wearability | 1 | 1 | 1/2 | 0.26 |
| Part quality | 1 | 1 | 1 | 0.327 |
| Attractiveness | 2 | 1 | 1 | 0.413 |

**Table 5.** Comparison matrix of the criteria in pairs 'Design'.

| Criterion | Adequacy to the collection | Adequacy to the brand | Versatility | Weight |
|---|---|---|---|---|
| Adequacy to the collection | 1 | 3 | 2 | 0.54 |
| Adequacy to the brand | 1/3 | 1 | 1/2 | 0.163 |
| Versatility | 1/2 | 2 | 1 | 0.297 |

**Table 6.** Comparison matrix of the criteria in pairs 'Production'.

| Criterion | Ease of production | Part durability in the collection | Weight |
|---|---|---|---|
| Ease of production | 1 | 2 | 0.667 |
| Part durability in the collection | 1/2 | 1 | 0.333 |

Finally, the weights of criteria and their respective sub-criteria can be seen in Table 7.

**Table 7.** Criteria and sub-criteria weights.

| Criteria for selection of the prototypes | Weight | Sub-criteria | Weight |
|---|---|---|---|
| Part Acceptance | 0.226 | Wearability | 0.260 |
| | | Part quality | 0.327 |
| | | Attractiveness | 0.413 |
| Cost | 0.239 | | |
| Design | 0.394 | Adequacy to the collection | 0.540 |
| | | Adequacy to the brand | 0.163 |
| | | Versatility | 0.297 |
| Production | 0.141 | Ease of production | 0.667 |
| | | Part durability in the collection | 0.333 |

### Application of the model in a case study

The built tool can be used for any garment products group to rank and consequently select the prototypes that will compose a collection. In the case of a company that produces shirts, dresses, trousers and blouses, the model can be used for each type of product, as shown in Figure 3.

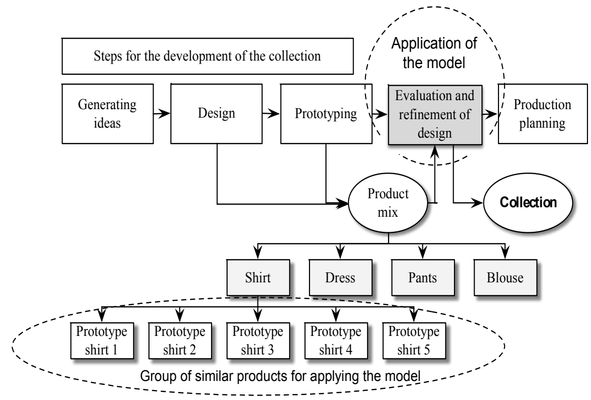


**Figure 3.** Tool use identification in the product development process.

Applying the model proposed in the methodology presented in Figure 2, it is possible to get the hierarchical structure with five prototypes in level four (alternative prototypes). Then, the experts judged the prototypes, carrying out the pair wise comparison of the prototypes for each sub-criterion, Table 8 shows the comparison matrix of sub-criterion 'wearability'. All matrices presented CR below 0.1, being within acceptable limit of the AHP.

**Table 8.** Comparison matrix of prototypes in the sub-criterion 'Wearability'*.

| Prototypes | P1 | P2 | P3 | P4 | P5 |
|---|---|---|---|---|---|
| P1 | **1** | 1 | 1/2 | 1/2 | 1 |
| P2 | 1 | **1** | 1/2 | 1/2 | 1 |
| P3 | 2 | 2 | **1** | 1/2 | 1 |
| P4 | 2 | 2 | 2 | **1** | 2 |
| P5 | 1 | 1 | 1 | 1/2 | **1** |

*CR = 0.02

Only the criterion Cost was directly defined by the cost values of each prototype, the values were inversely standardized, since the lower the better value for the company, and so their weights were defined as shown in Table 9.

**Table 9.** Weights on criterion 'Cost'.

| Prototypes | Cost | Weight |
|---|---|---|
| P1 | R$150.00 | 0.144 |
| P2 | R$110.00 | 0.196 |
| P3 | R$120.00 | 0.180 |
| P4 | R$90.00 | 0.240 |
| P5 | R$90.00 | 0.240 |

Wherefore, the weights in the prototypes each criterion and sub-criterion can be seen in Table 10.

**Table 10.** Weights for the criterion and its sub-criterion.

| Criterion/ sub-criterion | P1 | P2 | P3 | P4 | P5 |
|---|---|---|---|---|---|
| **Part Acceptance** | **0.244** | **0.215** | **0.212** | **0.186** | **0.144** |
| Wearability | 0.143 | 0.143 | 0.221 | 0.329 | 0.165 |
| Part quality | 0.257 | 0.257 | 0.170 | 0.145 | 0.170 |
| Attractiveness | 0.287 | 0.217 | 0.245 | 0.143 | 0.108 |
| **Design** | **0.191** | **0.220** | **0.194** | **0.208** | **0.186** |
| Adequacy to the collection | 0.253 | 0.231 | 0.199 | 0.168 | 0.149 |
| Adequacy to the brand | 0.152 | 0.197 | 0.227 | 0.227 | 0.197 |
| Versatility | 0.095 | 0.215 | 0.163 | 0.274 | 0.253 |
| **Production** | **0.072** | **0.192** | **0.175** | **0.300** | **0.256** |
| Ease of production | 0.056 | 0.159 | 0.201 | 0.319 | 0.265 |
| Part durability in the collection | 0.099 | 0.261 | 0.131 | 0.267 | 0.241 |

Then, it was possible to identify the weight of the prototypes in relation to the general objective 'Select the Prototypes', as shown in Table 11.

**Table 11.** Ranking of prototypes.

| Prototypes | Final Weight | Ranking |
|---|---|---|
| P1 | 0.175 | 5 |
| P2 | 0.210 | 2 |
| P3 | 0.192 | 4 |
| P4 | 0.223 | 1 |
| P5 | 0.200 | 3 |

Through the final weight evaluation, it was possible to rank the prototypes, leading to the following final ranking: P4 > P2 > P5 > P3 > P1 (the symbol '>' stands for 'better than'). The proximity of the final weights is the result of the prototypes within the same type of products (shirts) with very similar characteristics, as shown in Figure 3, so the model proposed appears necessary at this stage of the product development process of the garment. In this classification, defined by the preferences of experts, the company can choose which products will keep in the collection, and which products to modify or delete.

## Conclusion

The evaluation process of prototypes is the main decision point during the development of clothing product process, and involves many variables that influence the final composition of the collection. This is a complex process in which companies often make decisions subjectively and without well-defined criteria. The proposal of using a multi-criteria tool in decision-making for the selection of garment prototypes is innovative. Most studies in this area indicate the evaluation criteria, without demonstrate a way to use them simultaneously and systematically in prioritizing the prototypes. The Analytic Hierarchy Process model allows companies to make these decisions in a clear and straightforward manner, taking into account during the decision-making all the variables that directly influence the outcome of this process. Furthermore, the AHP enabled the construction of a model for the decision-making process through relevant criteria defined by the literature or by the company, and consequent evaluation to keep, delete or change the prototypes during product development process.

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