Application of AHP Method to Aid Destination Choice of Pre-Production Models in a Textile Industry

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Abstract

The study analyzed, through the Analytic Hierarchy Process (AHP) technique, the decision-making tool, the best resolution for the final disposal problem of pre-pruduction models of a garment company. Obtaining data was based on the identification of the problem, general understanding of how to improve and finally the application of the AHP method, it was concluded that the best decision was archiving the pieces, guaranteeing fidelity in the reproduction of the product and the aid for the development of new parts.

Keywords: Decision-Making. Analytic Hierarchy Process. Pre-Production Models, Textile Industry.

1. Introduction

The textile industry, like any other manufacturing or service industry, is faced daily with situations that require decision-making that takes them in different directions. Decision making is present not only in industries but also in the daily lives of human beings.

It is a business routine to decide between more or less rational alternatives, these alternatives may be problems or opportunities ahead. Meneguele (2000) says that the decision maker should not be taken by emotion, intuition, immediacy or fad, but should take into consideration all information and knowledge that is available to him.

Among the decision-making tools, the Analytic Hierarchy Process (AHP) method, widely used in industries as a support in multi-criteria problem solving. In addition to helping in the choice of options, it also justifies why that was the best choice.

The application of this tool in the garment industry arose from the need to make a decision about the final destination of pilot parts, since three alternatives are possible: discard, sell or file. Any one of the three alternatives, have their criteria with their respective weights from the preferences of the makers and experts in the field of clothing.

Using the AHP method, thus allowing the analysis of the three alternatives above in order to compare them, it is possible to use the knowledge of decision makers to compare attributes and convert them into quantitative data. The priority of each element or criterion that is organized in hierarchies is defined by the preferences of those responsible for evaluating the attributes, and finally the overall evaluation of each alternative can be determined.

Conversion to quantitative data refers to the priority of each element, ie its weight. This is best explained in Saaty's (2013) scale, which states that all elements are not equally important, quantifying the elements indicating how much each element dominates another.

According to Briozo and Musetti (2013) the resolution of a multicriteria problem, one must start with the construction of the structure: define the problem, then identify the constraints or criteria, and finally, which alternatives to be evaluated and selected. This occurs by crossing the criteria with the alternatives and the criteria with the ultimate goal.

The problem was related to the organization and layout to choose the appropriate final arrangement of the pilot pieces, making the main objective of the study to analyze the feasibility of the arrangement of pilot pieces of a textile industry in southern Santa Catarina, by applying the AHP method. (Analytic

Hierarchy Process). For this purpose alternatives will be identified for the destination of the pilot pieces; quantify attributes with experts and measure the priority and finally demonstrate application of the method.

No previous studies have been conducted to assign pilot parts, as they lack information for final disposal. The pieces were randomly assigned and often lost without objectivity in decision making, so it was necessary to study alternatives with certain attributes that with their respective weights help in decision making.

2. Methodology

The present study was developed in a garment company in the south of Santa Catarina - Brazil, whose volume of pilot pieces is significant, focusing on the creation of a decision making procedure to guide the pilot pieces in the best way. The AHP method was used for decision making, seeking to find possibilities of destination of the pilot pieces, aiming at the best resolution to the problem.

2.1 Methodological Framework

The research was initially characterized by a process of bibliographical exploration seeking to contemplate aspects related to decision making. This stage consisted of the necessary theoretical support for the field research.

According to Medeiros (2007), the bibliographic research is defined as the survey of the bibliography related to the subject that is intended to study, a formal process of knowledge acquisition.
After the bibliographic survey stage, the field research analyzed the use of the AHP method in the company object of study, for decision making. To achieve the goal of the final destination of the pieces, attributes and alternatives were evaluated in such a way as to be tested with the AHP method, making the decision making more assertive.

From this procedure it is understood that the research is characterized as exploratory and descriptive. Furasté (2007) explains that in descriptive research one must observe, describe, analyze, classify and record facts without any kind of interference.

The analysis of the collected data was performed under a quantitative and qualitative approach. Fonseca (2002) clarifies that the difference between quantitative and qualitative analysis is the possibility of quantifying the results. Quantitative research uses mathematical language to understand the causes of an event and the relationships between variables.

2.2 Data collection and analysis procedure

The development of the research was elaborated through an existing method, adapted to the reality of the company and thus developed and introduced in the textile industry. The problem was related to the organization and layout to choose the appropriate final arrangement of the pilot parts. As it is a confection, it is used to follow in pilot parts, which serve as a sample of how the product should be manufactured.

Before the product is marketed, a line is developed with several product samples, which are sent to the customer. After placing the purchase orders, the customer sends only samples approved for manufacturing, which will be used as an example of the finished products. These approved samples are called pilot parts,

and are important to the company during the manufacture of the product because if the batch of an order is different from the customer approved pilot part, it is cause for order disapproval and cancellation.

Over time, and due to high order demand, a large number of pilot parts were realized in stock. For in most cases, upon completion and shipment of orders, the pilot parts were left in boxes stored in the stock of raw materials. With the need for storage area, it was questioned the occupation of this space, bringing to light the decision about choosing a more suitable destination for these pilot parts. Thus, the best options for solving this problem were analyzed using the AHP method.

Based on the need for free stock space, three options have been suggested for solving this problem: disposal, sale of parts or archiving of pilot parts.

3. Results Analysis

In table 1, attributes, alternatives and degree of importance of each attribute were considered, considering all items as relevant facts that should be taken into consideration in all alternatives that may be the best option, the importance is how important this attribute is. in relation to others.

Attributes / Alternatives	Discard	Archive	Sell	Importance
Space occupied	20 m²	40 m²	45 m²	3
Product Reproduction Fidelity	1	10	3	9
Long Term Billing	Null	Excellent	Medium	7
Financial flexibility	R$5,00	R$10,00	R$3,00	3
Social and environmental responsibility	No	Good	Enough	5

Table 1 – Attributes x Alternatives

Source: Authors (2018)

The alternatives that turned out to be the options are: discard, file or sell, the pilot parts is intended for one of these three options. Attributes have their certain weights in each of these alternatives.

The attributes are: space occupied, product reproduction fidelity, long term billing, financial flexibility, social and environmental responsibility. The occupied space deals with the area used to store the part. To discard, the piece should be in a warehouse of about 20sqm until someone comes to get it to end. If it is filed will need a warehouse with 40sqm to deposit the piece, along with the others. If the option is to sell, the piece should be sent to the bazaar where sales are made in certain seasons in the year, this bazaar with 45sqm. Taking into account costs such as depreciation, cleanliness of the environment and the built space itself, the smaller the area, the better for the company.

Fidelity in product reproduction refers to the ability to reproduce in the future on a large scale, ensuring the details of the pilot piece. This can also help customers close deals more easily by ordering from viewing what has already been produced. The values of the alternatives mean that the higher the fidelity the higher the probability of accuracy in future productions.

As for the long-term billing attribute, if it discards the parts, the billing is null, since, disposing of the part, the company is subject to disburse amounts for transportation and final disposal. Archiving the parts as already mentioned can guarantee future sales for customers who wish to repeat the part. Finally, if it is

for sale, revenue is existing, but low, as it will only be for the price of the part. Financial flexibility is about how much the company will have to invest for each of the options.

Finally, the social and environmental responsibility is the concern of the company with the environment, if you decide to discard, the piece will go to recycling points, where it will undergo a process in which the fabric will be transformed into yarn, which can be used as raw material. for the manufacture of new products. However, there are few initiatives, especially in the region, that involve proper disposal. Because the recycling process is very labor intensive and most of the tissue waste stations that have been found do not offer the option of tissue recycling. Another way to dispose would be to dispose of it in a landfill or landfill, and this option is not appropriate, since depending on the composition of the fabric, the pieces would take hundreds of years to decompose and could still release gases and toxic substances into the soil and in the water table. If you come to file the responsibility for the waste, it is guaranteed, since the archiving of the part will not harm the environment, but if the option is to sell, while the part is in the hands of the company there are no risks, but after purchase it can be used and later discarded by the purchaser.

After the explanation of each item, follows for the demonstration of the calculations according to Table 2.

Attributes	Space occupied	Product Reproduction Fidelity	Long Term Billing	Financial flexibility	Social and environmental responsibility	Relative Priority
Space occupied	0,07	0,08	0,06	0,07	0,06	0,07
Product Reproduction Fidelity	0,43	0,48	0,50	0,43	0,50	0,47
Long Term Billing	0,29	0,24	0,25	0,29	0,25	0,26
Financial flexibility	0,07	0,08	0,06	0,07	0,06	0,07
Social and environmental responsibility	0,14	0,12	0,13	0,14	0,13	0,13

Table 2 – Relative Priority of Second Level Criteria Matrix

Source: Authors (2018)

After comparing the attributes, according to the degree of importance defined by experts in the area, the matrix was normalized, adding the values obtained from each attribute by columns, with the result of this sum, dividing each column item by the overall sum The column allowed the relative priority values to be obtained, which is the average of each attribute per row. What gave the highlight value was the faithfulness in the reproduction of the product.

From this we proceed to the comparison of the criteria as shown in table 3.

Alternatives	To discart	To file	Sell
To discard	1	4	6
To file	1/4	1	2
Sell	1/6	1/2	1
Sum	1,42	5,50	9,00

Table 3 – Comparison matrix criterion space occupied

Source: Authors (2018)

Likewise, as was done with the attributes, it was made for the alternatives, in Table 3 the alternative space with the others was compared quantitatively, from values defined with the degree of importance. In table 4, the priority value of the space occupied criterion was obtained.

Alternatives	To discart	To file	Sell	Relative Priority
To discard	0,71	0,73	0,67	0,70
To file	0,18	0,18	0,22	0,19
Sell	0,12	0,09	0,11	0,11
Sum	1,00	1,00	1,00	1,00

Table 4 – Matrix Relative Priority Space occupied criterion

Source: Authors (2018)

The same was done with all alternatives, product reproduction fidelity, long-term billing, financial flexibility and environmental responsibility, all with their respective relative priorities, always with outstanding value.

Finally, Figure 1 shows us all the values obtained by comparing each criterion separately and their relative priorities found, the rows were multiplied with the relative priority column of the attributes (Table 2) and their sum.

$$\begin{Bmatrix} 0,70 & 0,08 & 0,09 & 0,17 & 0,09 \\ 0,19 & 0,79 & 0,70 & 0,74 & 0,74 \\ 0,11 & 0,13 & 0,21 & 0,09 & 0,17 \end{Bmatrix} \times \begin{Bmatrix} 0,07 \\ 0,47 \\ 0,26 \\ 0,07 \\ 0,13 \end{Bmatrix} = \begin{matrix} 0,131075 \\ \boxed{0,714985} \\ 0,153941 \end{matrix}$$

Figure 1 – Global equation

Source: Authors (2018)

The value found indicates that archiving is the best choice for business. As shown by the calculations, it was found that consideration was given to the importance and weight of all items.

4. Conclusion

The aim of the present study was to analyze, through the AHP decision - making method, the most suitable destination for the pilot pieces of a textile industry located in the south of Santa Catarina. The

research used in the case study was quantitative and qualitative and we used bibliographic research, because information was taken from existing articles and manuals and field.

Three alternatives for the final arrangement of pilot pieces in a garment industry in the south of Santa Catarina state were investigated. To decide the best alternative, between discarding, archiving or selling the pieces of the showcase, the AHP decision making method was used.

The AHO method showed, quantitatively, that the alternative archiving pilot parts is the best option, with approximately 71.5% when compared to the other alternatives. From this decision the company should have a space in its factory park to organize the stock of pilot parts.

5. References

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