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QUALITY FUNCTION DEPLOYMENT IN TEXTILE INDUSTRY: A CASE STUDY FOR EMBROIDERY MACHINES

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Abstract: *According to existing literature, quality function deployment is a tool that can be used to relate the requirements of customers with the technical characteristics of products in order to satisfy these requirements. Since its development in Japanese industry, quality function deployment is subject to much literature that describes its employment in different fields. The existing literature also illustrates the use of quality function deployment in different areas of the textile industry. Nevertheless, quality function deployment has been less used for embroidery machines. Within this context, the aim of this study is to present the employment of quality function deployment for the linkage of the requirements of customers with the technical characteristics of embroidery machines. A case study illustrates the approach, which was conducted taking into account three embroidery machines (one of the machines was considered as Our Product, the other two were considered as Competitor A and Competitor B). Following the approach described in the existing literature, the main steps of the employment of quality function deployment for embroidery machines are shown: the establishment of the requirements of customers; the establishment of the technical characteristics; the devopment of the matrices of the quality function deployment: the planning, relationship, correlation and technical matrix.*

Key words: *qfd, customer requirements, technical characteristics, embroidery, machines*

1. INTRODUCTION

Quality function deployment (QFD) is a quality tool that can be used to establish the characteristics of products that are necessary to satisfy the requirements of customers [1]. Since its development in Japanese industry, it is subject o much literature that describes the employment of QFD in different fields [2]. In the textile industry QFD has been used in different areas, such as the apparel design [3], selection of cotton fiber [4], improvement of quality of T-shirt [5] or lifecycle evaluation of products [6].

However, QFD has been less used for embroidery machines. Therefore, the aim of this article is to illustrate the employment of QFD for the linkage of the requirements of customers with the technical characteristics of embroidery machines in order to accomplish these requirements.

2. MATERIALS AND METHODS

The research was conducted taking into account three embroidery machines. One of the

machines was considered as our product, the other two were considered as Competitor A and Competitor B.

3. RESULTS

Following the approach described in [7], the next steps presents the employment of QFD for embroidery machines:

a) The establishment of the requirements of customers (WHAT's List)

The following requirements of customers were determined:

a1) reliability;
a2) noise;
a3) serviceability.

b) The establishment of the technical characteristics (HOW's List)

The following technical requirements were determined:

b1) thickness of the material <1 mm;
b2) embroidery area 2080 cm^2;
b3) sewing speed 1000 stitches/minute;
b4) memory storage capacity 40000000 stitches.

c) Planning matrix

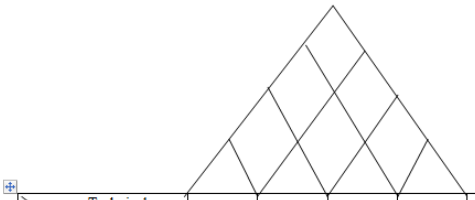
The planning matrix is depicted in figure 1.

Technical characteristics (HOW's) / Requirements of customers (WHAT's)		Thickness of the material	Embroidery area	Sewing speed	Memory storage capacity	Importance of WHAT's	Competitive analysis			Planned coefficient	Improvement factor	Market leverage point	Overall importance
							Our product	Competitor A	Competitor B				
Reliability						4	3	4	3	4	1.2	1.2	5.76
Noise						5	4	4	4	4	1	1.5	7.5
Serviceability						4	4	4	5	5	1.2	1.2	5.76
Importance of HOW's													
Percent importance of HOW's (%)													
Competitive benchmarking	Our product												
	Competitor A												
	Competitor B												
	Target values for our product												

***Fig. 1**: The planning matrix*

d) The relationship matrix

The (9, 3, 1, 0) scale was used to establish the relationship between each requirement of customers and each technical characteristic. The relationship matrix is shown in figure 2.



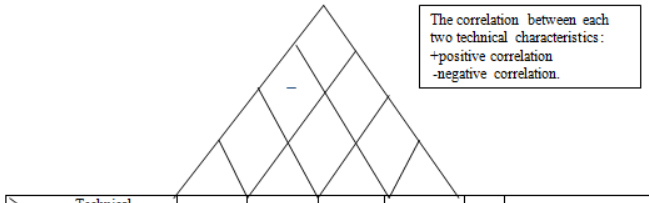
Technical characteristics (HOW's) / Requirements of customers (WHAT's)	Thickness of the material	Embroidery area	Sewing speed	Memory storage capacity	Importance of WHAT's	Competitive analysis: Our product	Competitive analysis: Competitor A	Competitive analysis: Competitor B	Planned coefficient	Improvement factor	Market leverage point	Overall importance
Reliability	1	1	3	1	4	3	4	3	4	1.2	1.2	5.76
Noise	3	1	9	0	5	4	4	4	4	1	1.5	7.5
Serviceability	0	1	1	1	4	4	4	5	5	1.2	1.2	5.76
Importance of HOW's												
Percent importance of HOW's (%)												
Competitive benchmarking: Our product												
Competitive benchmarking: Competitor A												
Competitive benchmarking: Competitor B												
Competitive benchmarking: Target values for our product												

Legend
Relationship scale: 0=no relationship, 1=weak relationship, 3= moderate relationship, 9=strong relationship.

***Fig. 2**: The relationship matrix*

e) The correlation matrix

The correlation matrix between each two technical characteristics is presented in figure 3.



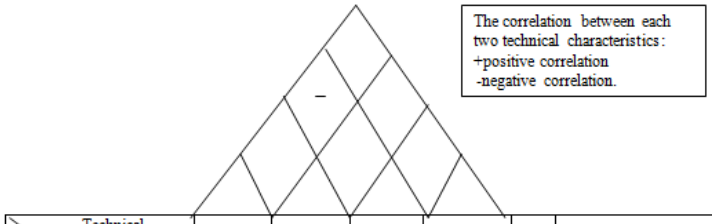
Technical characteristics (HOW's) / Requirements of customers (WHAT's)	Thickness of the material [mm]	Embroidery area [cm²]	Sewing speed [stitches/minute]	Memory storage capacity [stitches]	Importance of WHAT's	Competitive analysis: Our product	Competitive analysis: Competitor A	Competitive analysis: Competitor B	Planned coefficient	Improvement factor	Market leverage point	Overall importance
Reliability	1	1	3	1	4	3	4	3	4	1.2	1.2	5.76
Noise	3	1	9	0	5	4	4	4	4	1	1.5	7.5
Serviceability	0	1	1	1	4	4	4	5	5	1.2	1.2	5.76
Importance of HOW's												
Percent importance of HOW's (%)												
Competitive benchmarking: Our product												
Competitive benchmarking: Competitor A												
Competitive benchmarking: Competitor B												
Competitive benchmarking: Target values for our product												

Legend
Relationship scale: 0=no relationship, 1=weak relationship, 3= moderate relationship, 9=strong relationship.

***Fig. 3**: The correlation matrix*

f) The technical matrix, which is depicted in figure 4.

The importance of HOW's for each technical characteristic was computed by multiplying each value in its column of the relationship matrix with the corresponding values of the overall importance (e.g. thickness of the material: 1*5.76+3*7.5+0*5.75=28.26). The target values of the competitive benchmarking were established by comparing the ones of Our Product with those of the Competitor A and Competitor B.



Technical characteristics (HOW's) / Requirements of customers (WHAT's)	Thickness of the material [mm]	Embroidery area [cm²]	Sewing speed [stitches/minute]	Memory storage capacity [stitches]	Importance of WHAT's	Competitive analysis			Planned coefficient	Improvement factor	Market leverage point	Overall importance
						Our product	Competitor A	Competitor B				
Reliability	1	1	3	1	4	3	4	3	4	1.2	1.2	5.76
Noise	3	1	9	0	5	4	4	4	4	1	1.5	7.5
Serviceability	0	1	1	1	4	4	4	5	5	1.2	1.2	5.76
Importance of HOW's	28.26	19.02	90.54	11.52								
Percent importance of HOW's (%)	18.92%	12.74%	60.63%	7.71%								
Competitive benchmarking: Our product	≤1	2080	1000	40000000								
Competitive benchmarking: Competitor A	≤1	2000	1000	40000000								
Competitive benchmarking: Competitor B	≤1	1920	1200	40000000								
Competitive benchmarking: Target values for our product	≤1	2080	1200	40000000								

Legend
Relationship scale: 0=no relationship, 1=weak relationship, 3= moderate relationship, 9=strong relationship.

***Fig. 4**: The technical matrix*

4. CONCLUSIONS

In this work, quality function deployment was used for linkage of the requirements of customers with the technical characteristics of embroidery machines in order to accomplish these requirements. A case study illustrates the employment of the approach.

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