The quality function deployment method in garment industry

Danijela Paunovic 1*, Gordana Colovic 1, Vladimir Nikolic 2

1 The College of Textile – Design, Technology and Management, Starine Novaka 24, 11000 Belgrade, Serbia
E-Mail: du.co@sbb.rs
2 College of Polytechnic, Krfska 7, 11000 Belgrade, Serbia
E-Mail: nikolicmvl@sbb.rs

Summary
New philosophy of production in clothing industry is based on informatics technologies and production for the market, not for a warehouse. This has caused permanent and intensive revitalization of the process and the system. High frequency market changes caused by global competition in clothing industry have caused production-business systems (PBS) to set permanent production goal: short delivery terms, high quality of clothing products and prices that are acceptable on the market. Achievement of goals of quality and increase in PBS potentials are enabled through application of continuous Quality Management System improvement (QMS). If the “voice of the user” is taken into consideration as one of the most important factors in quality management, application of the method of Quality Function Deployment (QFD) initiates and provides the right kind of information for adequate decision making, correctly positions PBS on the market and creates conditions necessary for establishment of feed back and for estimate of realized improvement.

Key words: QFD, garment industry, quality.

1. INTRODUCTION

Industrial way of production needs a thorough preparation of manufacturing because, simultaneously, it is necessary to combine several factors: people, time, machines and place of production, organization and material in a coordinated and rational system. Technological system of garment production must provide the quality of the product that is expected, necessary scope of

* corresponding author
production, delivery of ready-made garments in the expected time, maximal use of capacities with minimal expenses. Deviations and faults occur in different places and in various frequencies, because of a variety of designs of clothing articles and because of a great number of procedures in the production process.

QFD is a powerful tool that enables significant improvements in the product/process characteristics. However, it is not a short-term solution to the product development problems. QFD provides systematic approach to creation of the team outlook, on what needs to be done, the best ways to do it, the best order in which the proposed tasks have to be accomplished and on the staffing and resources that are required to enhance customer’s satisfaction. It is also a good format for capturing and recording/documenting the decision making. Applied through the Kaizen philosophy under Total Quality Management (TQM), QFD is a highly developed form of integrated product and process development in existence. Companies that were using QFD for the product development, have experienced, in average:

- 50% reduction in costs,
- 33% reduction in the product development time,
- 200% of increase in productivity.

Producers of clothing products should, therefore, choose business strategy that will enable them to adapt to changes in the surrounding, they also, must study and implement TQM approach for strategic management, as well as to adopt QFD method for efficiently reaching of goals of clothing products improvement.

In clothing industry which must realize high quality flexible product, the place and role of QFD method in the framework of the QMS quality loop has for a goal achievement of precisely defined level of quality that suites users' demands. For the first time in our clothing industry suggested method is applied in the example of female denim trousers.

2. QFD IN GARMENT INDUSTRY

![Figure 1. Potential areas of research leaning on the Theory of product [1]](image-url)
In order to answer the question of what is happening with the product during its *origin*, *exploitation* and finally, what are the needs that it has to satisfy - it will be necessary to discuss its *features* already assuming that it is necessary to focus the research on the product. After initial classification of features, scope of research can be expanded on other essential questions: about the life span of the product, influences of time and space variables, chain of values, and other, relevant for the product.

Finally, discussing usability of research of the product phenomenon in the framework of a separate theory indicates possibility of acquiring new knowledge on entity structure, their mutual ties.

Placing the product into focus of research makes it possible to understand it as an entity that can satisfy the needs of mankind. Clearly stated position that generating of the product influences a large number of factors and circumstances whose influence should be researched, can be added to this. High level of rationality, observed from the point of view of sustainable development, will be present more and more in the future period.

QFD method is mostly used in quality management processes in Japanese companies, and so their experience is being followed in application and in the way of introduction into use. Japanese society for QC recommends QFD for defining "the voice of the buyer", as a scientific process. The voice of the buyer is also the motivating factor for the QFD method, and as such determines success or failure of the product and service on the market. Barnard and Wallace (1994) have integrated QFD as a compulsory method for development strategy defining [2].

Consumer's needs are one of the starting foundations of clothes designing; therefore information received from a designer must be realistic, clear, and precise with recommendation for the quality level of clothing articles. It must also be given promptly, so that the new collection can appear on the market at the right time. If the buyer's demands that are important for their satisfaction are not harmonized, critical components of the products and services not established, and then removed in the phase of critical parameters of the production process and not transferred into procedures and instructions for realization and control of clothing articles, the battle for prestigious place on the market and for the buyer of clothing articles will be lost.

3. PHASES OF THE QFD METHOD APPLICATION IN GARMENT INDUSTRY

Implementation of the QFD method in clothing industry is represented through 4 principles of work in 4 phases:
- phase 1 - translates buyer's demands into the product features,
- phase 2 - translates the product features into features of its parts,
- phase 3 - translates features of parts into technology of fabrication and
- phase 4 - translates technology of fabrication into technical instructions.

Forwarding information from one organizational unit to another (marketing, development, technology, production) through "four houses of quality" (Fig.2."House of quality"), in which demands ("What") transform into characteristics of the product, part of the product or process ("How"), with following technical target values and their correlations in experimental part, on example of female denim trousers led to:
- product designing time decrease,
- quality of clothing product improvement(the offered quality is exactly as the customer demands),
- reduction of total cost of designing and production,
- plans and programs for training the workers, especially in critical working places,
- definition of procedures of work,
- documentation and quality management system.

![House of Quality House of Values](image)

*Figure 2. House of Quality House of Values, (Mizuno & Akao, Japan, 1979)*

House of quality – relations matrixes:
WHAT–HOWs : Most important matrix of QFD (market demands and quality elements),
WHATs--WHYs: For establishment of WHATs priorities,
HOWs --HOWMUCHs: Team determines how much each of HOWs can vary in order to satisfy buyer’s demands,
HOWs -- HOWs (Matrix of sensibility): for identification of quality correlation between HOWs, since possible solutions may not contribute a lot to values of buyer’s demands; or that they are disharmonious.

When questions of clothing product buyers are analyzed through poll and claims on female denim trousers, a list of buyers' wishes is formed (WHATs). They can be divided into:

1. Basic(primary, expected, unspoken-understood, "must be"),
2. Derived (secondary, spoken, "might be"),
3. Exhilarating (tertiary, unspoken-pleasantly surprising, "it would be nice, if it existed").

**4. ANALYSIS OF THE QFD METHOD ON EXAMPLE OF CLOTHING ARTICLE**

Analysis has been carried out with the use of the QFD method in the framework of PBS-1 and partially in the framework of PBS-2 through 4 phases based on the part of planning and construction preparation. Each of these phases is represented through matrixes presented as houses of quality. For the first time, this method was applied in PBS in domestic clothing industry.
In order to obtain relevant data, marketing research has been conducted through polls and claims of denim trousers buyers. Results were systematized, photographed and analyzed and as such prepared for the first phase of transformation of the buyer's voice into characteristics of the product. Meanwhile, in order to reduce the number of claims and maintain the position on the market, all the possible causes of occurrence of error were examined - for each possible error it is necessary to analyze the cause with Ishikava diagram (Cause and effect diagrams), which takes into consideration consequence-cause influences of man-machine-material-method-surrounding-management and measurement.

In Figures 3, 4, 5, and 6 were shown four houses of quality on the basis of comparison of PBS 1 and PBS 2, as well as on the basis of the buyer's evaluation of the given product in order to answer the questions of HOW to satisfy the buyer's needs and improve the quality and features of clothing product.
Phase 1:

- Through analysis of houses of quality based on marketing research it has been established what buyers really want by taking into consideration their priorities.
- On the basis of performed SWOT analysis data of comparison of similar PBS on the basis of the production of female denim trousers [4] were included.
- On the basis of reported buyers' claims (from sales facilities of analyzed PBS) most frequent claims and the possibilities of their elimination were established using the statistic method.
Figure 5. House of quality - phase III critical parameters of the process

- On the basis of buyers' demands in the field of WHAT, buyers' demands, received through the market research, are given. Buyers' demands were systematized and shown in Figure 3. In the field of HOW the product characteristics are given. Their numeric significance is established and for each is separately given an amount in percentage. Fashion trend is in the first place, while factors of organoleptic characteristics of denim trousers follow.
- Correlation has been established between the degrees in which dimensions of HOW support dimensions of WHAT. Grades were given from 1-9, thus presented in well known symbols.
- Numeric significance of some quality characteristics was established, but it was not possible to establish whether dimensions of HOW with highest absolute value would really add to market success of the product.
- Between characteristics of HOW and WHAT conflicting goals can exist, therefore it has been established in the matrix of the roof that such problems may occur during the realization of technical rules.
- It is very difficult to compare two or more PBS because of the protection of privacy, but the comparison has been carried out and they were graded from 1-5 where spotted characteristics were
given in diagrams in houses, (there are two moments in which QFD is used: when a new clothing product is being developed and when the existing one is being improved. When we are developing new clothing product we establish what is it that is good or wrong with the competition. While we improve already existing product we ask users how they would grade certain characteristics of our product in comparison with the products of our competitors. This allows us to improve every characteristics of the clothing product that is essential to the user, in areas where the competition is better then us. Strategy of PBS-1 is to design clothing products that are better or at least on the same level of quality as the products of our competitors, with which we compare them (Benchmarking).

Figure 6. House of quality - phase IV critical parameters of production

- Possibility of improvement or new construction of the product was graded from 1-10. This gradation represents the system of complexity, where they are ranked as low-high. Fabrication of some characteristic parts (house of quality 2), technology of sewing and finishing (house of quality 3), as well as application of certain technical rules (house of quality 4) are of the highest level of complexity.
Phase 2:

- In the second phase, characteristics of the clothing product parts are established (house in Figure 4).
- Critical characteristics of parts are included in the field as dimensions of HOW with analysis from the FMEA (pun Text) method [5]. Degree of correlation has been performed and based on that two targeted critical areas of female denim trousers were defined, such as: waist side seams and slit.
- On these parts of clothing product exists the highest degree of errors, which exerts influence on reduction of quality.

Phase 3:

For each individual critical part all operations of fabrication were analyzed and influential critical parameters were established. Characteristics of parts have moved out of the house of quality 2 into the field of WHAT, and the field of HOW shows the technology of fabrication.

Sewing and finishing technologies (stone washing, finishing, designing with the use of the laser fabrication of pattern making and prototypes, marker cutting, fabric lay, bundles marking are of the highest level of complexity, by the sequence of critical parameters of the process.

QFD analysis indicated the significance of some of the HOWs. Today we still compare ourselves with chosen raw models and the competition, in order to see if we are better or inferior in the given category. If we find out that we are inferior, it is necessary to establish whether it is really important and must improve ourselves. If we find out that we are just like our competitors, and category is not too important, we will not change the existing state.

Phase 4:

Matrix of establishment of procedures is provided for the next process of research, which after the application of all mentioned methods uses data from the third house. The goal is to get:

1. preventive measures for the production process.
2. such plans for providing quality that will really implement "the voice of the buyer" in the product and its characteristics,
3. optimal level of working out of instructions for each operation,

5. CONCLUSION

Previous experience in Serbian clothing industry, based on the principles of designing of clothing products through creative effort and personal creativity of the designer or PBS owner, did not begin having in mind the real buyer and his needs, but from an outdated fashion trend, or an imagined user that would buy the clothing product.

Complex analysis and acceptance of the team standpoints, which analyzes the real buyer of the clothing product, brings PBS staff in clothing industry to think about which methods to use (QFD, FMEA, SWOT, PNQ, Ishikawa, Design of Experiment, Taguchi and other tools of quality) which enable identification of the quality product that will have the real place on the market.

As the end result, the following steps were undertaken in the analyzed PBS:

- quality control between the phases is introduced in every segment of the construction preparation in a classic way and also in the computing system,
- technological operations performed on previous machines are controlled by the workers,
• fabrication of female trousers is followed through all the phases of manufacturing and through every technological operation up to final processing and packing, in order to increase the percentage of error discoveries,
• potential errors according to priority are ranked,
• priorities risks factors are established.
• introduction of quality system, application of new SRPS ISO standard of sizes, ISO standard for stitches and the kind of seams, training of workers and team responsibility was provided.

Besides the advantages of this method, there are also disadvantages that manifest themselves as one-sidedness - insisting on quality only, and in the course of the work, because of the great number of clothing articles, there are problems such as matrix sizes, slow assembly line processing. By introduction of software solutions for fabrication of houses of quality and by data keeping, these disadvantages can be easily removed.

REFERENCES