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QFD – A Modern Method of Products Development in the Textile and Clothing Industry

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Abstract *Given the current business environment profoundly marked by the globalization phenomenon and the free movement of goods, organizations must create a management framework to quickly adapt their products and services to the increasingly diverse requirements of consumers. In this context organizations in various fields, such as the textile industry, must continuously track the modernization and adaptation of these products to customers' requirements in order to survive in the competitive battle and to create a competitive advantage. Quality function deployment is an extremely useful method that facilitates communication within the actions of planning and decision-making in the action of developing new products tailored to the actual demands of consumers. It brings the new product closer to what customers want and reduce design time and costs for these processes. QFD application in the textile industry can bring in the Romanian economy a competitive advantage needed for the survival of organizations in this field.*

Key words Textile industry, quality, innovation, renewal, quality function deployments

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1. Introduction

By 1989, in Romania there were numerous production capacities of textile industry articles, which are of course owned by the state, which have placed our country as a leading provider of textile clothing items, especially in the former Eastern European bloc. After the political and economic changes in 1989, the Romanian textiles market was dominated by a series of trade and brokerage firms in the textiles, thus facilitating communication with foreign markets at a larger scale, diversification of trade relations and the application of marketing strategies considered innovative for Romania.

The period 1999-2000 marked a new phase of the textile industry development in Romania, Romanian private companies set up since 1990 which have managed to grow during this period, becoming increasingly popular internationally. Also the '90s brought on the market the confrontation with some form of unfair competition of firms from countries with large resources of textile raw materials and supported by state policies and aids, such as: Turkey, China, India, Thailand, Pakistan, Mexico and others.

According to some studies [4] carried out on the development of textile industry in Romania, during 1989-2005 there were spectacular developments in the clothing industry, namely the considerable increase in the share of total group from 28% as represented in 1989 to 62.5% in January 2005, but not due to

competitiveness of brands, but particularly by applying the "lohn" system. But this system has ruined the primary textile industry that has never had outlet any longer. In this context, the textiles group (yarn, fabrics, knitwear) has experienced the most dramatic decline in history, namely the weight reduction from 52% in 1989 to 15.2% in January 2004, due to the massive imports of products from Turkey and China in colors and patterns different from the ones produced in Romania, at much lower prices but of a questionable quality, which have allured the Romanian consumer with the affordability and degree of novelty.

After 2005, light industry in Romania has been affected by the international context, through the total abolition of quotas system on imports of textiles. This decision of the World Trade Organization, which has overseen the steady decline in rates since 1995, when the Textile and Clothing Agreement had been signed in Marrakech, it meant that all WTO members opened the door to unlimited imports from Asia, China being the main beneficiary of these economic measures.

In the case of Romania this agreement meant on the one hand the loss of outlets with the European Union, which had at that time 85% of textile exports, on the other hand the loss of the internal market, already suffocated with goods from China.

Therefore, after 2005 we can speak of a dramatic decline in this sector of the national economy, especially until 2007. Lack of medium and long term strategies, ignoring innovation and research in the field of textile, lack of investments in this field of economy, technological obsolescence, lohn system practicing, lack of production orientation to customer requirements are just some of the issues that has contributed to decline of this industrial branch.

After Romania joined the European Union, industrial production of the textile industry sector experienced increases and decreases due to the international context.

Unfortunately, even after accession, Romania has taken no advantage of all the opportunities for positioning the textile sector ranked first among Member States. A study on the effectiveness of Romania in European projects has revealed that although the absorption of European funds is an opportunity for economic growth in any activity sector, it is noted that in our country there is a lack of authority and coordination in accessing Europe money [3].

As researchers in the textile industry appreciate, due to the influence of several factors among which we find globalization and trade liberalization, in the last 20 years the European textile sector has undergone some changes in the production processes, as they become increasingly oriented to increase productivity and to improve products quality [11].

Reviving the textile sector, however, is dependent on the creation of high quality products at the lowest possible cost. However, a product can be manufactured with excellent results at low costs, but that do not satisfy the requirements of customers in that market [10]. This might indicate that the design has been made without taking into account the requirements of potential customers or, even if attempted to meet these requirements, they have been translated incorrectly in the quality characteristics of the new product.

In the textile industry, research has shown that, in order to be competitive, SMEs must be "innovative, flexible and responsive to market's demands" [1].

Product innovation refers to new or significantly improved products or services, which differ from previous products made by organizations in their desire to gain a competitive advantage. These include significant changes in the technical specifications in embedded software components and materials, „friendly" use (facilities in the using process) and other functional characteristics [9].

The importance of design is therefore fundamental to success. The design must reflect customer's demands expressed and latent in connection with the respective product. The sources of information that can be used to identify customer's demands are varied. The question is what method should be used for client media coverage in the world organization to be more accurate. Starting from this idea function QFD (Quality Function Deployment) has been developed or, as it is also called the "customer's voice" [5].

2. Contents

QFD was first conceptualized as a method used for developing new products, in 1966, under the umbrella of what is called Total Quality Control in Japan. The implementation of this method took place in 1972 by Mitsubishi Heavy Industries Kobe Shipyard [13], as detailed method of implementation and quality improvement used to translate customer needs into technical specifications of the new product [12]. In 1978

the first book on the subject appeared in Japan, after that being also translated into English. [6] Basically it connects customers, design engineers, competitors and production. It provides a broad perspective of the whole design and production, helping significantly to eliminate certain deficiencies in production activities through preventive actions made in the design phase of the product. In addition, it can be used as a method of comparing the various products of the organization with competitors' products, and the results are used to define new targets in understanding the priorities for achieving competitive products [2].

By using QFD, organizations can ensure that customer requirements are correctly translated into the technical specifications on all stages of design and product development and that all activities of products or services development are regarded from a customer perspective.

In conclusion QFD has three main objectives, namely: to prioritize expressed or latent customer requirements, to translate these requirements into features and technical specifications, to obtain a high quality product by focusing on customer satisfaction at all stages of its manufacture.

QFD construction involves four phases [14]:

- product planning (House of Quality) - translating customer requirements and expectations in technical specifications to fulfill them;
- product design - translating technical specifications in key elements of quality characteristics;
- planning process - identifying key operations that contribute to obtaining the key values of quality characteristics;
- process control - establishing process control plans, training plans to control the entire process, by taking into account the customer's voice.

Product Planning - Building the House of Quality

As in the first phase the data obtained on customer requirements and needs about the respective product, competitive opportunities, information about the most important quality characteristics of the product or about the technical capacity of the organization to get those quality characteristics necessary to meet customer requirements in terms of efficiency, product planning is considered critical for the success of the entire QFD process.

House of quality is the chart support of the entire QFD method. It is a special chart that consists of several matrices: results matrix, correlation matrix, matrix relations, technical specifications matrix, customer satisfaction assessment matrix (figure 1).

The first step in achieving the QFD project is to determine which market segments will be analyzed during the process and to identify who the customers are. QFD team (made up of people who are part of all company's departments) gathers information from customers about the requirements they have for the product. In order to organize and evaluate these data, the team uses simple quality tools, such as affinity diagram or tree diagram.

For example, in the case of men's shirts, customers' requirements, made by them have been:

- easy to wear;
- comfortable to wear;
- to be attractive;
- to be safe, resistant to wear and washing;
- ensuring a smooth movement of the body;
- to fit to as many clothes and accessories as possible;
- to be molded on the body;
- to correspond to the preferences for color, pattern;
- to have appropriate sizes;
- not to wrinkle easily.

As not all product requirements are formulated expressively by customers, the team must analyze and document the requirements that are consistent with product standards and truly reflect the market segment requirements.

Once the essential requirements of the customers have been established they are written in matrix relationships with quality characteristics of the product concerned (the lines are passed quality requirements of customers and the column Quality Characteristics that meet these requirements).

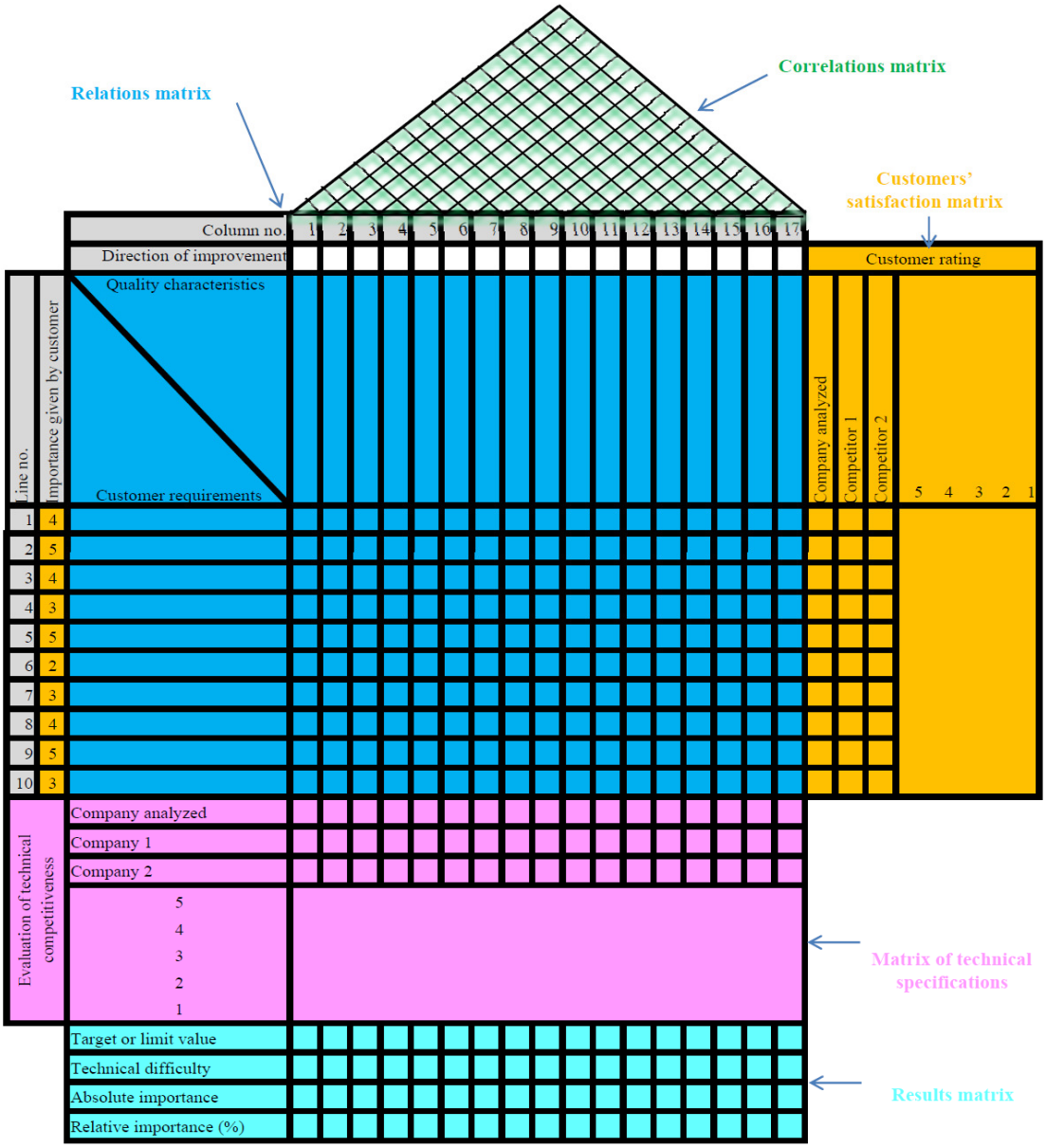


Figure 1. House of quality

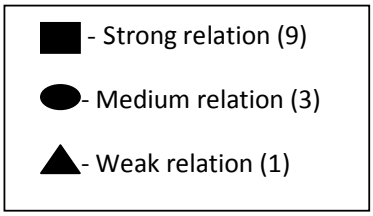
Therefore, in the example studied, the quality characteristics of "men's shirt" product selected by the technical department were as follows:

- sizes/complying with the standards;
- mass of product;
- thermal insulation capacity;
- capacity of moisture transport;
- vent capacity;
- number of colors;
- gloss;
- number of patterns;
- draping capacity;
- fiber composition of fabric;
- stability of shape and sizes;

- ability to return from wrinkling;
- elasticity of volume;
- resistance of dye;
- resistance to mechanical stress;
- resistance to destructive agents;
- ability to form pilling.

Each requirement is analyzed by customers and an importance score is given to it from 1-5, to ease their choice, by methods such as focus-group or questionnaire-based statistical survey. The importance attached by customers to the quality requirements is very important because it allows the QFD team to discover what their prioritization and investigate further opportunities to improve the company's product. The importance score is placed to the left of QFD diagram (figure 2).

Coverage of customer requirements through the quality characteristics of the product is placed on the relations matrix, at the intersection of rows (requirements) and columns (features) by the following graphic system (figure 2).



The analysis of the relationship between the customer requirements and quality characteristics of the product is the result of QFD team's group decision, in collaboration with the technical department. Basically the team must discover what are the quality characteristics of the product that have some impact on the customer requirements in terms of their satisfaction and to what extent each quality characteristic covers those requirements (strong, medium, weak).

Understanding how the company's customers assets and appraise competitors' products in relation to the analyzed company's product can be a competitive advantage particularly important in designing a new product or improving an existing product. For this, the QFD team will analyze customers' satisfaction degree for the analyzed company's product compared with competitors' products, related to the requirements made by those. The results will be expressed in a satisfaction score from 1 to 5 (5 - completely satisfactory, 1 - completely unsatisfactory) and will be placed in customers' satisfaction matrix (figure 2).

From the comparative analysis of customers' satisfaction it is observed that the analyzed company's product has obtained lower scores compared to competitors in case of requirement 2 (comfortable wearing) that has 5 in the importance score given by customers, requirement 3 (attractive) that has 4 in the importance score given by customers and requirement 9 (appropriate sizes) that has 5 in the importance score given by customers. By analyzing the data obtained in the relations matrix and customers' satisfaction matrix, the QFD team decides on the need to improve the quality characteristics covering these requirements (Fig. 2) and directions for improvement (↓,↑ or 0).

The analyzed product is then compared in terms of technical specifications of quality characteristics with the products of competitors' companies, the results are listed in the matrix of technical specifications. To facilitate this analysis, each quality characteristic of the product receives a grade from 1 to 5, based on technical performances recorded by the compared goods (5 for very good, 1 for very poor).

Following the comparative analysis of the examined product and the products of competitors' companies, in both respects, of technical specifications and satisfaction degree of customers' requirements, the QFD team sets the target or limit value desired for the quality characteristics of the new product. The results are listed in the results matrix (figure 2).

The new values obtained are analyzed by the QFD team in terms of technical difficulties to obtain, since it is possible that some of them might conflict with the product policy of the organization's or exceed its technical capacity. Technical maturity level of the organization, technical training of staff, costs, business risk, product policies of the organization are considered, in order to avoid such changes that would create an imbalance in the organization. The results are set out in difficulty scores from 1 to 5 (5 for high level of

difficulty), and are listed in the results matrix (figure 2). Further, the QFD team determines possible interactions/correlations between the quality characteristics of the product, selected for analysis. The purpose of this analysis is to determine how the variation in values of some quality characteristics affects the values of the other features. This analysis is very important for designing the new product as it shows the impact of actions to improve the whole product. The results of these analyzes are listed in the correlations matrix, which forms the roof of the quality house, according to the following chart:

⊕ - Strongly positive correlation

\+ - Positive correlation

⊖ - Strongly negative correlation

— - Negative correlation

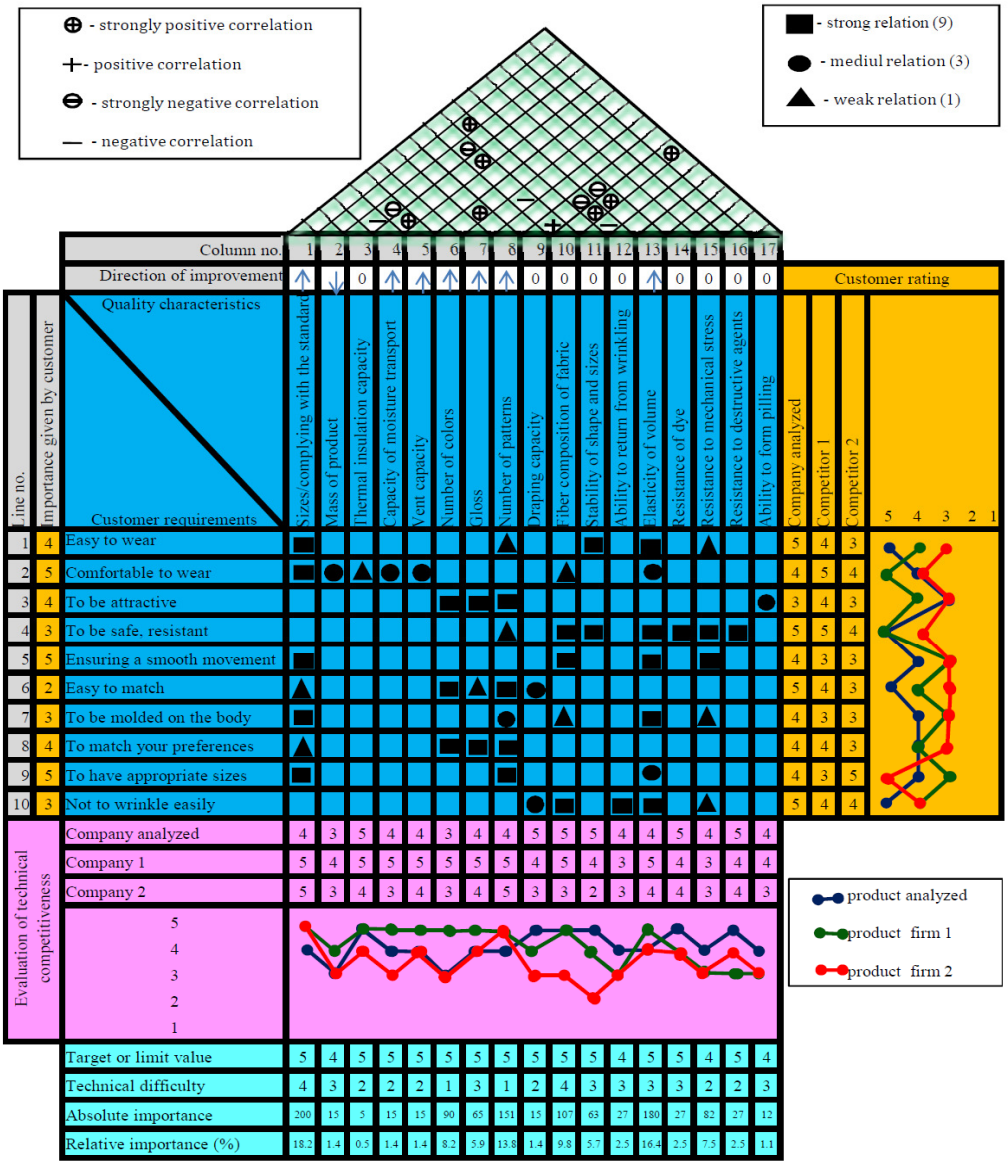


Figure 2. House of quality for the „men's shirt" product

Too many strong positive correlations suggest some redundancy in choosing quality characteristics; however, the QFD team's attention is drawn to strongly negative or negative correlations.

For each quality characteristic the score of absolute importance is calculated by the QFD team as the result of products amount between requirements' importance formulated by the customer and the coverage ratio of requirements through that feature. For instance, for the first feature "sizes/complying with the standards", the absolute importance score is:

Sia = 4*9+5*9+5*9+2*1+3*5+4*1+5*9=200

Absolute importance scores for each of the selected quality characteristics are listed in the results matrix and show that technical issues have more importance for the organization's customers. Also, the relative importance score is calculated for each quality characteristic in part, as a share of total relative importance of all features. From this information the QFD team will find out which of the quality characteristics provide greater satisfaction to customers in terms of the formulated requirements and which therefore will need to be improved.

Product design

Once the technical specifications of the product are established, they will serve the design team to develop the new product concept. The new product's design requires creativity and innovation. However, information from the first phase will have to be documented. It is possible that the design team will achieve several product concepts. In this case, for the selection of the new product one will have to use brainstorming techniques, product benchmarking, cost or impact studies and market analyses. A simplified relations matrix can also be used to analyze the impact of the requirements of each product resulting from the first stage. Basically, the resulted requirements, for the improvement of quality characteristics' certain values replace customers' requirements. "Customers voice" becomes "engineers' voice" and the result is translated into design specifications. The new product concept is represented by block diagrams or project drawings.

Process planning

In this phase of process planning, the technical department proceeds with planning manufacture processes. Since there may be several manufacture processes, these are translated into process diagrams, establishing process parameters to be kept under control. Evaluation of several processes and selection of one can be done using a simplified relations matrix, where customer requirements are design requirements and the result is given by the planning parameters of the manufacturing process.

Process control

The steps of the process developed in the process planning matrix are used as the basis for the planning and defining the quality control process and shaping specific measures in a control matrix. The result of this type of planning and decision making is that the production focuses on the critical processes, on those dimensions and features that will have a significant effect on the production of a new product to meet customers' requirements. There is a clear route from the requirements formulated by the customers, in the first phase, to the design and production decisions making to meet those needs. Disagreements on what is important at every stage of the new product's development process must be minimized to correctly "translate" customers' requirements and to achieve a competitive product to satisfy these requirements.

3. Conclusions

QFD is a systematic method of developing a new product, by which the organization shall ensure that customers' requirements are translated correctly into its specifications. Therefore, achieving or exceeding customers' expectations means more than maintaining or improving customers' performances. It means the design and manufacture of new products that "delight and amaze" the customer, by meeting latent unspoken requirements but understood and translated correctly by the QFD team. Companies that understand this, that

to be competitive you have to put an emphasis on innovation and creativity and meet the needs of their customers, will be able to grow in the global business environment of the 21st century.

References

1. Bachman J. M., Barbieri M., Dumitrescu I. (2011). *Performance evaluation module for textile materials,* In: Industria Textilă, Vol. 62, Issue 2, p. 105.

2. Desay A., Thomassioan J. *„Engineering course desing bazed ofn quality function deployment (QFD) principles: Incorporation of diverce constituencies and continuous improvement”*, Proceedings of the 38th ASEE/IEEE Frontiers in Education Conferences

3. Florescu M., Visileanu E. (2012). *Statistical analysis and the efficiency of Romania`s participation in European Projects*, In: Industria Textilă, Vol. 63, Issue 3, pp. 137-143.

4. Folcuț O., Pociovălişteanu D.M., Despa R., Ivănescu I., Mustea R., Ivănescu M.M. (2009). *Romanian textiles and clothing industry – present and perspectives*, Analele Universității Constantin Brâncuşi din Târgu Jiu, Secțiunea economice, nr.3, pp. 239-256.

5. Militaru C. Drăguț B. (2009). *Management prin calitate*, Editura Printech, Bucureşti, pp. 142-168.

6. Mizuno, S., Y. Akao (1994). *QFD: The Customer-Driven Approach to Quality Planning and Development*, Asian Productivity Organization, Tokyo, Japan, available from Quality Resources, One Water Street, White Plains, NY, Session T2G, pp. 17-21.

7. Niță M. (2005). *Strategies and promotional techniques for clothing industry*, RICCCE 14, vol. 3, pp. 90 – 97, Bucureşti, September.

8. Olaru M. (coord) (2000). *Tehnici şi instrumente utilizate în managementul calității*, Editura Economică, Bucureşti, pp. 77-152.

9. Pascu E. (2011). *Inovație şi design în condițiile de criză,* In: Industria Textilă, Vol. 62, Issue 2, p. 108.

10. Popescu D. (2004). *Full business în industria confecțiilor de îmbrăcăminte*, Editura ASE, Bucureşti, p. 12.

11. Pricop F., Scarlat R., Iordănescu M., Ghițuleasca C., Popescu A., Moga I. C. (2013). *Integrated systems of monitoring and controlling wastewater quality*, In: Industria Textilă, Vol. 64, Issue 1, p. 40.

12. Rosenthal, S.R. (1992). *Effective product design and development, How to cut lead time and increase customer satisfaction*, Business One Irwin, Homewood, Illinois 60430, pp. 73-80.

13. Sullivan L.P. (1986). *Quality Function Deployment*, Quality Progress, June, pp. 39-50.

14. http://thequalityportal.com/q_know01.htm