Annals of DAAAM for 2010 & Proceedings of the 21st International DAAAM Symposium, Volume 21, No. 1, ISSN 1726-9679
ISBN 978-3-901509-73-5, Editor B. Katalinic, Published by DAAAM International, Vienna, Austria, EU, 2010
Make Harmony Between Technology and Nature, and Your Mind will Fly Free as a Bird
Annals of DAAAM International

IMPROVEMENT OF QFD WITH A QUALITY PLAN

ORITA, A[drian] & DRAGHICI, G[eorge]

Abstract: *The efficient tracking of customer needs and their transformation into functional requirement are essential for avoiding the delays due to the bad understanding. In the traditional way of working with the QFD we cannot explain ushow to find the functions of the product to look for then the relationship matrix between needs and functional characteristics. The improvement proposed in this paper consists of the introduction of the process of transformation of the product of which we extract the functional modules and the basic functional characteristics. A case study is conducted to demonstrate the usefulness of the proposed framework in analyzing the effectiveness and performances of an assembly machine in packaging industry.*
Key words: *Quality Function Deployment, Functional Analysis, Conceptual design, Product lifecycle*

1. INTRODUCTION

In this fast changing world, hitting the right target is made more difficult by emerging customer segments, new technology, and competitive pressures. What works today may not be enough for tomorrow. You have to hit it with laser precision if you want the benefits that come with a focused product development process.

This is precisely where QFD is strongest. In the design of the new products (in the re-design too) the essential role returns to research fast and precise of the needs of the customers. In order to reach this objective there are several methods as brainstorming, bench test, diagram of KANO, Voice of Customer (VOC) and last but not least the Strategic Analysis Tools (Bartikowski, B., Llosa, S., 2003). In most of cases there is still confusion between the objectives of the customer and the technical specifications or functional requirements of the product. This paper proposes a quality function deployment (QFD) framework and shows the stages of an industrial application which was successful.

2. OVERVIEW OF QUALITY FUNCTION DEPLOYMENT

Quality function deployment (QFD) is a "method to transform user demands into design quality, to deploy the functions forming quality, and to deploy methods for achieving the design quality into subsystems and component parts, and ultimately to specific elements of the manufacturing process." (Akao, Yoji, 1988), as described by Dr.YojiAkao, who originally developed QFD in Japan in 1966, when the author combined his work in quality assurance and quality control points with function deployment used in Value Engineering. As techniques and tools based on QFD we speak about the House of Quality appeared in 1972 in the design of an oil tanker by Mitsubishi Heavy Industries.

The « WHATs » represents the "voice of the customer" and the « HOWs » records the functional characteristics of a product including how customers' needs can be welcomed. The correlation matrix shows the positive and the negative relationships between the technical characteristics of the product. The fields Target Values get the degree of interaction between WHAT and HOW. The score of this interaction measures to which level the product performance will satisfy customers' needs.

Some of the major limitations of the traditional application of the QFD are: unsystematic and vague identification of customer's needs, non-structured functional research and without considering the entire lifecycle of the product.

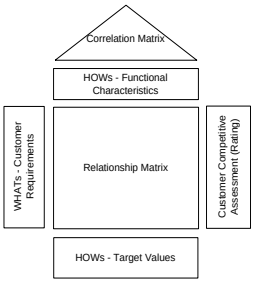

Fig. 1.QFD House of Quality

3. PROPOSED METHODOLOGY

The general principle of the proposed methodology is illustrated in the figure below:

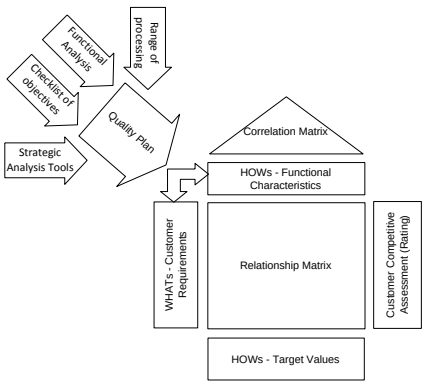

Fig. 2. QFD House of Quality for Enterprise Product Development Processes

This improvement is beneficial during the phase of creative conceptual design (in axiomatic design), when the designers have to pass from WHAT - domain of design parameters (DPs) to HOW - domain of functional requirements (FRs) (Suh, 2001).

According to our experience the flexibility of our tool also allows the use in a process of systematic design (Pahl&Beitz, 2007)without losing its efficiency.

The proposed methodology combines four techniques into Quality Plan: 1) Strategic Analysis Tools; 2) Checklist of

customer's objectives; 3) Functional Analysis; 4) The range of processing.

3.1 Strategic Analysis tools

The customer's requirements are identified using value engineering and Strategic Analysis Tools.

Examples of analytical methods used in Strategic Analysis include well known marketing tools (***):

- SWOT analysis:defines the objective of the project or business activity and identifies the internal and external factors that are important to achieving that objective. Strengths and weaknesses are usually internal to the organisation, while opportunities and threats are usually external. Often these are plotted on a simple 2x2 matrix.
- PEST analysis: a technique for understanding the environment in which a business operates.
- Porter's five forces analysis : a framework for assessing and evaluating the competitive strength and position of a business organisation
- Fourcorner's analysis: a useful tool for analysing competitors.
- Value chain analysis: is based on the principle that organisations exist to create value for their customers.
- Early warning scans: the purpose of strategic early warning systems is to detect or predict strategically important events as early as possible.
- War gaming: War games are a useful technique for identifying competitive vulnerabilities and misguided internal assumptions about competitors' strategies.
- Scenario Planning: a technique that builds plausible views of possible future for a business.
- Market Segmentation: the purpose is to identify the similarities and differences between groups of customers or users.

3.2 Checklist of customer's objectives

We built a tool called « Quality Plan » which includes a list of objectives through all the life cycle of the product like: Costs, Performances, Reliability, Technological Level, Concepts of safety, and Risks, After Sales Services, Options, Standards, etc.

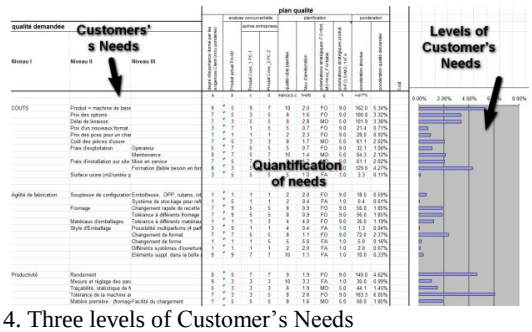

Fig. 4. Three levels of Customer's Needs

This checklist constitutes the base of the analysis of the customers' needs. It is balanced and we obtain the ranking of every objective.

3.3 Functional analysis (FAST)

The Quality Plan includes the Functional analysis (FAST) which establishes the functional characteristics of the product. A functional analysis can be facilitated through the use of functional flow block diagrams (FFBDs) for the purpose of structuring system requirements into "functional terms" (Blanchard, B. S., 2006).

3.4 The range of processing

The range of processing (transformation) is a strong tool tobring the transformations to light from the raw material up to the finished product. Thanks to this technique we define the future functional modules which will be used in the functional breakdown system (FFBDs).

4. APPLICATION OF THE PROPOSED METHODOLOGY

The final results of the application of the improved methodology are shown in the figure below. At the end of the phase of conceptual design of packaging machine we obtained the system specification. This specification constitutes the top "technical-requirements" document that provides overall guidance for system design from the beginning. Further, this top-level specification provides us the baseline for all lower-level specifications: development, product, process, material, maintenance, recycling.

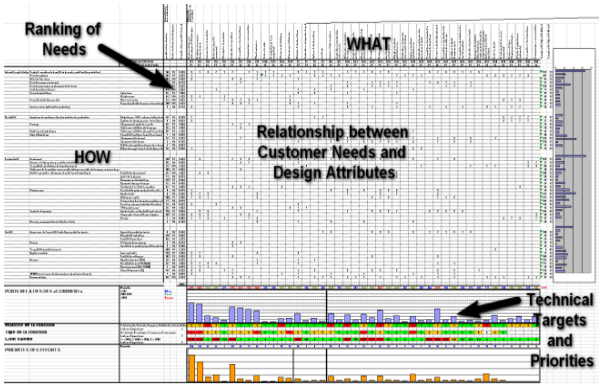

Fig. 3. The final result of animprovedQFD process

5. CONCLUSION

The industrial application of this improvement of QFD proved that the translation of the customers' needs into functional characteristics of the product was made without losses or without distortion of information coming from the customer. This method was particularly appreciated in the projects developed in small and medium-sized enterprises with complex products of small series.

Although the QFD method may not be the only approach used in helping to define the requirements for system design; it does constitute an excellent tool for creating the necessary visibility from the beginning.

Thanks to Quality Plan we can complete the research with the introduction of the AMDEC in the QFD so offering to the designers a vast platform of analysis and synthesis of the needs of the customers.

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