Chapter 5
Quality Management, Tools, and Interactions

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ABSTRACT

The primary goal of any organization or company is to guarantee good performances as far as all sectors are concerned in order to achieve operational excellence at all levels. This can only be achieved through the prior integration of the customer satisfaction function, in which the offer quality is considered as the main determinant. Thus, the launch of new complex and innovative products becomes necessary through developing new products or improving existing ones that meet specific customers' needs, since they have become more conscious and selective in the products they buy, while respecting the triptych cost quality time. In that context, the authors review three quality management tools that are widely used for that purpose—AF, QFD, and FMEA—before defining the advantages and disadvantages of each one, as well as relationships or potential interactions between them.

INTRODUCTION

Nowadays, it is crystal clear that the primary goal of any organization or company is to guarantee good performances as far as all sectors are concerned, in order to achieve operational excellence at all levels. which generally begins with a culture shift, where all leaders and employees are dedicated for creating not only a quality product but also providing great customer experiences, via the prior integration of the satisfaction function, in which the offer quality is considered as the main determinant. In fact, one of pillars or necessary key points that support the operational excellence are process excellence as well as commitment to quality, which has been considered nowadays a major and permanent concern. On the other hand, within such an actual industrial world, where competition is a key factor in the economic environment of companies, organizations strive to compete in the highly competitive global economy,

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as the level of competition is increasing day after day. Thus, the launch of new complex and innovative products becomes necessary, through developing new or improving existing products that meet specific customers' needs, since they have become more conscious and selective in the products they buy, while respecting the triptych Cost Quality Time. In other words, companies must match or surpass their competitors' products in terms of quality, price, time, and service in order to survive. Some organizations have achieved impressive results as far as their ability to convert raw materials into goods and services is concerned, through investing in advanced technologies, focusing on efficiency and productivity and establishing a new management policy. However, the organization's ability to develop new products to meet the customer's changing wants and needs has not kept pace, taking in considerations interactions of several functions necessity. Hence, the importance of using quality management tools and methods in product design has been realized. Among the most widely used methods, we will focus on three ones: AF (Functional Analysis), QFD (Quality Function Deployment), FMEA (Failure Mode & Effects Analysis). Thus, the design process is presented as a macro-process based on three complementary points of view: functional features, technical aspects and reliability conditions. Indeed, "AF" is an approach that involves all sectors of the company, whether functional or operational, and it proposes to explain needs and requirements to be met, in terms of technical functions and solutions, which makes it possible to achieve product optimization while meeting the use constraints. Nevertheless, this method remains sometimes difficult to implement. The second tool "QFD" method aims at translating the customer's voice into engineers' jargon to ensure continuous improvement. For this reason, the QFD is fully in line with a global approach for reducing costs and deadlines specific to a Total Quality Action, by revealing the optimal solution to be implemented by the company. It allows to target the necessary parameters to satisfy the customer, build the perceived quality and discover early in the project cycle the sensitive points for which preventive measures should be taken. However, this analysis may have adverse consequences for the company if the conducted study is of poor quality. Furthermore, methodical thinking can make adapting to market needs more complex, as customer's requirements can change quickly. The third method "FMEA" takes into account more precisely the product-process-system triptych. Many authors have pointed out that this method is an extremely powerful tool used for created systems or those in operation. Also, it assists engineers during new systems design stage, in order to verify certain behavioral aspects, and make it possible to anticipate possible uncertainties. This reflection will naturally lead to many technical or organizational solutions to be put in place. However, it does not sometimes make it possible to take into account the combination of several failures whose criticality can be high. As a conclusion, we can note that no approach is really complete to cover all design different steps, since these three methods can be called complementary.

FUNCTIONAL ANALYSIS

Functional analysis is a method that integrates the need that will mark the product characteristics, technical solutions to satisfy its requirements, as well as the topological analysis that lays the groundwork for the future product development. It enables to characterize the functions offered by a product in order to satisfy the user's needs.

Functional analysis of the need: According to AFNOR, a function is defined as the set of actions of a product or one of its constituents expressed exclusively in terms of purpose; while a need is a need or desire experienced by a user. According to AFNOR, functional specifications (CdCF) is a document by