

# USING BENCHMARKING AND QFD IN THE PRODUCT DEVELOPMENT

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*Abstract: Satisfying consumers' requirements for product quality, price and production times constitutes nowadays a vast and sophisticated field of activities which penetrate all business functions of a company. These requirements present a serious problem to companies. It is very important that the management insists on introduction and perfection of individual methods at all company's levels and provides continuous on-job training of the staff.*

*In a dynamic and competitive marketing and globalization environment, benchmarking, TRIZ, QFD and FMEA have proved to be efficient tools of the TQM system. These methods help us develop products that will satisfy consumers, bring profit to the company and create a favorable image of the company. We used the methods in a case study which proved their justification and suitability also in further assessment and development of products.*

*Keywords: benchmarking, Quality Function Deployment, development*

## 1 THE PRODUCT DEVELOPMENT AS A PHASE OF A LIFE CYCLE OF THE PRODUCT IN INTEGRATION WITH THE TQM METHODS

There is a tight link between the market, company and products, which is shown in the quality of business functions or TQM systems.

The integrated life cycle of a product consists of all the vital phases of the product, all the way from its design, planning, supplying and recycling, and it is important for the demands of the customer who wants to increase the use of the product as much as he can.

That kind of integrated life cycle of the product consists of 6 phases which effect the product development [6]:

- ❖ **phase 0: Design for Management** is a concept which takes into account the operation of management and administration when designing a product
- ❖ **phase 1: Design for Manufacturing** includes manufacture, inspection, logistics (transport), and supply (purchase) of the product
- ❖ **phase 2: Design for Sale** is designing a product according to communication and distribution processes (sellers or independent marketing)
- ❖ **phase 3: Design for Use** must meet the needs of the potential customers – with the product design the manufacturer can have a direct influence on the product's use
- ❖ **phase 4: Design for Service** considers the construction of the product which will be possible to service and maintain and this has a great impact on the purchase of the product
- ❖ **phase 5: Design for End of Life** means all the processes like supply, use and recycling of the product.

The above mentioned agents have an influence on the design of the product and can be handled by QFD or benchmarking analysis, so that the product meets all the customer's expectations and requirements.

## 2 ELEMENTS OF BENCHMARKING

Benchmarking is a teaching and managerial method with the help of which the companies, inside and outside of their own branch, compare in defined referential points to make improvements of their own effects in the company.

Benchmarking is a process with a positive effect whose intention is to change or improve the procedures inside the company so the results could be better. It is necessary to search for the best methods and procedures in the companies which are the best in the branch, and after that the new

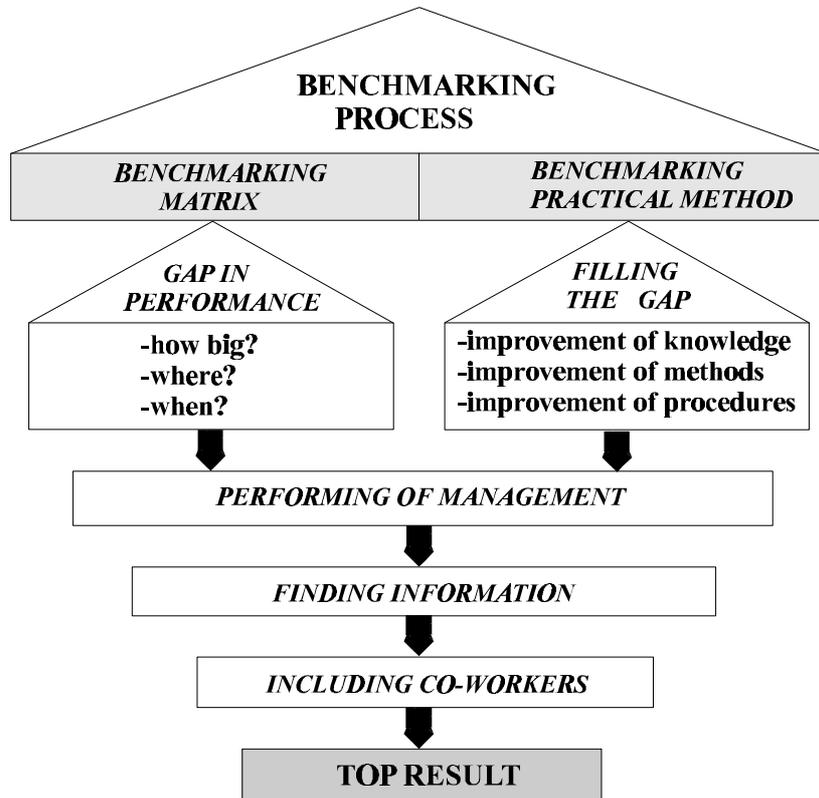
knowledge should be included into business procedures. It leads to profitable economical business economy regarding customer's needs and competitiveness, so it can be stated:

- benchmarking is a permanent process of measuring and evaluating products, processes, services and activities in comparison with leading companies in that field
- it also means to set an aim, find criteria and to set the business processes in the company to optimum with constant evaluation success
- it is also a search for the "best practices" in industry, which direct to achieving exceptional effects. The idea of the "best practices" is described as practical methods and strategies which can be used to meet the requirements of the customers as good as possible.

### 2.1 General Benchmarking Process

General benchmarking process involves many important items which help to better understanding of the process. Figure 1 shows those items and how they are connected.

The benchmarking process consists of two parts: practical steps and methods, matrix and theoretical issues [7]. Practical methods are defined by procedures and methods which are mostly used at practical work. Matrices or theoretical issues are specific characteristics of practical methods and they enable the numbering of introducing new practical procedures and methods in the company. In comparison to outside environment it is important to know that in the company there are gaps in performance, which means there are deviations of companies from the competition when performing effects.



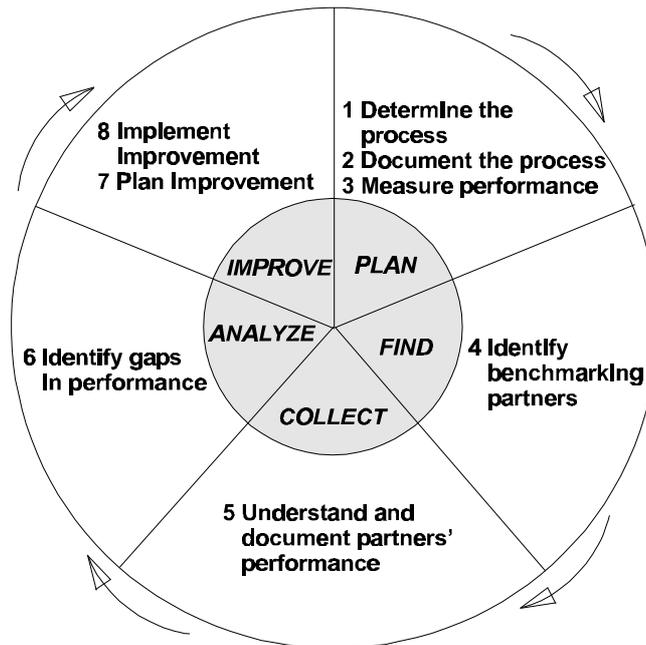
**Figure 1.** General Description of Benchmarking process

The results of all the activities enable the company to achieve top results and to stay competitive.

Figure 2 shows eight steps that can be followed in a general benchmarking process. This process assumes that benchmarking finds place with a benchmarking partner. That partner is a similar company in the same sector, or a company from a different sector which has a similar process that can be compared.

### 2.2 Product Development with Integrated Benchmarking

Integrated Benchmarking is a wider use of Benchmarking in the process of the development of the product, when projects, products and processes are considered to optimize the strategy of manufacturing and marketing.



**Figure 2.** The Benchmarking Wheel

This relation is seen in the following lines where the development of the product is defined with integrated Benchmarking in 6 phases, the constant flow of information supports the whole process [6]:

**(1) Searching for ideas** (life cycle and forecast of the market; referential services and solutions):

- Development of a new product
- Improvement of the existing product

**(2) Market analysis** (potential customers; potential competitors):

- Defining the market
- Market pull (defining customers` demands)
- Technology push (evaluation of new concepts; evaluation of competitive products – Benchmarking)

**(3) Project work** (confirmation of goals):

- Confirming the strategy
- Making projects
- Confirmation of goals and references of the best services (Benchmarking)

**(4) Searching for and evaluation of the dominant principles/ solutions:**

- Components of the parts
- Processes of parts

**(5) Systematic search for solutions:**

- Search for solutions and evaluation supported by Benchmarking

**(6) Market test (evaluation), introduction, production and marketing:**

- Simultaneous engineering – development of the production process

### 3 PRINCIPLE OF QFD

QFD is used in the early phase of product development and it is applied to the whole technical process development, production planning, manufacturing and providing quality.

QFD is performed in four phases [1] (Figure 3):

- PHASE 1- it transforms customers' demands into product characteristics
- PHASE 2- transforms product characteristics into characteristics of its parts
- PHASE 3- transforms characteristics of the parts into production technology
- PHASE 4- transforms production technology into production instructions

Each phase is represented through one or more matrices .

QFD method with clear and logical steps permits clear understanding of different phases in the system of designing new products.

The advantages of QFD are:

- products meet customers' wishes and demands and there are practically no changes in products in serial manufacturing,
- we can learn in time if our product will be successfully competitive on the market,

- motivation is greater due to QFD method, because of teamwork and on-time communication at all levels,
- all new knowledge on the changes of market demands and technical innovations can be used in the designing product process in different phases; so this method is dynamic [4]:
- easier and clearer product costs and production processes definition which enables product cost optimising.

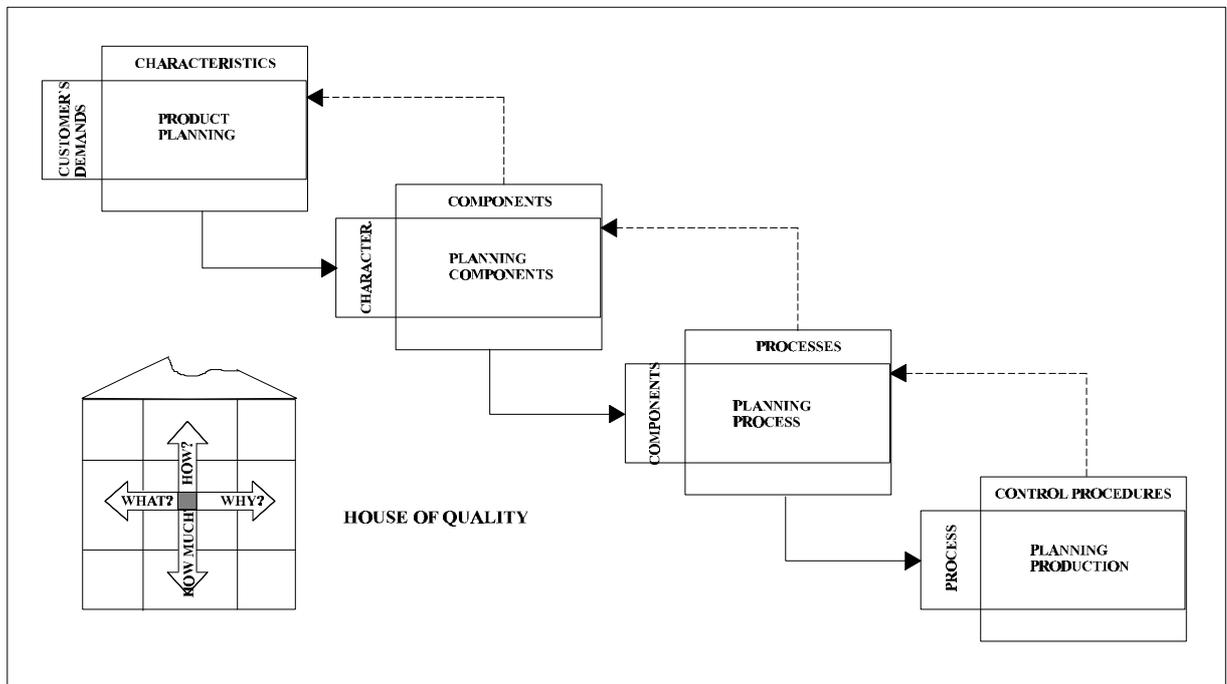


Figure 3. QFD in four phases [5]

#### 4 APPLICATION OF THE BENCHMARKING AND QFD METHODS IN THE COMPANY

Benchmarking is a process with a goal which can be achieved by carrying out the process in 10 steps [6], described in the end in table 1. The analysis result of each phase is controlled at the end by critical questions and in this way a successful and correct performing of the Benchmarking process is guaranteed.

Both methods have been practiced in the Slovenian company AGIS – manufacture of brakes. The first step was to choose a representative example – we chose the manufacture of brakes. We analyzed the primary brake cylinder Ø24,4 which was introduced as a new product in the company, the purchaser was a bigger European company. The Customers` demands were clear in the construction documentation, but in the 2<sup>nd</sup> and 3<sup>rd</sup> step we added some information from the market. The 4<sup>th</sup> step pointed to some deficiencies of the product – especially packaging was in question. In the following steps a simple bag was replaced by a polyvinyl bag. In the end we ascertained that all the goals planned like quality, reducing the costs and simple use were attained.

The last basic step of carrying out the Benchmarking process is recalibration which is urgently needed for procedures and methods to adjust when the terms change. The methods of competition constantly change so the procedure of recalibration or another examination of Benchmarking – referential points must be introduced so that manufacturing is run by new procedures and methods.

Table 1. Supervision list of the ten steps of Benchmarking process

STEP	THE CONTROL LIST OF TEN STEPS OF THE BENCHMARKING PROCESS
1	<b>Effect identification – choice of a candidate</b> <ul style="list-style-type: none"> <li>• Is the benchmarking survey based on the mission of the company function ?</li> <li>• Is the chosen effect grave for the success of a certain function?</li> <li>• Is Benchmarking equally applied to the methods, procedures and theoretical issues?</li> </ul>
2	<b>Identification of comparable companies</b> <ul style="list-style-type: none"> <li>• Are the chosen comparable companies the best competitors or leading companies?</li> <li>• Are all the modes of Benchmarking considered when identifying the functionally leading company in industry?</li> </ul>

3	<p><b>Choosing the method of gathering data</b></p> <ul style="list-style-type: none"> <li>• Is a questionnaire needed?</li> <li>• Are the questionnaires tested so that they are first used in their own fields?</li> <li>• Are the internal sources completely checked – data and information?</li> <li>• Have public sources been investigated?</li> <li>• Is the information exchange base been searched critically enough before the investigation starts?</li> </ul>
4	<p><b>Determining the actual gap of performance</b></p> <ul style="list-style-type: none"> <li>• Does the Benchmarking survey of new information identify the differences between procedures and methods?</li> <li>• Do procedures and methods point to the cause of differences appearing?</li> <li>• Is the gap identified? Negative? Equal? Positive?</li> </ul>
5	<p><b>Projection of the future level of efficacy</b></p> <ul style="list-style-type: none"> <li>• Does the projection considers the up-to-date knowledge of the trend?</li> <li>• Does the gap imply logical conclusions in the way of tactical and strategic actions?</li> </ul>
6	<p><b>Defining the goals of the company</b></p> <ul style="list-style-type: none"> <li>• Are the results introduced to the parts of companies in matter?</li> <li>• Do all the methods pay regard to acceptability?</li> <li>• Do the customers and parts of companies agree on the results of Benchmarking?</li> </ul>
7	<p><b>Development of enterprising goals</b></p> <ul style="list-style-type: none"> <li>• Are the goals examined and Benchmarking findings totally considered?</li> <li>• Are the Benchmarking procedures clearly described and structured so that achieving of topmost results of leading companies is obvious?</li> </ul>
8	<p><b>Planning and performing</b></p> <ul style="list-style-type: none"> <li>• Do the plans show how to fill in the gap?</li> <li>• Is the action being carried out?</li> <li>• Do the long-term plans aim to the realization of planned goals?</li> </ul>
9	<p><b>Supervision and documenting the progress</b></p> <ul style="list-style-type: none"> <li>• Are the Benchmarking - referential points included into the management and financial process?</li> <li>• Is supervision carried out?</li> </ul>
10	<p><b>Recalibration and growth</b></p> <ul style="list-style-type: none"> <li>• Is there a plan of recalibration?</li> <li>• Is Benchmarking institutionalized?</li> <li>• Is the leading position achieved?</li> </ul>

#### 4.1 Accomplishment of the QFD analysis

The Quality Function Development method is based on team work, so we worked in groups too, together with the leadership the goals were defined and we analyzed the problems and the methods. Due to the four phases of the QFD method it was possible to achieve good work surveillance and reach quick decisions. QFD was used to handle the characteristics, important for the life of the product. Clear matrices and an evaluation system give a profound estimation of the product, because it is being constantly compared to other products in competition.

The analysis and estimation of the parameters with the criteria of influence showed the adequacy of customers` demands for our product. The analysis indicated that if we want to compete with other companies, it is necessary to improve the packaging. The matrix pointed to the precision of manufacturing the following components: primary cylinder, piston and shell. Potential weaknesses and faults of the product which were identified by the QFD method were later handled by the FMEA analysis and in this way the quality of the product and the manufacturing process were assured.

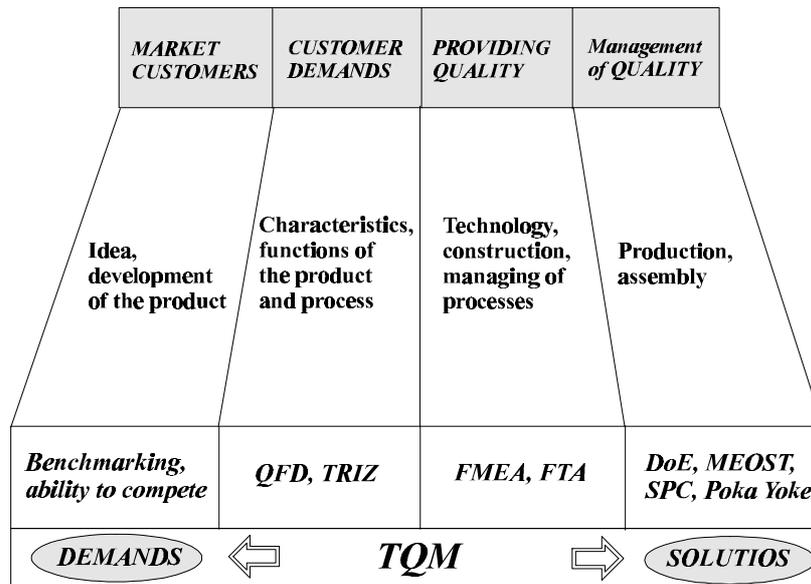
## 5 CONCLUSION

If we want to meet the customers` expectations about a product, are necessary improvements, based on the feedback of the customers. Procedures for obtaining new information should be designed, for example questionnaires, catalogues, seminars, fairs and services supported by educated personnel. The information must be processed by the TQM and the results should lead to taking new steps to satisfy the customers.

The integration of the TQM tools is shown in Figure 4. The methods presented make it possible to offer a product that the market requires and which has the solutions which are going to lead to a successful company and a satisfied customer.

The company compared some important characteristics of their own product and the product of a competitor. We identified some weaknesses of our own product, so we made some changes –

improvements and inspected the progress. Due to continuous improvements of products of competitors, it is recommended to observe and imitate those products.



**Figure 4.** Integrating the methods in TQM System

The comparison between our product and the product of the best competitor in the branch showed that we are able to compete on the market, but the process of estimation must always be present so that we can keep the place we have achieved.

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