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**IMPROVING THE BUSINESS PROCESSES THROUGH  
THE SIX SIGMA APPROACH**

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***Abstract***

*The Six Sigma approach is a response to the new “Company – Customer” relationship in the context of the contemporary market economy. The approach considers business activity as a continuous process. It aims at minimizing the gap between the company’s understanding of product “quality” and “value”, and the customer’s perception of product “quality” and “value”. The Six Sigma approach leads to business processes stability by set goal achievement. The achievement of the business processes stability means production of goods and services that meet customer requirements nearly perfect. This makes the Six Sigma quality management approach an approach for the improvement of business activity as a whole.*

*This paper draws attention to issues concerning project selection, and evaluation of the risk of its implementation.*

***Keywords:*** *Business Processes, Six Sigma, Cause-and-Effect Diagram, Project Assessment Matrix*

**1. INTRODUCTION**

The Six Sigma approach is a modern method for quality management, aimed at minimizing the number of defects in any process. It is a philosophy which, in achieving its strategic aims, provides such stability of the processes, that the defects are only a few in a million [3, 4 and 7].

The Six Sigma is a unique means of quality measurement, which can be applied irrespectively of the type, complexity and diversity of the processes and products. The attention is focused on the processes, as the final results depend on what happens during the processes.

When a company achieves a “six sigma” rate of improvement, it has limited its production defects to 3,4 per million, which is equal to 99.999 per cent quality production, and is virtually defect free. This guarantees customer requirements satisfaction, competitiveness improvement and bottom-line success [2, 3, 4 and 6].

The following terms are used and defined in the paper:

- “QUALITY OF THE PRODUCT FOR THE CUSTOMER” (QPC) – A combination of all customer requirements for the product, including as well the “hidden” needs, which are rarely shown, but are expected by the customer. It also includes some requirements, which the consumer fails to mention, considering them technologically unfeasible. This term includes the new needs, as well as wishes, which the producer can evoke in the customer as a result of innovation implementation.
- “VALUE OF THE PRODUCT FOR THE CUSTOMER” (VPC) – The individual evaluation of the price of a specific product, having the QPC.
- “QUALITY OF THE PRODUCT FOR THE COMPANY” (QPCo) – The quality of the products produced by the company according to specified technical requirements and conditions.
- “VALUE OF THE PRODUCT FOR THE COMPANY” (VPC) – A combination of the expenditures related to the whole production process for a given product, covering the whole process of idea origination, prototype development, experimental realization, production implementation, market realization, up to the last stage of the life cycle.

## **2. SIX SIGMA – A MANAGERIAL APPROACH**

### **2.1 THE SIX SIGMA APPROACH IN BUSINESS ACTIVITY IMPROVEMENT**

The study and analysis of the Six Sigma approach show that its implementation involves monitoring and evaluating the influence of the environment over processes in company. This provides the information needed to reshape the process in a way ensuring the desired quality acquirement. Therefore Six Sigma can be defined as a process approach. Its application covers all hierarchical levels and functional fields of management. But unlike the functional approach, where the attention is directed towards separate functions performed by different sections and employees, Six Sigma is focused on cross-functional processes, which join the separate functions in common floats, directed to the bottom-line success. The Six Sigma approach views business activity not as simply static, but as a dynamic process. It is not directed mainly at the vertical relations – which are usually well developed, but is oriented predominantly towards the horizontal relations in the organizational chart, determining the effectiveness of the business.

The Six Sigma views business as a “whole complicated process”, consisting of many sub-processes, developing in space and time. This concept in the core of the Six Sigma approach makes possible the achievement of the company’s main objective. On the one hand a wide variety of instruments and tools are applied to define problems and find solutions in the fields of productivity increase, rationalization of the supply networks for materials, row materials and half-finished materials, as well as regarding the finished

products marketing. On the other hand, achieving the company goals is done through the shortening the cycle of idea origination through its experimental realization, production implementation, production and marketing; and last, but not least through the human resources management. Therefore, it can be concluded the Six Sigma approach guarantees quality improvement of all processes in all functional fields, and contributes to their optimization. This gives grounds to argue that Six Sigma is a combination of both the process and the system approach, aimed at improving the effectiveness, as well as the efficiency of all the processes in a company. This way the Six Sigma approach contributes to the continuous development of the organization and management.

Based on different perceptions of the Six Sigma approach nature [2, 3, 4, 5 and 7], the following definition, emphasizing its main advantages if used as a business management approach, is proposed:

*The Six Sigma is a managerial approach, directed towards the improvement of all types of processes within a business – by their control and improvement on all levels, by losses reduction, by decrease of the invested resources, and by increasing customer's satisfaction – leading to a level of organization and management guaranteeing the achievement of the main objective of the company.*

## **2.2 THE SIX SIGMA APPROACH ADVANTAGES**

The Six Sigma approach incorporates a number of quality management techniques that help resolve some of the problems within a given process. The implementation of this approach is successful in improving the business process due to [8]:

- *Philosophy:* The Six Sigma is based on scientific principles where decisions are based on facts and data, rather than intuition. Projects are not initiated when the estimated company financial resources are below the industry average.
- *Project management:* Projects are managed strictly according to the eight phases of the Six Sigma methodology – Recognize, Define, Measure, Analyze, Improve, Control, Standardize and Integrate [5, 6]. Each phase is performed only after the requirements of the preceding are achieved. At any given time, it is possible to determine a specific project's progress in a unified way within departments and across the entire organization.
- *Well-defined roles and responsibilities:* Clearly defined roles for the work-team members and the expected contribution from each one of them.
- *Tools and techniques:* The Six Sigma applies a variety of instruments related to the aims and tasks addressed by the specific project.
- *Well-defined interfaces with the existing organization:* The Six Sigma provides a detailed blueprint which links each project to the existing organization. It provides the conditions needed for the Six Sigma implementation to all management levels of the company.

## **2.3 HOW DOES A COMPANY BENEFIT FROM IMPLEMENTING THE SIX SIGMA**

When the principles and methodologies of Six Sigma are properly applied to virtually any key business process, they return positive bottom-line results. Regardless of the company's type of work and mission, the following can be expected [2, 9]:

- Improved overall customer satisfaction, i.e. closing the gap between the “quality of the product for the customer” and the “quality of the product for the company”;
- Increased productivity and added value, i.e. increasing the “value of the product for the customer” and decreasing the “value of the product for the company”;
- Improved capacity and productivity;
- Reduced total defects and cycle time;
- Increased product and service reliability;
- Improved process parameters;
- Improved process flow;
- Return of investments for the implementation of the Six Sigma.

## **3. EXPERIMENTAL IMPLEMENTATION OF THE SIX SIGMA**

### **3.1. INITIAL INFORMATION**

*The objective* of the experimental implementation is to study the possibility of using the Six Sigma approach in the conditions of a Bulgarian company, and to evaluate the benefit of its implementation.

*The subject of research* is the influence of the Six Sigma approach on the business of small/medium sized enterprise (SME) in Bulgaria.

*The object of research* is BETA FEST Ltd. – a typical example of a Bulgarian SME. The company was established and has developed in the conditions of transition and early stages of a market economy.

*The line of business of BETA FEST Ltd. is* – the design and production of bottling equipment and packaging machines for the needs of the Food, Pharmacological and Chemical industries: vertical packing machines, bottling lines for still and carbonated liquids, automatic machines for margarine dosing and packing, automatic machines for the filling of dense products etc. and service.

### **3.2 DEFINING OF THE MAIN SIX SIGMA PROJECTS TO IMPROVE BUSINESS ACTIVITY**

The manager of the company formed a team (directive No 16/15.11.2002). The team includes the manager, the consultant and the leading specialists of the company. The main task of the team is to get acquainted with the Six Sigma concept, to determine the strategic priorities, goals and aims of the company, and to select the projects leading to their realization.

Initially a chart of the process was made (fig. 1), giving an overall view of the business of the company. In order to correctly define the key processes influencing the customer satisfaction, the team managed by the consultant conducted brainstorm sessions.

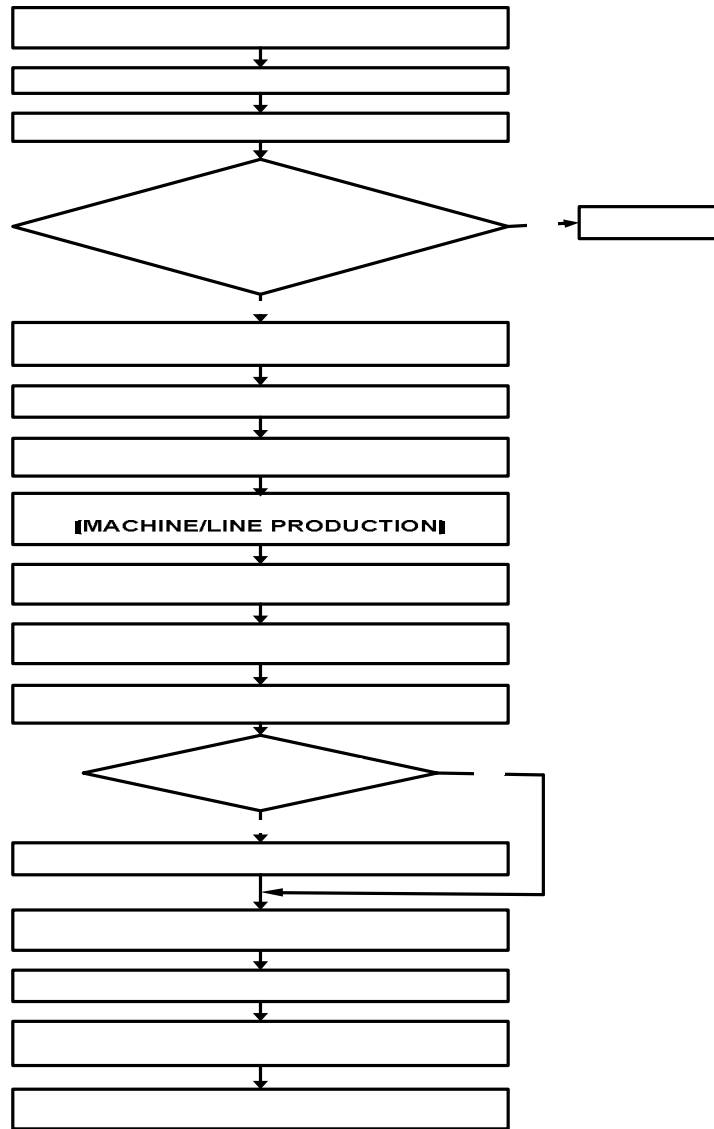


Figure 1 Process Chart

The aim is, by using the company's previous experience and the knowledge of the team members, to select these processes, which must be analyzed and if it is needed – improved. The outcome of the brainstorming sessions is summarized in a cause-and-effect diagram.

The results of a process can be attributed to a multitude of factors, and a cause-and-effect relationship can be found among those factors. The structure of a multiple cause-and-effect relationship can be determined by observing it systematically. It is difficult to solve complicated problems without considering this structure, which consists

of a chain of causes and effects, and a cause-and-effect diagram is a method of expressing it simply and easily.

A cause-and-effect diagram is a diagram, which shows the relationship between a quality characteristic and any factors influencing it. Presently, the cause-and-effect diagram is used not only for treating the quality characteristics of products, but also in other fields, and has found application worldwide [1 and 6].

During the brainstorming sessions, the following questions were asked:

- Do the products of BETA FEST Ltd. fully satisfy the requirements, demands, expectations and wishes (“obvious” and “hidden”) of the company customers?
- What are the most common reasons for defects/failures in the products of BETA FEST Ltd. during their exploitation?

The result effect implied by the two questions is presented briefly by the expression “customer dissatisfaction” (figure 2). It covers all the reasons for not fully satisfying the needs and wishes of the customer. They can be related to failures in the machines/lines, defects in the work of the machines/lines, inability to perform all functions that the customer desires, dissatisfaction due to a change in the qualities and parameters of the machines/lines, etc.

The “key” for the satisfaction of the BETA FEST Ltd. customers’ processes can be summarized as follows:

- Contacts with customers (negotiating);
- Machines/lines design;
- Details and assemblies production;
- Delivery of different parts;
- Assembly of the machines/lines;
- Service;
- Training of the customers to work with the lines/machines.

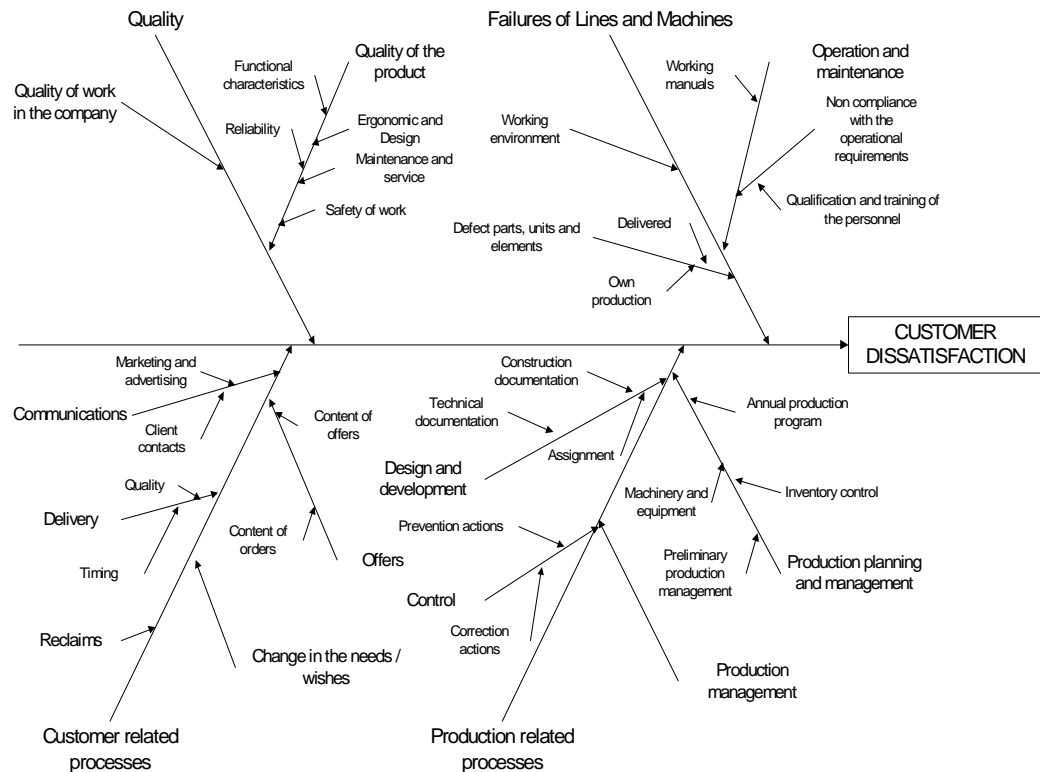


Figure 2 Cause-and-effect diagram

By defining the reasons for inefficient and ineffective organization and management of the company, the team draws the following conclusions:

- Very often during negotiations the wishes and needs of the customers are not clarified precisely, and information important for the production is omitted.
- The initial information provided by the customer often changes during production.
- Since the company doesn't have all the machines and equipment needed to produce some parts, it is necessary to place orders with subcontractors. This leads to an increase in the production costs of the final product, and sometimes to prolonging cycle times.
- The amount of the re-work is quite high.
- Failures in the machines/lines are observed due to improper exploitation by the customer or change in the exploitation conditions.

Based on this the team has formulated several projects:

- A procedure for buying the products of BETA FEST Ltd.
- Usage of standard software packages during the design documentation development.
- Choice and management of suppliers.
- Customer service improvement.
- Customer training program aimed to improve the exploitation of the BETA FEST Ltd. machines/lines.
- Improvement and renovation of the equipment and facilities of BETA FEST Ltd.

The team has chosen the following project selection criteria:

- The project contributes to closing/narrowing the gap between the "quality of the product for the customer" and the "quality of the product for the company";

- The project contributes to the minimization of the difference between “value of the product for the customer” and “value of the product for the company”;
- The amount of the investment needed for the realization of the project;
- Return of investment;
- Information and its obtainability;
- Resources required for the project’s realization.

On the basis of the defined project and the criteria for its selection, the team has developed a Project Assessment Matrix (Table 3).

The assessment of the project is made by a group of experts evaluating the level of influence of the  $i$ -th project ( $Pr_i$ ) to the  $k$ -th criterion ( $E_k$ ). The choice is based on the sum of the values of the co-relation between the relevant project and the criterion multiplied by the weight coefficients for each one of the criteria (formula 1).

$$Pr_i = \sum_{k=1}^m (\varphi(Pr_i, E_k) \cdot I_k), \quad i=1, \dots, n, \quad k=1, \dots, m, \quad (1)$$

where  $Pr_i$  is the total importance of the  $i$ -th project for the selection criterion

$\varphi(Pr_i, E_k)$  – the co-relation between the  $i$ -th project and  $k$ -th selection criterion;

$I_k$  – the level of importance of the  $k$ -th criterion ( $E_k$ ) for reaching the main goal. It can have values from 1 to 10, as the most important criterion is given a mark 10, and the least important one – mark 1.

The co-relation  $\varphi(Pr_i, E_k)$  can take the following values:

- 0** –  $i$ -th project doesn’t have any relation to the  $k$ -th criterion;
- 1** –  $i$ -th project has weak influence for the fulfillment of the  $k$ -th criterion;
- 3** –  $i$ -th project has medium influence for the fulfillment of the  $k$ -th criterion;
- 9** –  $i$ -th project has a very strong effect for the fulfillment of the  $k$ -th criterion.



<b>Importance</b>	<b>10</b>	<b>9</b>	<b>7</b>	<b>8</b>	<b>6</b>	<b>7</b>	
<b>Projects assesment criterion</b>	Contributes for narrowing the gap between the (QPC) and (QPCo)	Contributes for minimization of the difference between “(VPC) and (VPCo)	The amount of the investment needed	Return of investment	Information and its obtainability	Resources required for the project realization	<b>Total score:</b>
<b>Projects</b>							
Buying procedure for the products of BETA FEST Ltd.	9	9	9	9	9	9	<b>423</b>
Usage of standard software packages for the design documentation development	3	3	1	9	3	1	<b>161</b>
Choice and management of suppliers	9	9	3	3	3	1	<b>241</b>
Customers service improvement	9	9	3	1	3	3	<b>239</b>
Customers training program aimed to improve the exploitation of the BETA FEST’s machines/lines	9	9	1	1	3	1	<b>211</b>
Improvement and renovation of the equipment and facilities of the BETA FEST Ltd.	9	9	9	9	3	3	<b>345</b>

*Table 1 Project Assessment Matrix*

The score enables the selection of a project, which best contributes to the realization of the company’s strategy. The team efforts should be directed towards the realization of this project first.

Based on the received total scores in the BETA FEST Ltd. has been chosen the following project: *Buying procedure for the products of BETA FEST Ltd.*

#### **4. MAIN CONCLUSIONS AND RESULTS**

As a result of the experimental implementation of the Six Sigma approach in the BETA FEST Ltd., the following conclusions can be made:

The methodical sequence of Six Sigma implementation as a managerial approach includes:

- Alternative strategies for achieving the main goal of the company development;
- Development of a list of specific projects for the realization of each one of the strategies, and defining the processes which are “key” for narrowing the gap between the “quality of the product for the customer” and the “quality of the product for the company”;
- Increasing the “value of the product for the customer”.

The economic effect of the process improvement, the project execution and the realization of the strategy, are evaluated on the basis of the sigma level. The increase of the sigma level of a certain process is related to the realization of a specific Six Sigma project, and leads to an increase of the total sigma level of the company. This makes it possible to use the sigma level as a criterion for comparing alternative strategies, and helps for the choice of a suitable project.

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