REDUCING DELIVERY TIMES OF PRODUCTS USING DMAIC METHODOLOGY

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Abstract

The global market is a challenge for Croatian companies because the current business paradigm applied in the domestic market can hardly be applied globally. Faced with changing customer demand and increased competition, companies in the manufacturing sector have continued to question the production processes and continuously improve them if they want to survive in the global market and keep pace advantages over market competitors. One way of questioning, enhancement and improvement of existing business systems is DMAIC methodology.

This paper presents the application of the DMAIC methodology to a product that has lost its market position. Although the product price was competitive, the delivery times of products for customer were too long. To solve this problem, observed business entity starts DMAIC project of improvement operations. The project covers all functional units and their operating procedures, and the end result of the project activities were new working procedures. Changing its operating modes observed business entity is able to shorten delivery times and win new geographical segments of the global market without additional financial investment.

JEL Classification: D23, D24, O22

Keywords: Six Sigma method, DMAIC methodology, production improvement, cost reduction, project management.

1. INTRODUCTION

The purpose of the business of each company is to make profit and create conditions for further growth. Nowadays, the biggest challenge for almost all companies, participants in the global market, faced with the economic crisis, uncertainty, intense competition and a lack of funds to finance the production, is how to change and adapt business goals and strategies to satisfy the preferences of customers. One of the continuous questioning and improvement of production business systems is DMAIC methodology. This methodology is being successfully used through several decades by the leading global companies and their business results prove that through a systematic approach and application of DMAIC methodology can improve and enhance existing business systems.

The hypothesis assumes that the DMAIC methodology is a powerful and effective tool for improving the work of businesses at all levels of companies, and that in addition to improving manufacturing processes can equally well be used to improve everyday business activities in functional units, such as Sales, Purchasing, Production planning, etc.

As a testing ground for research we selected business entity Klimaoprema Inc. Samobor which operates 40 years on the market of equipment for ventilation. Since the observed business entity has a wide range of products, for testing hypotheses selected product called kitchen hood. The product, in various sizes, can be found in every contemporary restaurant, hotel and larger kitchens where they thermally processed and prepared food for more people.

2. DMAIC METHODOLOGY

DMAIC methodology is one of two approaches to solve complex business problems by using a method of quality improvement called Six Sigma. DMAIC is a systematic scientific approach based solely on the facts, where the main goal is continuously improve the already existing and well-established business processes. (Lunau et al.; 2009, 11). The term comes from the acronym DMAIC, English name of the individual steps approach: Define, Measure, Analyze, Improve and Control. (Eckes; 2003, 30). DMAIC methodology and the steps or stages of access are shown in Scheme 1.



Scheme 1. Phases of DMAIC methodology

Source: adapted according to: Lazibat, T. (2009.) Upravljanje kvalitetom, Znanstvena knjiga, Zagreb, pg. 259.

According to Scheme 1, DMAIC methodology presents a closed process that takes place continuously over a long period of time, and whose application eliminates unproductive business processes with the implementation of fixed measurements and the application of techniques to improve. The most significant phase of the DMAIC methodology is a phase change in the design of business processes. It is repeated until the results of the activities is not an optimal process that will enhance and improve the function of the observed system and annul the so called "bottlenecks" business processes whose appearance causes higher overall operating costs. In practice, the DMAIC methodology is most commonly used for constant improvement by reducing or minimizing the causes of variation in existing processes. This approach makes it easier to make changes on an ongoing and progressive basis and provides stability by minimizing variation that leads to additional costs and customer dissatisfaction. (Lazibat; 2009, 258.)

3. APPLICATION OF DMAIC METHODOLOGIES

DMAIC methodology is used for enhancement and improvement of the wellestablished existing business processes that take place over a longer period of time. Consequently, the production process of kitchen hoods in the observed enterprise can be categorized as previously mentioned process because the product is made continuously over the past thirty years. The product is selling well in the domestic market and the regional market and as such it was competitive, but with the arrival of the economic crisis, demand for the product in these markets reduced and progressively declined in recent years. Turning out to the global market given product is still competitive, but delivery times are too long for customers.

Applying DMAIC methodology in this particular case moves through the five above-mentioned phase, starting the first phase - phase of defining the problem.

3.1. Defining the problem

Previous product delivery times of 12 working days customers are perceived as too long and sales department has pointed out the need to shorten delivery periods if we want to attract new customers and retain competitiveness in the global market. In order to shorten delivery times, a project team was formed responsible for the project, and team members are assigned roles and duties in accordance with the Six Sigma methodology. The team's task was to examine the existing business operations of the observed system and find ways to shorten the current terms of delivery of the product.

3.2. The measurement process

After identifying the boundaries of the system and the problem of defining the project moved on to determine the time required to produce the product. To determine the time of labor, or labor costs in each functional department, it was decided to monitor document that passes through the entire system, and that is Production order. With the help of Production order business process was measured by observing the time units required to perform any work procedures in the process, and the measurement results are recorded in a standardized tables for data entry.

3.3. Process analysis

In the third phase of the DMAIC methodology previously obtained results of the measurements were selected and analyzed using statistical applications. Result of analysis is shown on the first diagram.



Diagram 1. Pareto analysis of working time spent by departments

Source: Authors' calculations.

In diagram 1 can easily be seen that the largest part of the total time of making an offer and closing the deal until the delivery of the finished product in a monitored business system is spent on planning and design of the product and that this working procedure is the "bottleneck" of the observed business system. Other departments, according to the first diagram, participate in a smaller share of the total cost of work time. Since it is according to diagram 1 process of designing and constructing products demonstrated critical to shorten product delivery deadlines, the project team was concentrated all of its activities on the analysis of the work and working procedures in this section.

3.4. Improvement process

Preliminary analysis of the working procedures of the Department of product design has highlighted the fact that the designer in charge of this group of products is continuously working on the construction and design of the kitchen hoods. "Ad hoc" solution that is immediately imposed, hiring another new employee, which would speed up the process of constructing the product and avoid "bottleneck" process in this functional department. Since the DMAIC methodology is based on facts and not on an "ad hoc" approach, the project team decided that all efforts and activities focus on the design and construction products and the development of technical documentation and thus try to expedite the process. To speed up the design process, it was necessary to examine the flow of information through the business system and see which information entering and leaving the Department of product design. Conducted activities have resulted in a flow chart of work through the system, which can be seen in Scheme 2.





Source: Authors' calculations.

The Scheme 2 shows the current way of working in the observed business system and the interaction between the individual functional departments. According to Scheme 2 it is evident that sales department sends Production order in the Department of product design, where it prepares the necessary documentation and after finish it Department of product design send it in the production planning. The Department of production planning is determined dates for the manufacture of products and documentation with Production order goes into production.

The further analysis of work in the Department of product design has been extended to the type and size of the product produced on an annual basis. The application of statistical methods for data analysis revealed that the data is grouped around one type of product and that in some cases the products differ in size by only a few centimeters. From the viewpoint of function and other useful properties the minimal difference in size does not affect the function of the product because they are designed with certain safety factor.

Review of annual production in the observed enterprise over the past five years has shown that the average annual production is 200 pieces of product. This also means that for more than 200 delivered products are made technical drawings, process documentation and worksheets necessary to produce the product. In order to improve the working procedures of designing and constructing the observed product all the above-mentioned data were grouped and analyzed using a statistical computer program. The results indicated that there is only one optimal model for the enhancement and improvement of the observed business system. Computer simulation indicated the need to change existing ways of working in the sales department by introducing new work procedures, and these are graphically shown in Scheme 3.



Scheme 3. The process after analysis and implemented improvements

Source: Authors' calculations.

According to Scheme 3, we can see that the new business process in the sales department is more complex than the former because it involves several working procedures that have so far existed. In addition to the increased complexity of the new working process it requires a little more focused work of employees in the sales department. In the optimal business process when a customer requests for a quotation of the observed product, an employee in the sales department has at its disposal a database of products already made. In the database are detailed descriptions of all manufactured products, and a new database is fully compatible with the ERP system used to manage at all levels of business in an enterprise. Employee in the sales department, based on the information in the database, selects one of the procedures by the method shown in Scheme 3.

If the query is related to a product already made in the observed business entity, this means that there is full documentation for this product, Production order for manufacturing opens directly into the sales department without having to constructor prepares complete documentation. Constructor's task in the new process is to control the opened Production orders in relation to the reference product and the information system approved by the department of production planning access, browse and use the necessary documentation. Further information and documentation flow goes, according to the working procedure scheme 3 to the production department.

If in the database does not exist same product in accordance with the wishes and needs of the customer, sales employee handles according to the procedure shown on the left side of Scheme 3 and offers the customer first dimensionally similar product that meets the tolerances field operating conditions. Thereby, Sales department informs customer about the possibility of buying a similar product with the same characteristics and seeks his approval. If the customer or the client is satisfied and agrees with the characteristics of the offered product, a production order goes in the standard way and it is approached to developing products according to existing documentation and the established operating procedures.

If a customer is not satisfied with the offered product and seeks product exclusively to the desired dimensions, it is opened, according to the procedure shown at the bottom of Scheme 3, the Production order to create entirely new products and approaches to making the entire technical documentation for a new product. After making all the necessary documentation and information about a new product, it is promptly entered into the database of products made and designed new product becomes a standard product offering.

3.5. Process control

After implementation of operating procedures shown in Scheme 3 employees in Sales department started to work by new operations. The new work process was monitored daily in order to avoid errors and delays, and the first problems were related to products database. Issues regarding indexing the data have been removed in the short term, and the base is flawlessly in daily operation.

The control process illustrated in Scheme 3 is carried out periodically and is based on the principle of random sampling. Two to three times a month database is checked, and daily backups are made.

4. EVALUATION OF IMPROVEMENT PROCESS

Shown DMAIC project after ending must go through the validation and evaluation how we would be able to assess the actions taken. Since this project falls into the category of simple projects with very short duration, the evaluation can be carried out by simply economic principles - the process of evaluating the improvements carried out before and after the carried out process of evaluating the improvements.

Diagram 1 shown the first Pareto analysis of total time spent working on the functional units of the observed business entity. It is based on the analysis found the "bottleneck" of the business system in the department of product design. After the introduction of the new Operating instructions for the sales department based on operating procedures shown in Scheme 3 it was re-conducted recording time spent working by departments according to a predefined method. Once again for the measure it's used Production order that circulated among all functional departments in the observed business entity, the results of Pareto analysis of the recorded working hours are shown in the diagram 2.



Diagram 2. Pareto analysis of time after the improvements

Source: Authors' calculations.

In the second diagram it is clear that time of work in the Department of product design significantly reduced and currently amounts 0.5 working hours. Working operations design and engineering products is moved from the first position in diagram 1 to the last place in the diagram 2 which indicates that this operation is no longer a "bottleneck" in the observed business system. The main reason for this significant reduction in working hours is the facts that during the thirty years are designed and constructed thousands of concerned products and all products are made with completed technical documentation. With new work procedures, as shown in scheme 3 all information flows bypass the Department of product design unless customer are looking for products according to special requirements. From the second diagram it is evident that the trends observed during the total product through the business system shortened so that according to the new mode of finished product delivery time is 5 working days instead of 12 days.

5. CONCLUSION

Most business paradigm assumes that the use of automated processes can replace manual work and that they can produce larger quantities of product per unit of time in order to reduce the total time of the duty cycle and the total cost of developing the product. Applying DMAIC methodology on the present case, showed that the delivery times of the product can reduced by using the same level of technological equipment. In our case, because of the steady operating mode, the "bottleneck" of the business system is representing the working procedures of design and construction products. Systematic approach, through five phases of DMAIC methodology, observed operating system is analyzed and further enhanced without large investments and additional costs, and the project resulted in the development of optimal process flow of information and documentation. With new operating procedures to the business process of the observed business entity is adapted to the needs and demands of the global market for shorter periods of development and delivery of finished products. Delivery dates are shortened from 12 days to 5 working days, and with a new way of working are achieved significant savings in time working on design and construction products.

Applying DMAIC methodology to the present case shows that a systematic approach and minimal investment can achieve big savings and reduce labor costs. Our study can be extended vertically using the DMAIC methodology to production process, which could cause further enhancement and improvement of the production process of the observed product.

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