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THE INFLUENCE OF WEB TECHNOLOGY ON THE IMPLEMENTATION OF „LEAN SIX SIGMA“ METHODOLOGY

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***Abstract*—**This study deals with the spreading issue of the web technology and its impact on the implementation of lean six sigma methodology. There will be presented some basical principles that can serve as the basis for many companies to build their models of quality management and development based on the principles of Lean Six Sigma. Web technology is expanding and offers huge potential looking to gain a competitive advantage. At the end of the study we will present a business model based on web technologies and lena six sigma principles.

***Keywords*—**web technology, Internet, lean six sigma, quality management, management development.

I. INTRODUCTION

IN the last decade of the twentieth century and the first decade of the twenty-first century we're witnesses of rapid growth of the Internet and Web technologies. In this study, under the term of Internet we understand the basic structure of the networked computers in a global world-wide network. On the other hand, we'll observe the web technologies from the perspective of a series of services that use the Internet as a carrier of information. Strictly viewed, the web technologies are related to specific protocols of data transfer such as „http“ or similar, but a continuous expansion of the new technology implementation leads to the appearance of new communication forms. Today there are web sites with dynamic elements which greatly extend the functionality of websites, in addition to this many technlogies today use the web technology to send and receive data. For example, surveillance cameras, various sensors and machines can be controlled via Internet. All of the aforementioned technologies are largely based on web technology.

On the other hand, the concepts of len and six sigma have brought certain changes in the way of business operations. Today's market is over-supplied with goods and services, so it is very important for the company to have a very clear strategy for the development and quality management. Quality is a rather vague concept, and depending on the pont of view it can be seen as a series of technical or a number of organizational characteristics. With the advent of len concept, and later the influence of six sigma concepts most quality aspects are integrated in one unit. Unfortunately, quality managament becomes a complicated process in which information plays an increasingly larger role.

II. WEB TECHNOLOGY

Since the mid-twentieth century, there is a new computer networking technology which exceeds the local character and creates new opportunities for the exchange of a large amount of information. At the commencement, the business sphere was not paying attention to this new technology, however, in the eighties of the twentieth century, there is a powerful penetration of Intenet and web technology in all pores of social and business life.

Briefly said, Internet has become the main carrier of information, and web service based on hyperlinked documents. This tecnology provides an ability to fast access information and therefore an easy acquisition of new knowledges. For the most of nineties, these technologies have had a major impact on the change of business manner. For example, creation and management of international multi-disciplinary teams are not in the domain of great and powerful organizations any longer and the trade has been changed.

At the end of the nineties appears newer concept of web technology based on the synergy of more different technologies. The popular name for this is web 2.0 and includes technologies that provide dynamic elements that further extent the capabilities of web technologies. At this stage it is possible to have greater control over the content of the sites, it's easier to manage databases,

and the like. These extensions provide not only an increase of multimedia capabilities, but also provides a solid basis to abandon the paper way of doing business operations. Thanks to Internet and extended web technology, it is possible to have an access to organizational resources no matter where they are. Many companies base their business just according to these technologies.

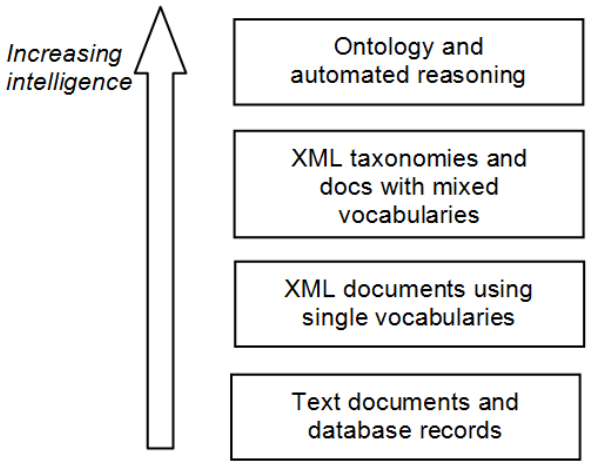

Fig. 1. Smart data continuum [1]

However, this is not the end. In the last few years there is a new paradigm of popularly known web technology as web 3.0, the technology created under the strong influence of the Semantic Web and personalization. The purpose of this technology, among other things, is to improve the data search. The „Classical“ to search is related to to th eidentification of key words, however, the semantic component is searching more different concepts and provides a much higher degree of flexibility. The end result of the new technology is creating an ontology, which is in the best way illustrated by the following sentence. „Web, Social Web, and even Semantic Web content can be reused for the creation of semantic content, shaping information (or existing knowledge) into ontologies.” [2] In this way are created some general rules through which will be easier to get the necessary information.

In the prior figure, it's is possible to see the development of web technology from the standpoint of data, where we can clearly observe that we're increasingly moving towards the creation of the artificial intelligence. But for the needs of the companies that seek to implement the lean six sigma principles, the new technologies can greatly help them.

III. LEAN SIX SIGMA

Lean and six sigma were originated independently and each of these principles is special in its own way. Through research and business practices, there had been led to the fact to merge these two principles and thus come to the stronger effect. Both principles, or rather business philosophies had relatively humble beginnings. The Lean principle is developed for the purposes of the production and surved to minimize errors while increasing value for customers, on the other hand, Six Sigma is aimed to eliminate variations in production.

„Lean“ is a holistic and sustainable business strategy in order to reduce the input values such as material, labour and other values. Holistic approach is very important that can be seen from the following sentences. „Traditional change programs failed for a number of reasons, which, for the most part, included a restricted focus of the improvement activities to a series of piecemeal activities, departmental improvements or just ‘technical quick fixes’ to get over a production problem.” [3] The starting point of this philosophy is the desire of the company that with its capacities to meet the demands of its customers when and where they appear.

At first glance, „lean“ philosophy is more related to the production process but that is not entirely true. The genesis of the philosophy can be linked with the company's efforts to reduce production costs, but philosophy itself has proven to be very successful in other fields of the business. „Lean“ philosophy includes the entire business of the companies including relationships with external partners (customers and suppliers), maintening relationships with local communities and new product development are also part of this philosophy.

Six Sigma is business strategy of quality management, rooted in good practice of "Motorola". The mid-eighties, this strategy begins to develop and today it is one of the most widespreaded. The staregy itself in the last ten years has spread beyond the production capacity and becomes the dominant force that is changing the way of new product development.

The method itself is of quantitive character and the

system is treated through a series of interrelated steps. This means that the large systems are divided into the smaller sub-systems, and then identify problems that cause errors. The method uses a number of parameters, most often these parameters are related to finance (reduction of costs, increase of profit and so on.). One of the most important components of Six Sigma conceot is reliability which is said: "Reliability must be valued by the organization and should be a primary consideration in all decision-making. Reliability of techniques and discipline are integrated into system and component planning, design, development, manufacturing, supply, delivery and servis processes." [4]

Merging of these two concepts has proven very successful. Merging first occurred in production management and later spreaded to other parts of the organization. "The fusion of lean and six sigme are required from the following reasons:

- Lean cannot bring a process understatistical control,
- Six Sigma alone can not dramatically improve process speed or reduce invest capital." [5]

IV. COLLECTION OF DATA

For proper operation of any system it is necessary to have adequate information, but for a system that aims to achieve the level of rapid response to market demands information becomes of crucial importance. A number of technologies have been tried in an attempt to achieve greater information flow and lower cost of use of mentioned technologies. Unfortunately, creating their own solutions proved inadequate, as time goes by so growing hunger for information.

On the other hand, web technology with all its extensions is becoming a great alternative which in addition to cost and inaccessability provides a great flexibility. For the use of web technology you need to have internet access and compatible PC. These are not excessive requirements so that most of the companies can afford these conditions to themselves. Today is not a problem to get the information, today the problem is to get to the useful information that mean something to us.

Information technology provides opportunities for data fusion, that is the merging of data from different information sources. „The data fusion can be classified in more different ways depending on viewpoints. There are three typical divisions of data sources: (1) informaition content, (2) relationship between data fusion and (3) semantic application of meaning" [6].

Basically, collected data from enterprises can be extremely extensive so it is necessary to make some form of analysis of common components in order to obtain key information. Sensor technology and various standards of data transfer can help in data collection. Semantic systems can assist in the classification of data and extract the necessary information.

V. RESEARCH

Research was carried out on the territory of Sebia in production companies and the subject of research was the impact of web technology on the implementation of a quality management system which includes the concepts of lean and six sigma. The research is important from the point of linking theory and practice in a business environment in which is Serbia today. From the research methods we have used interviews and analysis of documents. Interview is primary research method while the analysis of documents have been used as auxiliary method. We will use a qualitative approach because the quantitative approach can not provide us the proper insight in real situation of Serbian companies.

We asked two research questions as follows:

Research question 1: Impact of web technology in business.

Research question 2: Acceptance of quality management techniques.

We examined the managers responsible for production, development and quality in six companies on the territory of Serbia. Companies are in the domain of mechanical production and mainly work for needs of foreign trade. Five companies are listed as large companies while one company is listed as a small or medium-sized company.

Managers were asked questions related to experience including the use of internet and web technologies. The obtained responses were generally positive and the majority of managers considered the web technologies as their future, while several managers have expressed doubts about the usefulness in the production process. This can be explained by technological differences between the observed companies. Two of six companies owned the old technology for over two decades, and unfortunately, this technology has no opportunities that is offered by the new technologies. For example, the old machines have neither computer management opportunity nor the ability to connect the measuring sensors with the machines.

With the second group of questions related to acceptance of some techniques of quality management system, we had better results. All the comnpanies that have been examined, some of them had certificates of ISO 9001, TUV etc. It should be noted that all organizations are oriented towards the export of their products. The orderers and customers of products require strict adherence of the prescibed standards.

The analysis of documentation has proven that all the observed organizations have some certificates on adoption of the quality standard. The most common form of the adopted standards is from the group of ISO

standards (ISO 9001 and ISO 14000), for the needs of specific markets some companies have adopted other standards such as the German TUV standards, and the like.

The analysis of financial statements (final accounts, balance sheets and income statements) has affirmed that all businesses have some problems. The two companies have problems with huge losses, one company has a loss in excess of capital while other companies have low margine profits. In this business environment, investment in a new equipment is not a realistic option, while on the other hand, any inefficiency can lead to loss of clients.

VI. THE DISADVANTAGES OF RESEARCH

Each research has some disadvantages, all research methods have a tendency of analysis of a dimensional problem. Realistically business is extremely complex and requires an enormous engagement and free access to the entire organization, and even though there is a risk prediction of important facts.

In this study, we have used the interview with the managers of the organizations, but the lack of interview is reflected in the fact that required the respondents to answer offhandedly. In this way it is possible that to get some information inadvertently ommitted. On the other hand, analysis of documentation can make up for some mistakes.

Analysis of documents is usually considered an auxiliary method and is used to research the history of the organization, decision-making, etc. Documentation provides some insight into the organizational history, but documentation does not often provide enough information on the actual situation. Another major problem with the documentation is related to the access of the same, many important documents are simply not open to public scrutiny and are part of the business secret. However, many documents must be credible such as financial statements.

A model of quality management implementation using web technologies (figure 2).

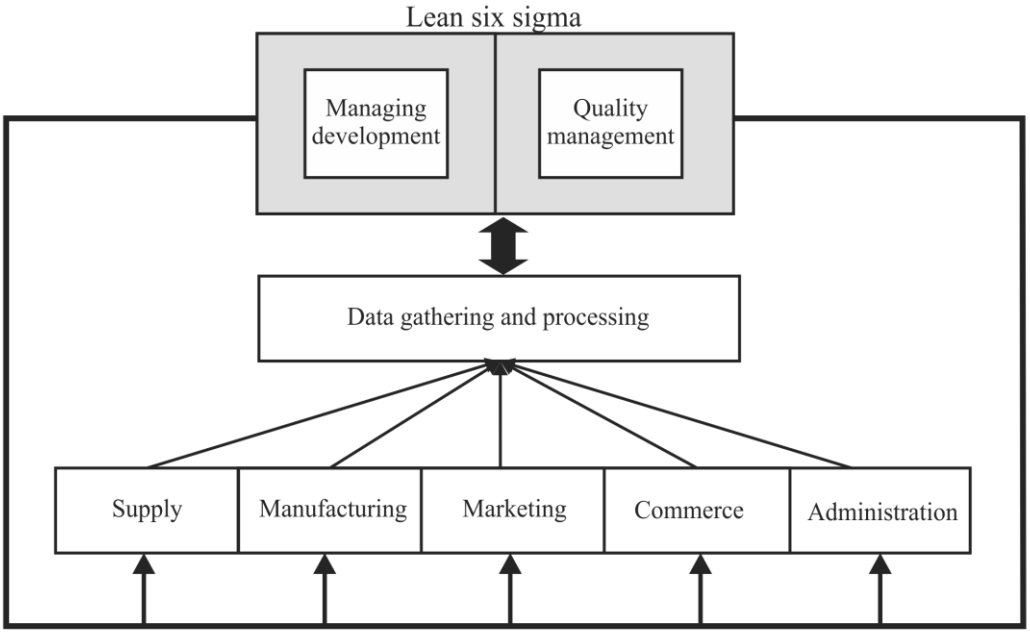

Fig. 2. A model of quality management implementation using web technologies.

The presented model is based on the theory and practice, model baselines are established in the market demand, on the one hand, and with the requirements of economy, on the other hand. The market demands new, high-quality, low-cost and and readily available products and at the same time are demanding lower-costs, higher profits of margin and easier operation. Techniques of lean and six sigma with web technology can become an extremely powerful tool for achievement of the emphasized goals.

Through web technology is possible to collect vast amounts of data, for example, in the production the installed sensors into the machines can measure the variations of the product in real time and at the same time it's possible to monitor the administrative operations. A series of applications and standards related to administrative tasks already exist. Questions and requests from the market can be collected through the marketing department, through various statistical models is possible to extract important imformation

about the movement of the market.

Through a system for processing and display of data is possible to observe some regularities, this part of the model is also used for „compressing“ large number of data. The danger always lies in the loss of data so that this part is extremely important for the proper functioning of the model. Today the companies are offered a wide range of artificial intelligence and external systems so that this part of the model can be relatively well configured.

The central place of the model is taken by the elements related to lean and six sigma techniques, quality management is related to the basical principles of Six Sigma, while the management development is related to the lean concept. These two close, but differents parts are important for the proper management of the entire system. The part that deals with the development is closer to lean concept, this part is aimed for the creation of development policies as well as monitoring the development of the organization. The part which is related to quality is closer to Six Sigma concept and it is aimed for the monitoring of anomalies in the system.

It should be emphasized that the most important part of the model is the feedback control with which is made regulation of all relevant parts of the organization. If the problems are identified, then there follows a series of actions which eliminate problems. Also the system is subject to changes in case of large market movements, such as the global economic crisis and the like. This connection can be used for continuous improvement of lean six sigma metedologies in the organization.

VII. Conclusion

This study presents the model of implementation of lean six sigma methodology using web technologies. The study is based on research carried out in the mid-2012th, in the territory of the Republic of Serbia. What is noticeable is the willingness to implement the quality management system and the relatively low impact of web technologies on business operations of the Serbian companies. The problem is the lack of money and resources for greater penetration of web technologies in organizations. Many companies have already introduced some form of quality control and have a relatively well-implemented information system and this fact tells us that in the practice is presented the realistic model.

Unfortunately, this model is more abstract and is used for academic understanding the position of Serbian companies in terms of web technology and quality systems of lena six sigma. For a realistic implementaion, it is necessary to take into account a number of parameters that were not important for this academic study. And yet, the model has a high utility value, primarily as a framework for creation of a future adapted model of implementation of the lean six sigma metodologies using web technologies.

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