Vinko Lepojević¹, Edin Kalač²

¹Faculty of Economics, University of Niš, Serbia
²DAI – USAID Agribusiness program, Novi Pazar, Serbia

Abstract. In analyzing the available Serbian references in the area of management, quality management and business excellence, no research has been found on the implementation of the SPC methodology in small and medium Serbian organization. The gap was filled with the research conducted in 30 Serbian companies which where analyzed by EFQM model through 2010 and the first half of 2011. The purpose of this paper is to introduce the reader to the characteristics of SPC tool and techniques for the continuous quality improvement of products, processes and services in organizations which want to implement EFQM excellence model.

Key Words: business excellence, EFQM model, process management, statistical process control, small and medium enterprises.

INTRODUCTION

The constantly increasing global competition that many industry sectors world wide have been facing over the past years, associated with fast technological changes and product variety proliferation have led to a new scenario in which industries, in order to remain competitive, must continuously change, improve and implement best practice management principles, strategies and technologies.

The competitiveness of a company is regularly dependent on its ability to perform well in dimensions such as cost, quality, delivery reliability and speed, innovation and flexibility to adapt itself to variations in demand. For that purpose quality techniques and
tools are very useful for the management to improve the company’s capability especially in the way of introduction of one of the models for business excellence like EFQM.

Depending on the purpose every organization will have to find a proper way and a combination of methodologies in its implementation process. The Statistical process control (SPC) is an approach to process control that has been widely used in many industrial and non-industrial fields.

Serbian small to medium-sized enterprises (SMEs) need to utilize management systems, especially quality systems in their operations and they are proposed to apply a suitable performance assessment and improvement model such as the EFQM. SPC tool and techniques for the continuous quality improvement of products, processes and services can be used in organizations which want to implement EFQM excellence model.

1. EFQM MODEL – THE PROMOTER OF BUSINESS EXCELLENCE

Business Excellence is a new paradigm in managing organization and it is based on the principles of Total Quality Management (TQM), measurement and improvement of many different aspects of the whole organization in terms of satisfaction of all stakeholders. Beside owners, these are: customers, suppliers, partners, employees, local and broader society, care for environment and others. Business Excellence provides the basis for the long term success and sustainable development of organizations and society. Excellence means achieving conditions which guarantee the growth activities in three dimensions of quality, innovation and improvement system in order to promote the interest level of those who benefit inside and outside the organization such as customers, staff, investors and society.

European Business Excellence Model is developed by European Foundation for Quality Management (EFQM), and this model is widely accepted by organizations of all kinds; production and services, large, medium and small, profit and non-profit sector. European foundation for quality management EFQM goes back more than 20 years, when 14 CEOs joined forces in 1988 to develop a Management tool that would increase the competitiveness of European organizations. Supported by the European Commission in the European Quality Promotion Policy, the founding members created the EFQM Excellence Model. The EFQM Excellence Model was introduced at the beginning of 1992. It is used as a basis for the framework for assessing organizations for the European Quality Award. It is now the most used organizational framework in Europe and has become the basis for the majority of national and regional Quality Awards [10, p.23].

The EFQM recognizes that organizations, on their journey to excellence, may show different levels of maturity. For this reason Foundation developed a staged route. The recognized levels are: [16] “Committed to Excellence”, “Recognized for Excellence” and European Quality Award (EQA) Level.

EFQM excellence model is a structure for organizations’ management, a self assessment tool, a framework for comparison with other organizations and consequently an effective tool for identifying areas for improvement [9, p.255-267].

The EFQM Excellence Model was introduced as the primary framework for assessing and improving organizations, in order that they might achieve such a sustainable advantage. Model of excellence can be the perfect tool for the detection of strengths and opportunities for an organization.
RADAR matrix is in the heart of the model. RADAR is a structured approach to question the performance of an organization; it is an essential part of a company's program using EFQM excellence model. As such, it is an integral part of the excellence model methodology. RADAR is an acronym for five interconnected phases: results, approach, deploy, assess and refine.

In Europe, EFQM and BQF organizations sponsored the research for the identification of correlations between adopted principles of the EFQM model and improved business results. Research showed business performance improvement on a short and long-term for the companies which effectively implemented the principles of the EFQM model. [2] Today more than 26 national and excellence awards are established in the countries of the European Union.

2. EFQM MODEL ELEMENTS

EFQM Excellence Model takes into account the eight basic principles of excellence: the focus on results, the focus on the customers, leadership and stability of purpose, management by processes and facts, development and integration of employees, ongoing learning, innovating and improvements, developing of partnerships and social responsibility of the organization.

The EFQM Excellence Model is based on 9 criteria. [11, p. 3] Model gives equal weight to "Enablers" and "Results". They are both valued at 50%. All nine criteria have different weights: Enablers (five criteria): Leadership (100 points), Strategy (100 points), People (100 points), Partnerships, Resources and Processes (100 points), Products & Services (100 points), and four of them are Results: Customer Results (150 points), People Results (100 points), Society Results (100 points), and Key Results (150 points). The 9 criteria are further sub-divided, resulting in a total of 32 parts.

The left side of the Model, "Enablers", and the right side, "Results", directly follow each other and are in direct cause-effect relationship, and together they make a whole. The 'Enabler' criteria cover what an organization does. The 'Results' criteria cover what an organization achieves. The ideal achieving a maximum of 1.000 points in the nine criteria is the purpose of EFQM. The more points an organization wins, the better performance it shows. Each of the 9 criteria has a definition, which explains the high level meaning of that criterion [16].

Concerning the Leadership criterion, excellent organizations have leaders who shape the future and make it happen, acting as role models for its values and ethics and inspiring trust at all times. They are flexible, enabling the organization to anticipate and react in a timely manner to ensure the ongoing success of the organization. Excellent leaders establish and help the realization of the company's mission and vision. They establish systems and values of the organizations needed for sustainable success and implement them with their behavior and the actions they undertake. In the period of changes the constancy of the purpose is sustained. When needed, the leaders are able to change the direction of the organization's activities and inspire others to follow their footsteps in this.

In the Strategy criterion, excellent organizations implement their mission and vision by developing a stakeholder focused strategy. Policies, plans, objectives and processes are developed and deployed to deliver the strategy. Excellent organizations implement
their missions and vision by developing a strategy which is focused on interest groups and which takes into consideration both the market and the sector in which they do business. Politics, plans, goals and processes are being developed and applied for the sake of realizing the strategy.

In the People criterion, excellent organizations value their people and create a culture that allows the mutually beneficial achievement of organizational and personal goals. They develop the capabilities of their people and promote fairness and equality. Excellent organizations manage, develop and use full potential of their people at the level of individuals, teams and whole organizations. They promote justice and equality and also involve and give authorizations to their people. They care about communication, rewards and acknowledgements for the sake of motivating and building commitment of the employees in the sense of making the best possible use of their skills and knowledge for the benefit of the organization.

In the Partnership and resources criterion, excellent organizations plan and manage external partnerships, deliverers and internal resources in order to support strategy and policies and the effective operation of processes. During partnership and resource planning and management, excellent organizations balance current and future needs of organizations, communities and environment.

In the Processes, product & services criterion, excellent organizations design, manage and improve processes for the sake of full satisfaction of customers and other interest groups, that is, for the sake of creating added values for them.

In the Customer results criterion, excellent organizations all-inclusively measure and achieve brilliant results for their customers.

In the People results criterion, excellent organizations all inclusively measure and achieve brilliant results regarding their people's issues.

In the Society results criterion, excellent organizations all inclusively measure and achieve brilliant results regarding the society they belong to.

In the Key results criterion, excellent organizations all-inclusively measure and achieve brilliant results concerning the key elements of their politics and strategy.

Through the 9 criteria those who assess organization can understand and analyze the cause and effect relationships between what organization does and the results it achieves. EFQM cannot be used as a tool for day-to-day business, since its positive effects can be seen in the long term.

3. PROCESS MANAGEMENT AS ELEMENT OF EFQM MODEL

Market competition makes an intensive pressure on enterprises and requires them to continuously improve their business performance. Every enterprise wishes to maximize its business performances, but it is very difficult in dynamic and complex conditions. In line with the changes occurring in the enterprise environment, as well as in the enterprise itself, the changes in the enterprise management are needed, too.

The traditional way of managing is based on the functions or organizational units, where each function in the enterprise has a particular manager responsible for its performances. This type of management contributes to the creation of barriers between the various functions, as designated manager cares only about the specific function, without
considering how the outputs of its functions affect other functions within the enterprise. Barriers between functions may mist the view of decision makers, since managers responsible for one organizational unit may influence only the work performed under its boundaries. This, traditional approach leads to local optimization, instead of optimization at the process as a whole, since processes usually stretch through two or more organizational units.

In order to provide optimization at the process level, rather than at the units' level, the process approach should be implemented. The process approach is expressed through process management, and it assumes change of focus from the organizational units to the processes, since the processes represent the connection between organizational units. This way of managing is important since it enables monitoring and control of the so-called business flow. In this way it is easier to balance the amount of work in progress and to define the responsibility for the process results. Therefore, it may be said that one of the main problems of traditional, hierarchical structure refers to the absence of process owner role or the managers which would be responsible for the process as a whole and which would take care of their efficiency. Beside identification of process owner, process approach assumes the change of the employees' attitude to process efficiency and their role in providing process efficiency.

Due to the importance of process approach and process management for providing competitiveness in modern conditions, the central place in the EFQM model belongs to the processes, more precisely, to the element process management. The position of this element and its importance for evaluation of enterprises business excellence proceeded from the fact that processes represent "the places" where enterprise's resources and competencies are combined and balanced.

According to Davenport [6] business process is a structured, measurable set of activities, with defined beginning and the end, whose realization assumes the usage of certain resources and is designed to produce specific output. Rummler and Brache [5] claim that the business process represents a set of steps, designed to provide products and services, while most of the processes are multifunctional. They add that, beside the process whose result is a product (service) for external users (customers) and which are called primary processes, there are processes whose results are not „visible” to external users, but are significant for the enterprise management and are, therefore, called supporting processes. Hammer observes business processes as organized groups of related activities which only together, in their mutual connection, provide the wanted output. [8] Here the accent is on the organization of activities, as well as on their interdependence, since all activities have to be aligned and directed towards the process objective.

Business processes may be explained as the sequences of mutually connected activities which use certain resources, and whose final result should provide satisfaction of their users, in terms of quality, quantity, costs and time. They are part of the value chain, which includes more business processes, from research and development of new products (processes), customers' orders, procurement, purchasing, production, sale, transport and logistics. Therefore it may be said that an enterprise's value chain represents the network of mutually connected processes. Processes are parts of the value chain, but they can be divided as well. For example, product development process includes market research, planning, design, development, testing, and documentation. Every process consists of the activities, which have to be synchronized in term of balancing of their resources capacities. The connection of process activities is usually presented through network diagram.
When observing the enterprise through its processes one has a reliable image of its
business performances. Hierarchical orientation and separation of organizational units
disables comprehensive overview of business. Employees observe only their role inside the
organizational unit and they do not have a wider picture of the process, for which they
perform certain activities. Since organizational division usually means insufficient exchange
of information, local optimum instead of process optimum is a logical result. Instead of this
state, employees which perform certain activities of the same process have to act as a team.
Processes have to be systematically managed and continually improved, because it is
the only way for adapting them to the ever changing needs of their results users. Therefore
it may be said that the first step towards process users' satisfaction is to design them based
on users' demands. When users' demands are taken into account in design phase process
effectiveness will be provided. This actually means incorporation of quality into process
or quality of process design. Process design will deserve the epithet "quality" if it:

- Is based on users' needs,
- Provides the best possible relationship between users' needs and enterprise's re-
sources and capabilities,
- Takes into account time restrictions, in order to anticipate the competition,
- Includes suppliers and increases the level of cooperation with them (just-in-
time principle),
- Assumes multifunctional team for designing, which means that desig is the re-
sult of cooperation of different organizational units (marketing, research and
development, production, financies and so on).

Though quality of process design is very important, it is not enough for achieving
process excellence. The quality of process realization is the second part of the process
excellence medal. The rule formulated by Pareto (80:20) is confirmed in the case of pro-
cesses, since some authors made conclusions based on their research that 80% of process
realization time is not used productively. [12, p. 151] This means that there are possibili-
ties for process improvement. However, those possibilities have to be identified, and this
assumes measurement and analysis of the data collected through measurement. Statistical
process control represents the part of statistical quality control, [7] whose main purpose in
process management is quality assurance.

4. STATISTICAL PROCESS CONTROL APPLICATION IN PROCESS MANAGEMENT

Statistical quality control is a general term used to describe a set of statistical tools used
for quality evaluation. It can be divided into three broad categories, namely: [3, p.663-667]

- Descriptive statistics – used to describe the characteristics and quality of their rela-
tionships; The most common measures are the mean, standard deviation, measures
the distance variations and forms of distribution data,
- Statistical process control - includes inspection of a random sample of the proc-
ess and deciding whether the process results in products with characteristics fall
within a certain range; Statistical process control provides the answer to the ques-
tion whether the process is working properly or not,
- Acceptance sampling - a process of random sample inspection of products and de-
cide on the acceptance of a whole based on the results; Acceptance sampling is a
category that determines whether a set of goods should be accepted or rejected.
Statistical process control provides information whether the process is stable or not, by making the difference between custom and special causes of variations or measured process characteristics. It assumes monitoring of inputs through the process or from one activity to another. The aim of statistical process control is to identify processes out of control and these are the ones whose variations represent the consequence of the special causes. The information that statistical process control provides is used for undertaking some actions with the purpose of getting the process into the state of statistical control.

The tools from statistical process control identify problems related to quality during the process realization. Quantitative measurement of quality characteristics is the basis for statistical process control application. The starting idea is to collect a sufficient number of samples or data, in order to gain the necessary knowledge about the monitored process.

The instruments for conducting statistical process control are different types of control charts. The main role of control charts is discovering and visualization of process characteristics' quality variations [15, p.660]. A control chart is a tool for the separation of variations that are the result of specific factors from variations that proceed from common factors, with the objective of eliminating the effects of specific factors and the establishment of stability and predictability of the process. According to Shewhart "certain phenomenon is under control when, based on past experience, its variation in the future can be predicted, and the limits for allowable variation determined. Predicting of variations within certain limits means that it is possible to determine the probability, at least approximately, that the observed phenomenon will be within predefined limits. [14]

Statistical process control assumes that the control limits are set based on statistical analysis of the data collected by observing the actual processes. In case when for the specific characteristics of products or components consumers can be consulted, the control limits may be determined on the basis of their demands, and their willingness to tolerate a certain deviation from the desired (target) value. Determining the specification includes the identification of the extent to which measured quality characteristics can take value, and that this should not reflect negatively on the quality. Depending on the quality characteristics, there may be one or two specification limits (upper and lower). Usually in addition to the specification limits, target or desired value of measured characteristics may be defined (the value that it should have).
Specific causes are considered responsible for the variation of measured quality characteristic outside the defined specifications, while the variation of measured quality characteristics within the specifications is attributed to systemic causes. Systemic causes cannot be eliminated in the short term, because they assume restructuring of the process. Unlike them, specific causes can be relatively easily removed and therefore improvements of process quality or incremental changes are usually associated with their elimination.

For successful application of statistical process control, beside control charts role, few other elements should be provided, and they are: management commitment, training of employees for using statistical tools, learning about the ways of measuring process characteristics, as well as initiative to change corporate culture and reduce employee resistance to change [1].

Any production process will produce products whose characteristics properties vary slightly from their designed values, even when the production line is running normally and these variances can be analyzed statistically to control the process. By using SPC tool, companies will control production line in function of reaching excellence in production process. For that purpose corrective actions (SPC) are used as a tool for initiating further continuous and systematic improvement. As the final result we will have excellence in production and excellence in satisfying consumer. In evaluation process companies with implemented SPC method will be better positioned comparing to companies without SPC placed in action. To meet this goal and to keep excellence, the SPC application must be complex and effective and SPC must be realized as a problem-solving process.

5. INVESTIGATION OF ACTUAL SITUATION IN IMPLEMENTATION OF SPC IN SMALL AND MEDIUM ORGANISATIONS

The cyclic performance of self-assessments according to the EFQM Excellence Model by submitting a document for the Award systematically encourages the organizations to on-going learning and continuous improvement and innovation. For that purpose organizations should use Quality Tools (QTs). There is a great variety of QTs since there are many quality improvement paradigms to help organizations improve their products or services. In addition, even similar organizations have different needs and, consequently, use different QTs [13, p.282]. In this investigation we will present current situation of implementation of one of the QTs - SPC in SME organization in Serbia.

The SMEs were selected from an initial group of companies whose management, business processes, performance and potential for improvement was evaluated by the application of EFQM Excellence assessment model developed by the European Foundation. The sample comprised 30 companies. The sample is „non-statistical“ based on the researcher assessment. It comprises respondents available during the research.

Research was done through Support to Enterprise Competitiveness and Export Promotion (SECEP) an EU funded project. The project is supported by the Ministry of Economy and Regional Development, SIEPA, the Office of the Deputy Prime Minister, the Serbian Chamber of Commerce and National Agency for Regional Development.

This program is designed to help SMEs become capable of competing in international supply chains of Multinational companies. Through this project Assessors use EFQM model as a diagnostic tool which identifies in detail strengths and weaknesses in company
The Role of Statistical Process Control for Providing Business Excellence According to the EFQM Model

performance and shows clearly how a company can improve its performance. One of the tasks was to investigate the level of usage of SPC methods in companies. The evaluators were asked to rate their degree of agreement with each statement according to a five-point scale from 0 to 4 (Table 1).

**Table 1. Level of usage of SPC in research process**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No evidence of statistic methods and skills</td>
</tr>
<tr>
<td>1</td>
<td>Some evidence of the use of process statistics in place</td>
</tr>
<tr>
<td>2</td>
<td>Statistical evaluation of production process is standard procedure</td>
</tr>
<tr>
<td>3</td>
<td>2 + management is fully aware and provides incentives for active use of SPC</td>
</tr>
<tr>
<td>4</td>
<td>3 + SPC in place used for actual process control</td>
</tr>
</tbody>
</table>

Concerning the size of the organisations included into the research, 19 companies (63 %) fall into the category of small and 11 companies (37 %) into the category of medium-sized companies.

**Table 2. Number of SME that use SPC and level of usage**

<table>
<thead>
<tr>
<th>Level of usage SPC</th>
<th>Small companies</th>
<th>Medium companies</th>
<th>Total SME</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>17 (89%)</td>
<td>7 (64%)</td>
<td>24 (80%)</td>
</tr>
<tr>
<td>1</td>
<td>2 (11%)</td>
<td>2 (18%)</td>
<td>4 (13%)</td>
</tr>
<tr>
<td>2</td>
<td>0 (0%)</td>
<td>2 (18%)</td>
<td>2 (7%)</td>
</tr>
<tr>
<td>3</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>4</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>11</td>
<td>30</td>
</tr>
</tbody>
</table>

The empirical research showed that Serbian organizations apply SPC concepts insufficiently in their business practice (Table 2).

The data presented in Table 2 shows that very a low percentage of SMEs in Serbia implement SPC. According to this data 80% of enterprises do not use any statistical tools for the research process. Small companies are in a worse position because only 11% in total has some evidence of the use of process statistics in place, medium companies according to this data show a little better result with 18%. Also, indicative data is that only 7% of the total SMEs prove that statistical evaluation of production process is a standard procedure, none of which are small companies.

The results presented in the paper "Performance Measures and Quality Tools in Portuguese Small and Medium Enterprises: Survey Results" show that 52.4% of SMEs in Portugal apply Statistical Process Control [13, p.294]. If we compare these results we can conclude that Serbian SMEs do not consider SPC as a fundamental paradigm for success in the global economy. Therefore, all small and medium firms wishing to go beyond the "old system of quality control" must ensure a wide implementation of SPC.

In practice medium companies use more 'QTs' than small ones. This may be a consequence of the main obstacle to the adoption of new tools 'training of employees'. If employees are to be involved in the quality improvement, they need to be trained; thus, 'em-
ployee training' should be an important measure for those companies that selected "employees' involvement to improve quality".

However, the limitation of this study is the small number of evaluated companies, which is statistically significant. This would be due to the fact that EFQM evaluation process is very demanding and expensive. Also, we must consider the fact that most evaluated companies do not seem to have a great understanding of the EFQM phenomenon, they are just beginning to implement TQM, which may justify the low numbers as their results.

CONCLUSION

We can say that in Serbian companies the systematic and organised implementation of the SPC is almost non-existent. Investigating the cause of such „poor” implementation gives main reasons like: insufficient engagement of the top management and the lack of knowledge. Authors think that the biggest obstacle to introducing a new tool like SPC is training of employees.

On the basis of our own experience gained in introducing the EFQM Model into Serbian organizations, we can confirm that conducting of SPC had positive effects on the change of improvement of management process. As an obligatory part on the way to excellence companies should use statistical tools for the purpose of continuous improvements of their practice. This is very important for Serbia, which is endeavoring to increase its added value as much as possible, along with the retention and boosting of its global competitiveness. Besides, in the long term, we see important effects of the use of the EFQM Model on the quality of life and welfare of the wider society.

To establish, sustain and empower its competitive position in the years of a very rough globalization and its approach to the European Union, Serbian organizations will have to implement the concepts based on the Business Excellence principles in a very intensive way. That means that in the near future they should use the SPC concept to improve capacities and capabilities.

REFERENCES

1. Antony J., Mason B., (2003), Key Success Factors for the Implementation of SPC, School of Engineering, University of Warwick, UK
The Role of Statistical Process Control for Providing Business Excellence According to the EFQM Model


**ULOGA STATISTIČKE KONTROLE PROCESA U OBEZBEĐENJU POSLOVNE IZVRSNOSTI PREMA EFQM MODELU**

Vinko Lepojević, Edin Kalač

Analizom dostupne literature u Srbiji iz oblasti menadžmenta upravljanja kvalitetom i poslovne izvrsnosti, nije pronađeno istraživanje koje se bavi implementacijom SPC metodologije u malim i srednjim preduzećima u Srbiji. Prezentovani podaci će izmeniti tu situaciju putem istraživanja koje je sprovedeno u 30 srpskih kompanija koje su evaluirane korišćenjem EFQM modela tokom 2010. godine i u prvoj polovini 2011. godine. Svrha ovog rada je da upozna čitaoca sa karakteristikama SPC alata i tehnika u svrhu konstantnog unapređenja kvaliteta proizvoda, procesa i usluga u organizacijama koje žele da primene EFQM model izvrsnosti.

**Ključne reči:** poslovna izvrsnost, EFQM model, upravljanje procesima, statistička kontrola procesa, mala i srednja preduzeća