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Application of Methods and Techniques for Quality in the Macedonian Companies

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Abstract

The research in this paper has been done with the aim to analyse the current situation of the Macedonian companies in the domain of applying the methods and techniques for quality in conducting the business processes. The process of obtaining quality is related not only to people's work, but also with the machines, the technology of the production processes etc. because of this it is necessary to have control that will evaluate the stability and the ability of the business processes. The control itself is not enough, because the processes need to be continuously improved by reducing the variations. The data from the research helped and gave useful directions in the creation of the subsystem's methodology – statistical process control. This methodology should help improve the performances of the business processes, and it will also help defining the measures for the realization of sustainable business systems and to encourage innovation.

Keywords: quality system, statistical process control, methods and techniques of quality, model.

1. Introduction

The methods and techniques for providing quality are instruments used to conduct activities for quality improvement, and are an integral part of the quality management according to the defined policy, aims and responsibilities of the company, and also for the creation of comparative advantages on the market. Their application in the Macedonian companies has to show how much they apply it and how much they are prepared for being present on the global market. In order to be successful in the application of TQM (Total Quality Management) strategy, the managers have to choose a methodology supported by different methods and techniques. In order to have an effect from the application of the methods and techniques for quality, we need to choose them correctly and coordinate them. Their choosing and application are under a lot of factors from organizational and technical character, so depending on the projection or the organizational structuring of the quality system, we can suggest their classification.

2. Literature review

Methods for improving the quality are the following: concepts, techniques, methods, studies, resources or i.e. all of the efforts toward quality improvement (Pareto chart, regressive analysis, and control cards, methods of causes and consequences, study of precision, punctuality and stability of the process). The role and the importance of the methods and the techniques for quality and the activities for quality improvement are emphasized in the ISO 9004-4 standard, by mentioning that the application of any of the methods will lead to a certain improvement (Arsovski, 2002). Based on the analysis that was

done in the companies that are in the metal-production in Great Britain, it can be concluded that most of reasons for the lack of methods and techniques for quality is the lack of education and the inexperience in their application (Sohal et al., 1990). However, the most common problem is in the way of defining them or i.e. in their adequate application.

The statement of a large number of authors is that the advantage of its application in the organizations can be noted in the following: raising the level of quality in all of the business processes in the organization; decreasing of all types of costs; decreasing the price of the products; creating confidence with the buyers/users; raising the employees' level of education. For these authors, the employees' motivation and productivity raise, the presence on the markets broadens by applying the methods and techniques for quality. The application of the methods and techniques for quality by the producers of automobile parts has been analysed by Sugiyama (1996). He has pointed out the following advantages: realization of competitive products whose quality fulfils the requests of the buyers/users; decrease of the costs; improvement of the abilities and the experience of the collaborators in the usage of tools for quality; an increase of the efficiency of the process.

Jayaram et al., (1998) conducted the same research in Brocka and Brocka by using around 50 methods and techniques for quality and gave a suggestion for applying 26 of them. When we say relevant, it means that they are available in literature.

Dale et al., (1998) in their research based on an analysis in the motor industry in Great Britain point out that the application of the methods and techniques for quality is an instrument for conducting activities for quality improvement and creating comparative advantages for the company.

Bauer et al., (2006) differentiate among 98 methods and techniques for quality that can be used in the direction for quality

improvement, but most of them are not applied in practice. However, having in mind all the methods and techniques for quality present in ISO 9004-4 and those analysed by many authors, it was concluded that the optimal number is around 30 of them that can have a broader usage in the industrial practice.

The system of quality in which the SPC (statistical process control) concept is not developed nor used, will not have enough guarantee for its survival. On the other hand the use of SPC without a developed system for data writing and SOP (Standard Operative Procedure) isn't logical, and the usage goes down only to noting errors and all of that requires well trained teams (Brannstrom-Stenberg & Deleryd, 1999). The usage of SPC is one of the requests of ISO 9001:2015 (Casadesus & Gimenez, 2000; Mitreva & Filiposki, 2012a). The essence of a statistical process control is to obtain stability of the processes and a foresight in production with a variation of three standard deviations from the average value of the given characteristic. In the meantime, all of the variations can go between defined intervals or so called tolerance boundary. If the process of series of cases and conditions and a series of phases in which it is expected that the given input value should give the requested output with as small variations as possible, and then we can say that the process is stable (Gauri, 2003). A preventive and a reduction for the variations of the characteristics can and should begin much earlier in "the life" of the product (Chepujnoska, & Mitreva, 2008).

For other authors the application of the statistical process control is part of the TQM (Total Quality Management) strategy for a permanent promotion of quality. It helps in the decision of which data is important and how to take the maximal knowledge from them, to avoid incompatibilities, analyse the current problems etc. (Taguchi & Clausing, 1983; Stoiljković, et al., 1996; Mitreva et al., 2014a, 2014b).

Although most of the statistical methods and techniques are used in the production companies, they have a broad usage in the services as well according to Xie, & Goh (1999).

Stenberg (1999) has emphasized the benefits of using statistical process control based on his research study of 89 Swedish companies. In the technologic processes have many irregularities in various technological operations. Most of them can be prevented if some corrections in the working are made.

3. Methods in the research and analyses of the results

The subject of interest in this paper is a deep analysis on the Macedonian companies in relation to the performances and control on the business processes. In accordance to the defined aims of an empirical research, the list of analysed company contains 3109 and it was made with the help of the Economic Chamber of Macedonia, while the research process itself participated only 363 representatives from the quality department, who are responsible for the quality control or the management. In choosing the sample a special attention was paid to analyse both companies with and without a quality system and to note the differences between them.

The research has been done through a questionnaire, and with a detailed study of the companies by the research team. Although the research was planned as an ambitious possibility to analyse the Macedonian companies (around 3109 from the created list), in the course it was proceeded with the participation of only 363 companies. It is 11,6% of the created base, but it is a usual number in this kind of a research (Bohdanowicz 2005; Medina-Munoz and Garcia-Falcon 2000). The research in the Macedonian companies had the aim to note their development in accordance to the four columns of the house of quality and to determine at which phase they are in the pyramid of the European award for quality. These were the criteria through which the situation in the Macedonian companies had to

be analysed, and used to confirm the gap between them and the developed European or world companies and their ability to be present on the global market. In this paper, we have presented only the results in relation to whether the Macedonian companies apply methods and techniques for quality in conducting the business processes, which represents a basis for a continuous promotion of quality and whether they are ready to accept the TQM (Total Quality Management) philosophy. The structure of the analysed companies – participants in the research according to the economic branch they belong to (National classification of jobs2 – Official Gazette of Macedonia, no.147/08) with the modification and the addition to the National classification of jobs applied since 01 January 2013 is given on *Figure 1*.

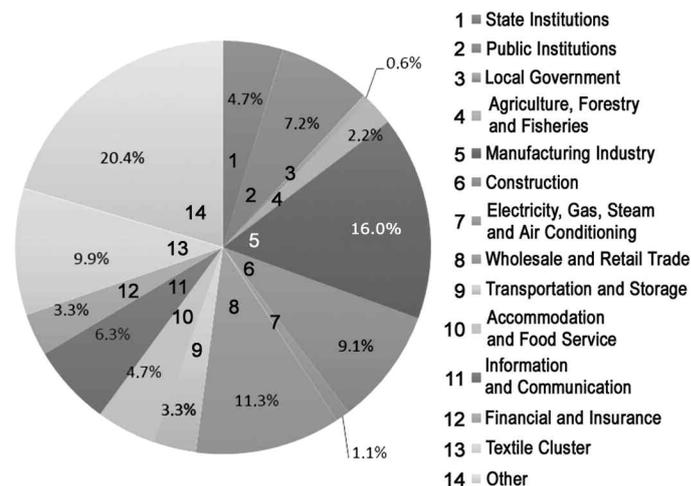


Figure 1. The companies – participants in the research divided in different economic branches given in percentages

The condition of the Macedonian companies was analyzed through the four levels of the quality house (standardization, methods and techniques for non-defective working, education, motivation and analysis of the quality costs). In this research are presented the results from the research concerning the application of the methods and techniques of quality and the provision of quality.

3.1. Application of the methods and techniques of quality in Macedonian companies

The methods and techniques for quality can be used to establish an efficient control over the processes by achieving a defined quality and lowest costs. In order to identify which methods and techniques are used in the Macedonian companies, we ask the following question: **How do they measure the quality of their products/services?**

All of the companies have answered this question and the received data is the following:

- 27.8% of the companies measure the quality of their product/services *through the service or the department responsible for measuring, analysing and evaluating;*
- 24.5% of them *do it through the realized profit;*
- 20.4% of them *do it by comparison to other companies from the same industry;*
- 13.2% of them *do it through an anonymous questionnaire for users that evaluate quality;*
- 14% of them have answered "other" (direct contacts with users, free open phone lines etc.)

Many organizational and technical factors influence the choice and the application of the methods and techniques for quality. The application and the choosing depend on the projection or i.e. the organizational structuring of the system for quality. In order to see what kind of an effect does the application of the methods and techniques for quality have, we ask the following

question: *In what way do the companies discover if their products/services do not fulfil the user's expectation?*

All of the companies have answered this question and the received data is the following:

- 42.1% of the companies have answered that they are informed about the non-quality of their products/services from **the reclamations made by the buyers**;
- 16.5% of them are informed from *the department for quality control*;
- 14.6% of them are informed from *the done sail (if it is increased or decreased)*;
- 9.1% of them are informed through an *analysis done by a questionnaire for the users*;
- 4.7% of them are informed by *following the competition* and
- 12.9% of them have stated "others" (*direct contacts with the users help them a lot in discovering if their products/services fulfil their expectations*).

From the conducted questionnaire, it can be seen that the companies **are not informed about the non-quality of their products/services by the department for quality control, but by reclamations; which shows that the non-quality has**

surpassed all control points and reached the user. These notions point to the fact that in most large companies there is an *inefficient department for quality control* of the products/services, because non-quality comes from the buyer/user.

*In order to discover if the Macedonian companies have an established efficient control over the processes by achieving a defined quality at lowest costs or not, we ask the following question: **What kind of control over the quality of the products/services do they practice?***

In our companies, the quality is in a very bad condition because of the unsuitable conducting of the business processes, the inefficient control with a large percentage of defects, even larger that it is allowed.

All of the companies have answered this question and the received data is the following:

- 41.9% of them *apply linear control*;
- 28.7% of them point out: (integral quality control and self-control);
- 20.9% of them *have a final control*;
- 8.5% of them *have an input control*.

The distribution of the results from the research divided in accordance to the economic branches is given on *Figure 2*.

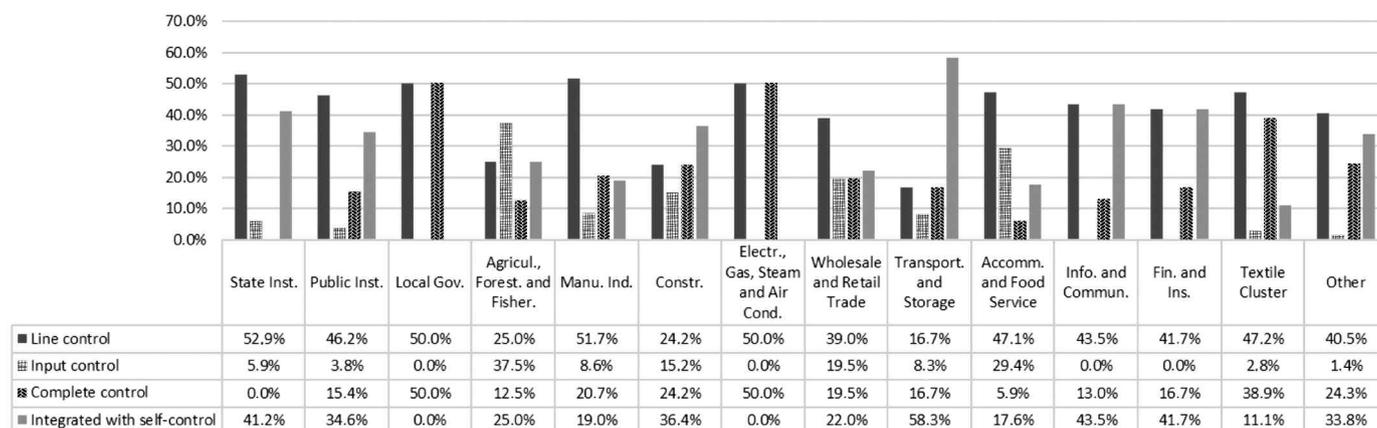


Figure 2. Types of control used in the companies/institutions according to economic branches

An example of an integral control and self-control is present in the analysed companies who have survived on their native markets or around the world more than 50 years as: *Alkaloid, Brako, Blagoj Gorev, Teteks, Skopska Pivara, Zito Vardar, Zito Luks* etc. Their consistency on the market is a result of the integral quality control that they used, and it is based on the participation of all the employees in the promotion of quality. This was achieved by changing the consciousness and the relation to work depending on their knowledge, study, desire and motivation for such work. The application of the model of an integral quality control does not request investments in new equipment, new technology, but only a different approach in the way of working, task accomplishing, mutual communication, unity in realizing quality, as well as correctness and high responsibility toward the work and the buyers.

The technical and technological equipment of the Macedonian companies is on an almost satisfactory level and it satisfies the current requests of the buyers/users to some extent. The problems mostly derive from the badly organized business processes and the inability to satisfy the requested quality standards. In Macedonian companies the same technology is used but we have lower business results. *The reasons are not only in the deficiency of modern technology, but also in the weak management abilities, the qualifications and the satisfaction of the employees and the quality of conducting the business processes. Chiefly, linear forms are applied for the conducting of the company (in certain phases) that are known for the higher working costs.*

In order to discover how efficient is the control of the

processes by achieving the defined quality at lowest costs of working, we ask the following question: **At what amplitude is conducted the control between the phases?**

All of the companies have answered this question and the received data is the following:

- 44.9% of the companies, do a **100% control** (this means that the measured characteristics are especially important for the quality, but that kind of control is expensive and should be optimized);
- 24.2% of them *do a control on an accidental sample*;
- 17.9% *do not have a control between the phases*;
- 12.9% of them practice a *statistic control*.

The hundred percent control is expensive and irrational, and it obtains quality but at a very high price.

The distribution of the results from the research divided in accordance to the economic branches is given on *Figure 3*.

The deficiency of statistic approach in the processing of the data, the evaluation of the quality and the transfer of information causes many problems in the Macedonian companies on the home and the global market. The application of the statistical process control (SPC) is present only in small number of companies. The guidelines about the importance and the usage of SPC and the improvement of the quality of the products/services have to be at a disposal of all the departments: marketing, sale, production, finances, human resources; but for that it is necessary to have a regular training for all the employees. **For that aim, the question that is asked is what happens with the reports from the conducted control**

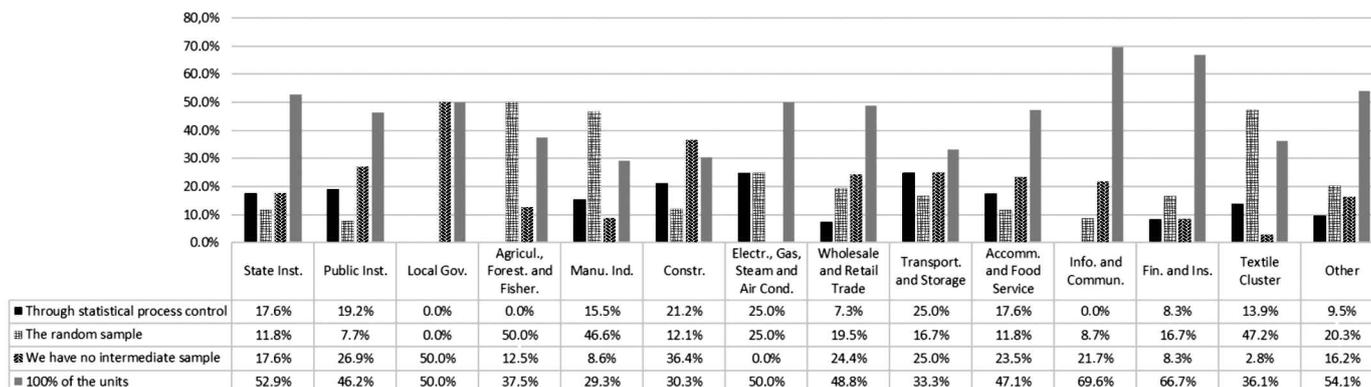


Figure 3. The amplitude of the quality control between phases in the companies/institutions according to the economic branches

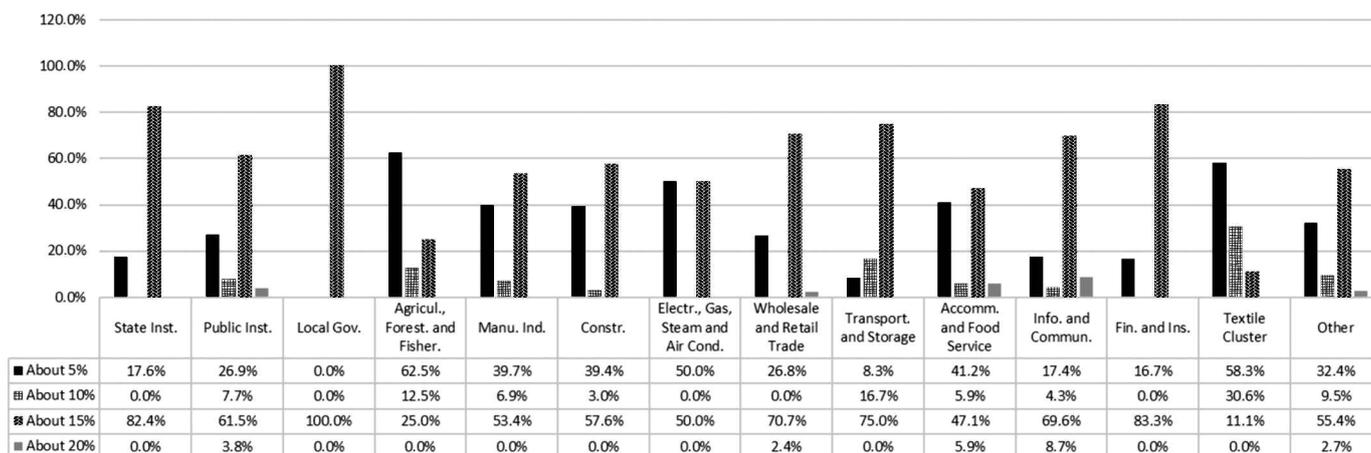


Figure 4. Percentage of the daily production that is being returned to a reproduction in the companies/institutions divided in accordance to the economic branches

between the phases.

All of the companies have answered this question and the received data is the following:

- 47.7% of the companies do not use quality control between the phases, and consequently there aren't reports;
- 35.5% of them have stated that the reports are distributed to the managers appointed for quality, who take complete corrective and preventive measures for a free development of the business processes;
- 11% of them distribute the managers appointed for that problematic, but mostly they are left there;
- 5.8% of them haven't projected a system for usage of the reports between the phases.

Stations for identification and analysis of the weak spots have to be determined in the whole company, so that costs for reclamations, the errors, the defects or i.e. the costs derived from the unfulfilled requests for quality are being analysed. The impracticability of the SPC (Statistical Process Control) can be noted from the data received from the research: **How much percentage of the daily production is return to a reproduction?**

- 55.9% of the companies register a return of the daily production to a reproduction to 15% of defects;
- 33.9% of them register a return of the daily production to a reproduction to 5% of defects;
- 8.3% register a return of the daily production to a reproduction to 10% of defects;
- 1.9% register a return of the daily production to a reproduction to 20% of defects.

The distribution of the results from the research divided in accordance to the economic branches is given in Figure 4.

Under an optimally organized quality control, there must not be more than 3% of defects. The reclamations, errors, defects should be reduced with a timely internal functional collaboration among the research, the marketing, the production and the informatics system.

In case of introduction of a new product/service, technology or methods for work, it is necessary to have a complete training program for all employees (Mitreva, 2013b).

In the Macedonian companies the errors in the processes hide in the fear. Everyone who discovers it, tries to "put it under the carpet" and to transfer it further in the business process. This is a problem of our business culture and in the building of a creative climate in the company. In this paper we suggest a methodology for the subsystem of a SPC as part of a universal, integral methodology for projecting and implementing the TQM system in the companies (Mitreva, 2011). This methodology can helped the employees' thinking by insisting that the company uses the TQM strategy and by their striving toward a future as "a world class" company. In order to achieve those desires, the managers and the employees had to gain additional theoretical and practical knowledge that will help in their conduct of the companies (Mitreva & Prodanovska, 2013).

4. Suggested methodology for the subsystem – Statistical Process Control (SPC)

SPC (Statistical Process Control) is not measured only by the current performance of the processes, but it also gives a basis for improving those processes (Mitreva & Filiposki, 2012b). **The course of building the subsystem of the statistical process control** goes through the following activities, Figure 5.

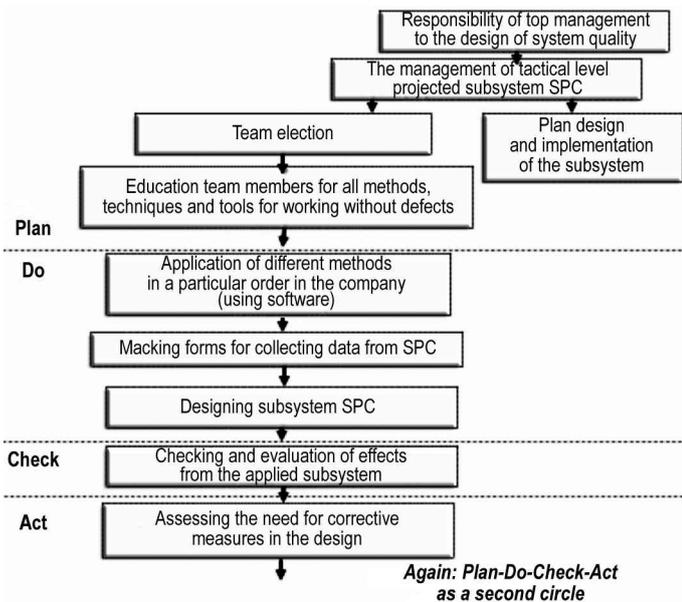


Figure 5. The course of the process for projecting the subsystem of statistical process control SPC (Statistical Process Control)

□ **(Plan) Step 1:** Plan for projecting and implementing the subsystem of statistical process control (SPC).

□ **Step 2:** Choosing team members.

The team is responsible for projecting and implementing the subsystem for non-deficiency working. When choosing team members, it is necessary to take specialized and competent people, who will use their experience, knowledge and skills to enable good projecting of the evaluation system for stability and the ability of the processes, all for the aim to conduct and rationalise them.

□ **Step 3:** Education for the team members for all methods and techniques for non-deficiency working.

The methods and techniques for non-deficiency working are used on all levels of the management for: an evaluation of the business results, optimization, and evaluation of the stability and the ability of the processes, the discovery and the prevention of the deficiencies/defects etc. The conclusion is that all of these levels need to be educated and trained for an efficient application of all.

- **On a strategic level** it is needed to have an education and training in order to apply the complex methods and techniques for conducting the quality as: FMEA analysis, QFD method, electronic conducting with the data, internal audit, technical network planning, experiment planning, quality costs analysis, etc.
- **On a tactical level** we need education and training for applying the statistical methods for costs optimization, methods for foreseeing quality, method for determining the vision of the developing companies, the planned experiment, etc.
- **On an operative level** we need education and training on the application of the statistical methods for evaluation of the capability and stability of the processes, the correlation, the regression, the dispersion, the control cards, the dependency on the causers for product quality from the production factors, etc.
- **On a routine level** it is needed to have education and training for the employees about the application of the basic tools for providing quality such as: Pareto diagram, Ishikawa diagram, Poka-Yoke method, the trend card, and all the methods that can be easily understood and applied in the working process. The most useful methods are the self-control and the Poka-Yoke method.

□ **(Do) Step 4:** An application of different methods and techniques for the established tasks and the confirmed aim of the company.

In the recent years the application of the software packages is more and more emphasized as fast and simple for usage (Mitreva et al., 2015a). There are different methods and techniques for non-deficient working that can be applied: methods for discovering the place where the most defects occur; methods for discovering the causes for the defects; methods for following the course of the processes; the methods for making decisions; methods for evaluating the stability and the capability of the processes; methods for evaluating the dependency between the characteristics; methods for evaluating the dispersion of characteristics etc.

Part of these methods have been used in some Macedonian companies (Mitreva et al., 2015b) for evaluation of the stability of the processes, the number or the percentage of the defects, the stability of the machines, to discover the causes for creating the defects and the variations etc.

□ **Step 5:** Creation of forms for collecting data from SPC.

The documents and the other acts that contain information for stability and capability of the processes can be written, transferred and received by various tools. The forms have to be simple, easy for computer processing, understandable for the employees. After collecting all the data, we need a table description with a previous edition.

The documentation of the applied statistical methods, it is very important to form for the documents of quality.

□ **Step 6:** The projecting of the subsystem for SPC in the company.

In the subsystem for conducting in the SPC in the company, we have to have defined:

- What needs to be controlled;
- The place where results are collected, recorded and analysed;
- The people who are obliged for collecting, recording and analyzing the results;
- The way in which the results are stated;
- The way of information;
- The creation and the realization of the policy for checking quality;
- Creating, operating and realization of the plan and the program for checking the quality;
- The determination and the realization of the way, the procedure and the tools for controlling the quality of the materials and the products who enter and leave the company.

□ **(Check) Step 7:** Checking and the evaluation of the effects from the application of SPC refers to:

- Study of the processes;
- An analysis of the processes, where the stability of the processes is evaluated with the help of the methods and techniques of SPC for non-deficient production;
- Process control quality;
- Control of the quality of the materials, the parts and the sub-parts of the products.

□ **(Act) Step 8:** The evaluation of the need for corrective measures in the projected subsystem of SPC.

On the basis of the checking and the evaluating of the effects from the SPC application, we have suggested corrective measures for promotion of the subsystem by promoting: norms; indicators; methods and instruments for quality control. Then the circle starts to turn again.

5. Conclusion

Based on the received results and the above mentioned aims for the research, it was confirmed that the Macedonian companies lead:

- ❑ poor care for quality;
- ❑ unnecessary attention to a continuous education;
- ❑ poor investments in innovations;
- ❑ the quality system is created in very small number of companies;
- ❑ very little care for the employees, buyers, distributors and the environment;
- ❑ poor application of SPC;
- ❑ work with large costs.

In this paper we suggest the methodology for the subsystem of a statistical process control as part of the universal and integral methodology for projecting and implementing the TQM system in the companies. Part of the methods were used in some Macedonian companies (Mitreva et al., 2014a, 2014b, 2016a, 2016b). Approaches] for an evaluation of the stability of the processes, the number or the percentages of the defects,

the stability of the machines, to discover the causes for defects and variations etc. The effects from the application of this methodology have led to: a realization of the defined quality, protection of the buyers/users from defective products, and with that an increase of the competence of the companies on the market, profitability, improving the quality, decrease of the defects and the costs in the work, an increase of the satisfaction and the participation of the employees in the decision making. This points to the fact of a universal application of this methodology in practice independently of a belonging to any economic branch.

Q-as

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