Application of Total Quality Management (TQM) in the Macedonian Railways Transport in the Republic of Macedonia

Elizabeta MITREVA[*], Elenior NIKOLOV[**], Biljana NIKOLOVA[***]

Abstract

The subject of this paper is the design and implementation of the philosophy of total quality management (TQM) in some segments of Macedonian Railways Transport, which produce services of public interest in the Republic of Macedonia, by analyzing the company's business processes and optimizing them to achieve consistently exceeding the growing expectations of service users. Special activities are analyzed in control department of revenue or in business process of data input from the tickets where mistakes are detected on a monthly basis. To this aim, is used the TQM methodology which is based on exploiting the knowledge of all employees and operating teams in the continuous improvement of business processes, including the methods and techniques for faultless operation. The results of this study showed that the application of total quality management in Macedonian Railways Transport not only lead to improvement of service quality, but also increased productivity and cost optimization of quality. In the future, the implementation of this methodology in the company will not only enable satisfaction of service users, but also satisfaction to suppliers, employees and the community.

Keywords: *improvement of quality, control charts, Pareto analysis, Ishikawa diagram, total quality management (TQM).*

1. Introduction

Total quality management (TQM) system is structured to meet the internal and external needs of customers and suppliers by integrating them with the company and improving the business climate, the opportunity for innovation and development, and improving business processes and culture (Mitreva, 2011). In practice, many organizations recognize that the TQM philosophy is to constantly improve the performance of products/services. The commitment of management, focusing on customers, the involvement of all employees in the process, continuous improvement, partnership with suppliers and measuring performance are basic concepts that underpin the philosophy of TQM and are imperative for the survival of companies in the 21st century (Mitreva, et al., 2013).

The application of the integral methodology for designing and implementing TQM system in Macedonian Railways Transport means applying several methodologies: Methodology for the subsystem – internal standardization; Methodology for the subsystem – statistical process control (SPC); Methodology for analyzing the total cost of a given process; Methodology for the subsystem – education; Methodology for evaluating the success of the projected and implemented system on TQM (Audit) (Mitreva, 2011).

Today, however, the success of business processes can not be imagined without the use of computer information systems. Computer systems for its hardware and software content are the basis for rapid transmission of information on the implementation of business processes that are always associated with answers to the questions, who, how, where, when and connection with questions: who – whom that corresponds to the finished works in the enterprise. Through them you get information about the development of standardization, defect-free production, cost analysis as basic pillars of the system with total quality management (TQM) (Mitreva and Chepujnoska, (2007).

2. Research methods and analysis of results

2.1. The need for designing a quality system in Macedonian Railways Transport

The design and implementation of the TQM system in Macedonian Railways Transport are based on many pillars, and one of them is the internal standardization (Mitreva, et al., 2014a). Standard operating procedures are intended to define the flow of all activities for each process and on that basis to define the obligations and responsibilities of each employee. The purpose of these standards is to unify the quality of work of all participants in an operation or process. At the creation of these standards are incorporated expert knowledge of people, their experience and the ability to streamline processes. Thus, on one hand builds the wealth of the company, the other hand creates independence of each new employee from the experience of the preceding (Mitreva, et al., 2014b).

Corporation MZ - Transport is one hundred percent state capital constituted to manage the internal and international market of transport services, according to the directives of the European Union and the criteria of the International Union of Railways (UIC) - Paris for a contemporary rail system.

This company manages the transport equipment for the Macedonian Railways on the principle of sustainability of social values, and in order to provide quality, reliable, economic and environmentally friendly transport services for passengers, goods and services in domestic and international rail traffic.

An attempt by the Macedonian government to improve the quality of public services imposed new focus of activities in the public sector towards meeting the wishes and needs of service users. The philosophy of TQM is established as good practice in the private sector, while in public organizations because of the traditional bureaucracy in market operations revealed a mixed picture of sluggish system.

[*] "Goce Delcev" University, Faculty of Tourism and Business Logistics, Stip, Macedonia.
Correspondent author: Elizabeta Mitreva, E-mail: **elizabeta.mitreva@ugd.edu.mk; elizabeta.mitreva@gmail.com**.
[**] Military Academy – Skopje, Macedonia, E-mail: **elenior.nikolov@ugd.edu.mk**.
[***] "Goce Delcev" University, Faculty of Tourism and Business Logistics, Stip, Macedonia, E-mail: **bibinikol@gmail.com**.

As a result of pressure from the government and the market, the company Macedonian Railways - Transport is moving in the direction of increasing the speed of travel, increasing the capacity of the fleet, increase safety and reduce traffic deviations, harm reduction, cooperation with pre-accession funds for financing of investments from the EU. The design and implementation of the system in TQM in Macedonian Railways - Transport will mean to the company's management with their good will and persistence to engage their human resources by forming teams of all profiles, integrating their knowledge in terms of cost reduction and achieving the required level of service quality, and proactive internal and external communication in order to achieve customer requirements (Mitreva, et al., 2014b).

Model implemented of the quality system in the business processes of the Department for control of revenues (DCR) from the International Union of Railways (IUR)

The business process in department for control of revenue as part of the financial sector works exclusively in regulations according to form for calculation in international passenger traffic prescribed by the International Union of Railways.

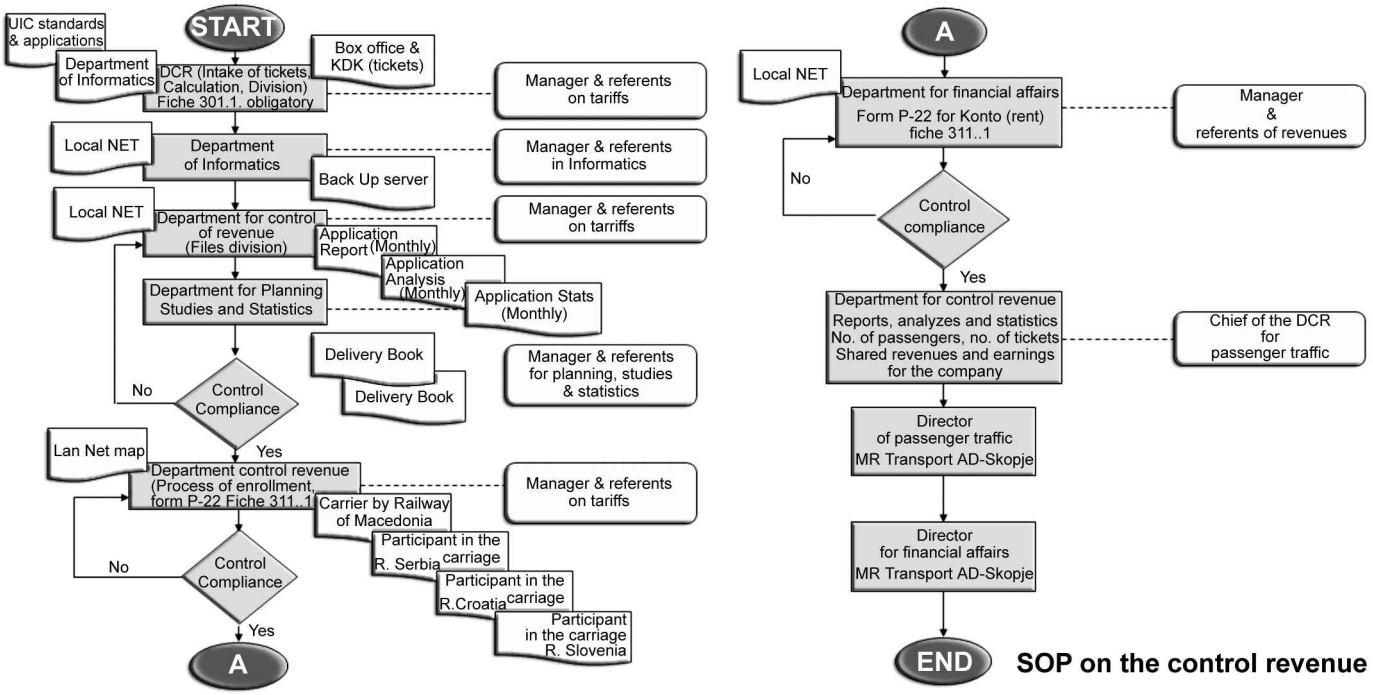

Figure 1. **Standard operating process for revenue sharing other participating shipping**

Starting from this basis, we analyzed the established system of quality in business processes of the department for control of revenue and with corrections and amendments thereof, through the access on QC-CE - Pyramid model, we improved its efficiency and effectiveness (Mitreva, 2011). Figure 1 shows a standard operating procedure for business process in the department for control of revenue, which referred to the documents used in the process, the involved employees, and the possibility for additional comments or explanations indicating the instructions that define the subprocess. The standard operating procedure begins with the planned activity and the input information for the initial state; it continues with the activities of the business process and from every stage receives output information that is input for the next phase; finally, the business process ends with information – a result, Figure 1.

Through QC-CE model for quality we define the obligations and responsibilities of all employees. Thus we created a code of conduct in order to achieve good interpersonal relations. Through the QC-CE - Pyramid model can be standardizing all business processes in the company through standard operating procedures in the form of current cards. Moreover is accomplished vertical and horizontal connectivity between employees, according to the structure of the pyramid (Mitreva, 2011). Thus, quality assurance in the company is followed by the flow of information in accordance with standard operating procedures. The circle is closed by correcting, while to provide an answer to questions: what, who, where, when, to whom gives information with complete supporting documentation in which is precised quality, commitments and responsibilities. To be an effective quality system, though it needs to be defined, it should be well documented.

If we consider only the business process in the Department for control of revenues application of TQM (Total Quality Management) strategy mean improving the quality by examining of the business processes through their defining, their improvement and design, improving the productivity and optimizing the cost of quality. The model is the integration of information technology with the internal standardization of business processes between: the departments of financial management and control of revenues (DCR) and between departments for Informatics and DCR (Mitreva, 2013b).

Department of Informatics – from the International Union of Railways (IUR) receives the encoded applications or software solutions for ticket processing and distributed to all members no later than September 15 of the year. Working teams from the Department of Informatics undertake special codes and adapt, translate for the company's needs. Departments in other sectors working on applications received from the Department of Informatics etc.

Such existing built on information system is good and provides quality data management but the problem is that the information do not come on time, but are delayed and is reduced ability to intervene in time on the business process. While standard operating process is prescribed by IUR and applications made by IT teams used by the referents of the DCR, are observed mistakes in the report for input data that make the process unstable. It should therefore the involvement of all employees in discovering the causes and the corrective measures. Therefore it should be applied appropriate methodology for methods and techniques for faultless

production and methodology for optimizing the costs (Arsovski, 2002). This methodology offers exactly the support of top management, acquired due presenting the results of the implementation part of the methods and techniques in this company, as well as involvement and commitment of every employee, because just the executors of the processes are those that are improving them (Oakland, 2000).

The performances of the results in the Department of Control of revenue are analyzed on a monthly basis and are defined in the document on measured key indicators (Key Performance Indicator) and for which the records are kept by fiscal year. Based on these analyzes were undertaken steps to address the cons, and the document was used for further reporting and determining the needs in the next fiscal year.

Through the application of the methodology for the methods and techniques for faultless production is found that the process "verification of data entry application" makes mistakes which should be corrected (Beskese and Cebeci, (2001). Through Pareto analysis can be seen most influential reasons for deviations. Data were collected in the check list by type of ticket which made mistakes, Table 1, Figure 2.

Table 1. **Types of mistakes made by ticket type in input data train tickets**

No. of steps in process division	Data entry of train tickets	Mistakes	Total number of mistakes	Percentages
10	Kilometers – km;	50	50	27.17%
5	Class - I or II;	40	90	48.91%
6	Price	30	120	65.22%
13	No. of ticket	15	135	73.37%
2	Way station - (via);	10	145	78.80%
3	Referral station – to;	9	154	83.70%
8	Type of train	8	162	88.04%
11	Exact share	7	169	91.85%
12	Code of the KDK	5	174	94.57%
7	Benefit	4	178	96.74%
4	Direction - 1 or 2	3	181	98.37%
1	Starting station - from;	2	183	99.46%
9	Number of train;	1	184	100.00%
		184		

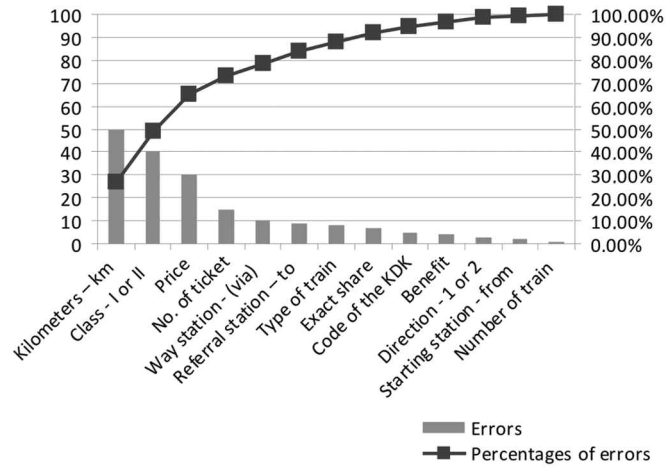

Figure 2. **Pareto diagram of mistakes in data entry of train tickets**

To discover the reasons for the problems, it is applied Ishikawa diagram with an emphasis on "the processes" or the place where you need to make changes to improve the performances of the process (Casadesus and Gimenez, (2000). With detailed consideration of the process have revealed the crucial causatives in response to the question: who, what, where, to whom, when wrong, Figure 3.

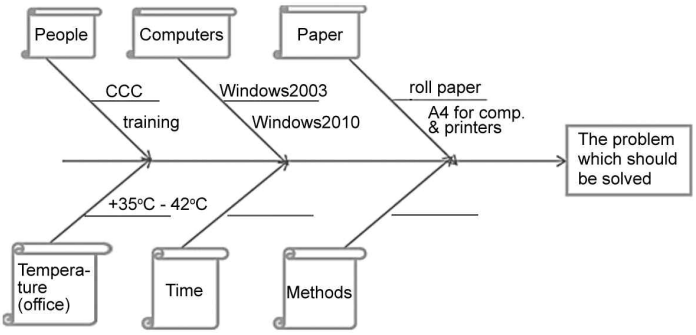

Figure 3. **Causes-and-effects diagram (Ishikawa diagram) to establish the crucial causatives of mistakes**

With detailed analysis penetrated into essence of the problems in the area of standard operating process in that is emerging mistakes resulting instability of the operating system. Resolving the problems is not a complicated method and requires a new way of thinking and using a simple tool (Mitreva and Prodanovska (2013). The objective is finding the real cause of the problem and preventing recurrence of the same. Best results are achieved when this tool was applied by team which is directly involved in the operational process. The team leader with the members identified the following causatives:

- employees – due to the different education and culture, and lack of training;
- technology – due to the different software – applications Windows 2003 and 2010;
- materials (paper, which is printed on standard A4 or roll);
- working environment (rooms without air conditioning);
- time (speed for inputting data or different training) and
- use of different methods in the business process.

The combination of the model QC-CE pyramid model gives the choice of solution or defines the responsibilities of each employee in the company and enhances collaborations between employees revealing their rules of behavior (Mitreva, 2011). Why it is needed a structured process in resolving problems? Structured methodology establishes a standard practice and is effective for improvement of the Product and Process as well as daily activities. Besides that it used facts and focuses on the origin of the problem by finding the original cause. The analysis is completed with proposed corrective measures and defining the responsibilities of each employee in the business process by creating internal coordination and cooperation. With the implementation of new solutions that are adopted as a standard, is applied the control card, as a tool for monitoring the stability of the process, Table 2 and Figure 4.

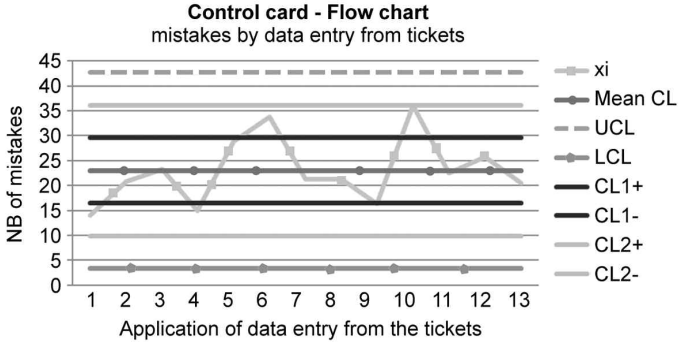

Figure 4. **Control card**
Flow chart of data entry from tickets

Table 2. **Types of mistakes made by ticket type in input data of train tickets**

No. of steps in process "Division"	Data entry of tickets	Application error **A**	Application error **B**	Application error **C**	Application error **D**	middle mistake **xi**	Mean CL	UCL	LCL	CL1+	CL1-	CL2+	CL2-
1	Starting station	6	12	32	6	14	23.00	43.00	3.00	29.67	16.33	36.34	9.66
2	Intermediate station (via)	25	18	25	15	20.75	23.00	43.00	3.00	29.67	16.33	36.34	9.66
3	Referral station	17	33	21	22	23.25	23.00	43.00	3.00	29.67	16.33	36.34	9.66
4	Direction 1 or 2	7	15	27	11	15	23.00	43.00	3.00	29.67	16.33	36.34	9.66
5	Class 1 or 2	35	23	15	42	28.75	23.00	43.00	3.00	29.67	16.33	36.34	9.66
6	Price	50	35	28	22	33.75	23.00	43.00	3.00	29.67	16.33	36.34	9.66
7	Benefit	11	24	31	19	21.25	23.00	43.00	3.00	29.67	16.33	36.34	9.66
8	Type of train	15	22	37	11	21.25	23.00	43.00	3.00	29.67	16.33	36.34	9.66
9	Number of train	19	8	26	12	16.25	23.00	43.00	3.00	29.67	16.33	36.34	9.66
10	Kilometers - km	40	50	33	21	36	23.00	43.00	3.00	29.67	16.33	36.34	9.66
11	An accurate share	21	35	9	25	22.5	23.00	43.00	3.00	29.67	16.33	36.34	9.66
12	Cipher KDK	9	16	41	37	25.75	23.00	43.00	3.00	29.67	16.33	36.34	9.66
13	Number of ticket	25	15	9	33	20.5	23.00	43.00	3.00	29.67	16.33	36.34	9.66
						23.00							

By monitoring process application data entry tickets by using the control card can be seen that all points lie in the control limits, and alternately deployed symmetrically around (CL). And the process is stable.

3. Conclusions

The analysis from the practice has shown that the application of the methodology for total quality management in Macedonian Railways Transport lead to increased effectiveness and efficiency of the center. In this way the traditional model of evolution of business processes where are measured the mistakes, the omissions and the reclamations, in this center is offered preventive, proactive work.

Macedonian Railways Transport, the benefits from the application of the methodology for the design and implementation of TQM system, looks at:

- ❑ the application of internal standardization improves the staff's responsibility in the implementation of business processes;
- ❑ the application of statistical methods and techniques shrink defects in operation and is a significant benefit, especially when looking for quality at the lowest fixed costs of operations;
- ❑ application software packages increases efficiency in the application of statistical methods and techniques;
- ❑ by analyzing the cost of quality can be controlled losses and to reduce them to the minimum in terms of consumption of materials and energy.

Without commitment of the top management to set goals for quality and consistency in their implementation, all these efforts will only be spending time and money, while at the same time will reduce the possibility of success in the following such an initiative.

This methodology is an integral and universal meaning that is applicable to all companies regardless of the industry they belong to, and the success of its implementation will depend on, only if it is achieved the integration of information technology with Inter standards, methods and techniques for faultless production, system cost analysis and continuous education and motivation of employees to provide competitive advantage (Mitreva, 2011). The integral methodology for designing and implementing TQM system has feedback resulting from the necessity of permanent improvement of business processes. By repeating or spiral repeating of these cycles will be seen the benefits of the application, thereby is changing organizational culture to such initiatives and represent an incentive to higher goals of excellence.

TQM strategy to be introduced in all forms, it is necessary constantly learning about new approaches to the quality. The implementation of TQM philosophy in companies shows the level of awareness of leadership and level of development of culture of employees (Chepujnoska and Mitreva, (2008). Reforms by the Government visibly are changing the working culture of the public sector to continuously improve the quality of services to citizens. **Q-as**

References

[1] **Mitreva, E.** (2011), *Model-integral methodology for successful designing and implementing of TQM system in Macedonian companies*, International Journal for Quality Research, 5(4), pp. 255-260.

[2] **Mitreva, E., Taskov, N., Kitanov, V., Filiposki, O. & Boskov, T.** (2013a), *The Need for Information System Design in Building a House of Quality*, International Journal of Pure and Applied Sciences and Technology, 16(1), pp. 26-33.

[3] **Mitreva, E. & Chepujnoska, V.** (2007), *Application of the Total Quality Management concept (TQM) in managing company's information*, Economic development, Skopje, 9(3), pp. 297.

[4] **Mitreva, E., Taskov, N. & Lazarovski, Z.** (2014a), *The need for the design and implementation of TQM system for the airport services TAV Airports Holding*, Macedonia, in: 8th International Quality Conference, 23 May 2014, 8th IQC, Center for Quality, Faculty of Engineering, University of Kragujevac.

[5] **Mitreva, E., Taskov, N. & Crnkovic, S.** (2014b), *Application of methodology for business process improvement in specialized diagnostic laboratory*, Quality - Access to Success, 15(141), pp. 91-95.

[6] **Mitreva, E.** (2013b), *The superior customer's value of the new economy implemented within Macedonian companies*, International Journal for Quality Research 7(2), pp. 215-220.

[7] **Arsovski, S.** (2002), *Management of quality economic*, Kragujevac.

[8] **Oakland, J. S.** (2000), *Total quality management – Text with cases*, 2nd edition, Butterworth Heinemann.

[9] **Beskese, A. & Cebeci, U.** (2001), *Total quality management and ISO 9000 applications in Turkey*, The TQM Magazine, 13(1), pp. 69-73.

[10] **Casadesus, M., & Gimenez, G.** (2000), *The benefits of the implementation of the ISO 9000 standard: empirical research in 288 Spanish companies*, The TQM Magazine, 12(6), pp. 432-441.

[11] **Mitreva, E. & Prodanovska V.** (2013), *The Management Teams are a Unique Business Potential that can Initiate*, *Identify and Manage Change within the Organization*, in: Applied Social Sciences: Administration and Management, Cambridge Scholars Publishing, Newcastle upon Tyne, UK, pp. 57-65.
[12] **Chepujnoska, V. & Mitreva, E.** (2008), *Methodology for optimization of the quality costs*, Economic development, Skopje, 10(1), pp. 213.
[13] **Mitreva, E., Taskov, N., Sazdova, J., Gjeorgieva, I. & Gjorshevski, H.** (2015a), *The Need for Implementation of Integrated Management Systems (IMS) in Macedonian Companies*, Quality - Access to Success, 16(147), pp. 62-65.
[14] **Mitreva, E., Taskov, N. & Angeleski, M.** (2015b), *Approaches for the Advancement of Business Processes in a Company that Deals with Graphic Production*, Actual Problems of Economics, 6 (168). pp. 190-201.
[15] **Stoiljković, V., Uzunović, R. & V. Majstorović, V.** (1996), *Q-tools*, CIM College, The Faculty of Engineering Nis, www.CIMCollege.co.yu/QMS.
[16] **Deming, W. E.** (1996), *Kako izaći iz krize*, PS Grmeč, Beograd, pp. 30.
[17] **Kanji, G. K.** (1998b), *An innovative approach to make ISO 9000 standards more effective*, Total Quality Management, 9(1), pp. 67-78.
[18] **Nakata, Ch.** (2002), *Activating the marketing concept in a global context: An MNC country managers' perspective*, International Marketing Review, 19(1), pp. 39-64.
[19] **Prodanovska, V. & Mitreva, E.** (2012), *Incorporation, authorization and encouragement of the employees in order to improve the quality of the educational process*, in: Two decades of academic teaching, 18-19 June, Timisoara, Romania.
[20] **Sohal, S. A., Abed, H. M. & Keller, Z. A.** (1990), *Quality assurance: Status, structure and activities in manufacturing sector in the United Kingdom*, Quality Forum, 16(1), pp. 38-49.
[21] **Stenberg, M.** (1999), *Implementation of statistical process control and process capability studies: requirements or free will?*, Total Quality Management, 10(4-5). pp. 439-446.
[22] **Taguchi, G. & Clausing, D.** (1983), *Robust quality*, Harvard Business Review, 64(4), pp. 65-75.