

## **Difficulties in ISO 9001 implementation in Manufacturing and Service Organizations: Empirical Evidence from Serbia-Montenegro**

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**Abstract:** *We have tried in this paper over an original data set, to quantify the problems faced by firms from Serbia-Montenegro during the implementation of ISO 9001 and to check statistically if firms from the manufacturing and the service sectors faced the same type of problems. Two main results can be drawn from our paper. Firstly we show that firms from Serbia-Montenegro mainly faced «training and efficiency» related problems. This result makes sense since it seems that firms from Serbia-Montenegro unfortunately do not involved their employees in the certification process while it is one the main request of the 6.2.2 of the ISO 9001 standard. Secondly, we show that manufacturing and service firms faced the same types of problem except for the “infrastructure related problems”. This result makes also sense since it reveals the fact that in Serbia-Montenegro, infrastructure is more present in manufacturing sector than in service one.*

**Keywords:** *ISO 9001 certification, manufacturing sector, service sector*

### **1. INTRODUCTION**

Development of ISO 9001 standard since the period of eighties during the last century until the actual version from 2001, namely structurally unchanged version from 2005, has resulted in a four-level modular division. Every module has specified requests that organizations have to meet in order to fulfil certification conditions and every module represents separate entities wherein various researches can be performed. On the other hand, organizations operate in conditions of contemporary information achievements with an increasing accent on implementation, usage and storage of knowledge. Significance of knowledge is also stressed through the phrase “explosion of attention to knowledge” with its influence on management, organization and strategy. Growths of competence and possible

approaches to organization have been linked up with the knowledge economy during several last years [1,2]. Some researches indicate that regarding knowledge, organization of knowledge creates an enormous advantage in the market [3, 4, 5]. These premises are also joined by premises stated in [6, 7], where knowledge is being characterized as one of the most critical resources that helps organization in acquiring competitive advantage at the global market. In accordance with that, some prognoses based on researches stated in [8] indicate that in the 21<sup>st</sup> century certain jobs related to knowledge (e.g. jobs of professionals and managers), shall participate with 25% in total work force. [9] also states that 40% of organizations that implement knowledge management shall introduce a position of director of knowledge management sector who shall manage that system. In order to implement knowledge and in order to have an

effective and efficient operation of the organizational system, it is necessary to provide conditions of infrastructure and working environment. It implies provision of adequate stowage areas for performance of all organizational activities and provision of necessary hardware and software. All previously stated elements are related to module 6 of the standard and requests for provision of human resources, infrastructure and working environment. Precisely, that is the reason why this paper includes a research realized exactly in the area of a module for resource management with a purpose to draw conclusions relating significance of the stated requests and provide conditions for improvement. An additional reason for research in this area is the fact that area of human resources from the aspect of management of inconsistencies, i.e. problem incidence, occurs as the critical one in a part of the whole ISO 9001 model [10]. According to the same research, it has been observed that problems in the part of module 6 by vary frequency and type subject to activity of the organization (productive and service), as well as in the part of subtypes of these activities. Therefore this paper has a goal to point to specificities of individual elements of this module in relation to activity of the organization.

## 2. DATA AND MODEL SPECIFICATION

For effective design and implementation of ISO 9001, the management attitude is crucial and can be understood by examining senior management commitment and support, appropriate quality policy and regular management reviews. The establishment and implementation of ISO 9001 is a long-term program involving the participation of employees from all levels and all functions within an organization. Therefore, it is essential to have total commitment and support from senior management and employees to initiate the development and implementation of an effective quality program. We understood that the essential factors for successful implementation of ISO 9001 are mostly related to employees, as the majority of our variables will present employees' characteristics.

### 2.1. Database and descriptive statistics

The database we use was collected in 2004-2005 by two certification bodies of Serbia-Montenegro (YUQS and Savezni zavod za standardizaciju) and put under a SAS and Excel format by the Center for Quality of Podgorica (Montenegro). This data set is reliable since firms pay for an audit of their ISO certification. This data set allows us to understand which types of problems are usually present (during and after the implementation of ISO 9001) in the manufacturing sector and in the services sector in Serbia-Montenegro. We have divided these problems in four groups: the resource related problems, the training and efficiency related problems, the infrastructure related problems, and the working environment related problems.

**The resource related problems** contain two subgroups: *resource ownership* and *resource accessibility*.

**The training and efficiency related problems** present the characteristics of human resource capital. The vast majority of quality experts and researchers seemed to agree that human resource issues are at the core of quality philosophy and employee involvement and commitment is essential for successful introduction of ISO certification. This second group of problems includes four subgroups: *training and efficiency*, *assessment efficiency*, *awareness and motivation*, and *procedures and records of training*. Continuous training and education in work-related and statistical techniques present the basic steps for successful acceptance of ISO certification by employees. In the literature we can find that there are significant differences between manufacturing companies that perform better than service companies in providing employees with more training in basic and advanced statistical quality techniques, devoting more resources to employee training, implementing more effective employee involvement programmes, and giving employees more responsibility for the quality.

**The infrastructure related problems** include three sub-groups: *adequate infrastructure*, *infrastructure control*, and *procedures and records related with previous certification*.

Finally, **the working environment related problems** include three sub-groups: *appropriate working environments, managing working environments in appropriate ways, and procedures and records related to previous certification.* Only if a company respects all of these working conditions will employees be able to understand the importance of ISO certification for companies in general but also for themselves.

More information about these four groups is available from the below table 1.

Table 1. Dictionary

<b>THE RESOURCE RELATED PROBLEMS (PROBLEM 1)</b>	
<i>Resource ownership</i>	Firm reports a resource ownership problem if there is no record list about organisational and supplier's resources.
<i>Resource accessibility</i>	Firm reports a resource accessibility problem if employees do not have access to some resources necessary for their work.
<b>THE TRAINING AND EFFICIENCY RELATED PROBLEMS (PROBLEM 2)</b>	
<i>Training efficiency</i>	Firm reports a training efficiency problem if there is no evaluation system about the training system within this firm.
<i>Procedure efficiency</i>	Firm reports a procedure efficiency problem if there is no estimation about procedure efficiency required by the quality system.
<i>Awareness and motivation</i>	Firm reports an awareness and motivation problem if there is no strategy to motivate the employees.
<i>Training Procedures and records</i>	Firm reports a problem concerning the training procedures and records if there is no record about training of employees that is required by the quality system.
<b>THE INFRASTRUCTURE RELATED PROBLEMS (PROBLEM 3)</b>	
<i>Adequate infrastructure</i>	There is no adequate infrastructure.
<i>Infrastructure control</i>	There is no infrastructure control that is required by the quality system.
<i>Procedures and records related with previous certification</i>	There are no infrastructure records for the previous implementations of quality system inside the firm.
<b>THE WORKING ENVIRONMENT RELATED PROBLEMS (PROBLEM 4)</b>	
<i>Appropriate working environments</i>	There is no adequate working environment.
<i>Managing working environments in appropriate ways</i>	There is no responsible to monitor the working rules required by the quality system (that will be for instance the case if employees on elevator do not wear helmet as prescribed by procedures).
<i>Procedures and records related to previous certification</i>	There are no working environment records for the previous implementations of quality system inside the firm.

Our database includes 103 ISO 9001 certified firms, 57 from the manufacturing sector (55%) and 46 from the service one (45%). We have also the size of these firms. However for the sake of simplicity, we have defined three dummy firm size variables: *small size companies* include firms whose number of employees is less than 50 employees, *medium size companies* are firms having a number of

employees between 50 and 250, and *large size companies* are companies with more than 250 employees. Important to mention that adoption of ISO 9001 certification has positive correlation with company's size (see [11] for the case of France).

We are now able to analyse Table 2 that provides some descriptive statistics.

Table 2. Descriptive Statistics

	<i>Companies in manufacture industry</i>	<i>Companies in service Industry</i>
<b>Company's size (a)</b>		
<i>Less than 50 employees</i>	26%	33%
<i>50 to 250 employees</i>	21%	28%
<i>More than 250 employees</i>	53%(a)	39%
<b>Problem 1-Resource</b>		
<i>1 No problem</i>	96%(b)	100%
<i>2 Resource Ownership</i>	2%	0%
<i>3 Resource Accessible</i>	2%	0%
<b>Problem 2- Training and efficiency</b>		
<i>1 No problem</i>	49%	41%
<i>2 Training efficiency</i>	7%	15%
<i>3 Assessment efficiency</i>	4%	7%
<i>4 Awareness and motivation</i>	7%	4%
<i>5 Procedures and Records of Training</i>	33%	33%
<b>Problem 3- Infrastructure</b>		
<i>1 No problem</i>	75%	63%
<i>2 Adequate infrastructure</i>	9%	17%
<i>3 Infrastructure control</i>	5%	0%
<i>4 Procedures and Records</i>	11%	20%
<b>Problem 4- Working Environment</b>		
<i>1 No problem</i>	75%	83%
<i>2 Appropriate working environment</i>	18%	13%
<i>3 Manage working environment on appropriate way</i>	7%	2%
<i>4 Records related with previous certification</i>	0%	2%
<b>Total number of companies</b>	57	46

Source: YUQS & Savezni zavod za standardizaciju, 2004-2005 Audit evaluation database of 103 companies from Serbia-Montenegro.

Lecture: (a) 53% of companies in manufacturing industry have more than 250 employees.

(b) 96% of companies in manufacturing industry report no problem regarding the first type of problem.

Table 2 shows that the majority of companies in both sectors are concentrated in the category of big companies, 53% for the manufacturing sector and 39% for the service sector.

Furthermore according to Table 2, the resources type of problems does not seem to be an important issue. Indeed no company from the service sector has reported this type of problems and in manufacturing sector, only two firms have reported such a problem (with respectively one firm concerning the resource ownership and one concerning the resource accessibility).

The figures from the category “training and efficiency related problems” suggest that:

- [1] many firms faced such a problem : 51% of the manufacturing firms and 59% of the service firms;
- [2] the problems mainly concern “procedures and records of training”: 65% of all “training and efficiency” problems faced by manufacturing firms and 56% of all “training and efficiency” problems faced by service firms.

Concerning the infrastructure related problems, we can see that:

- a) respectively 25% and 37% of the manufacturing firms and of the service firms have reported this type of problems.
- b) under the sub-groups “adequate infrastructure” and “procedures and records”, firms from the service sector report more problems (comparing to manufacturing firms).
- c) however, firms from the service sector do not report any problem relating the sub-group “infrastructure control”.

Finally, for the working environment related problems, the results imply that:

- a) respectively 25% and 17% of the manufacturing firms and of the service firms have this kind of problems.

- b) manufacturing firms report more problems for each sub-group, except for the sub-group “recording previous experience with certification”.

## 2.2. Results and discussion.

Another objective of our paper is to answer whether there is a significant difference between the manufacturing and the service sectors concerning our four categories of problem. The descriptive statistics from Table 1 seem to drive the conclusion that this difference exists.

In order to provide a clear-cut answer to this question, we run the NPAR1WAY procedure using SAS software. The NPAR1WAY procedure performs nonparametric tests for location and scale differences across a one-way classification. This procedure provides several non-parametric tests however we choose to present the Wilcoxon test. Given the relatively small size of our data set, we will compute the so-called Exact Wilcoxon test that, on the contrary of classical Wilcoxon test, is more suitable for “small” size sample.

Let us briefly present this test. Suppose the data consist of  $N$  observations that are classified into two levels:  $n_1$  observations in the first population with distribution function  $F_1$  and  $n_2$  observations in the second population with distribution function  $F_2$ . The Wilcoxon test (called also the Wilcoxon-Mann-Whitney scores test) compares the two distributions for a shift in location. That is to say, to test *either*:

$$H_0 : F_1(w) = F_2(w), \text{ whatever } w$$

$$\text{versus } H_1 : F_1(w-\theta) = F_2(w), \text{ whatever } w$$

or to test :

$$H_0 : F_1(w) = F_2(w), \text{ whatever } w$$

$$\text{versus } H_1 : F_1(w+\theta) = F_2(w), \text{ whatever } w$$

where  $\theta$  is an arbitrary shift parameter.

Let us consider a random sample from each of the two populations:  $X_1, \dots, X_{n_1}$  and  $Y_1, \dots, Y_{n_2}$ . The Exact Wilcoxon test is easy to compute by the following way:

1) Combine and arrange the N observations in an increasing order and assign rank  $R_j$  to the jth observation.

2) Calculate the statistic  $S = \sum_{j=1}^N c_j R_j$ , where  $c_j$  is an indicator denoting the class (0 or 1) to which the jth observation belongs.

3) State a level  $\alpha$  of significance and compute the one-side p-value  $p_1$  defined as:

$$p_1 = \Pr(Z \geq S) \text{ if } S > E(Z)$$

$$p_1 = \Pr(Z \leq S) \text{ if } S \leq E(Z)$$

Where Z is the test statistic (for instance Z has a standard normal distribution) and

$E(Z)$  is the expected mean of Z.

4) If  $p_1 < \alpha$  then rejection of the null hypothesis  $H_0$ .

The estimation results are presented in the below Table 3.

Table 3. Problem sensibility on the two sectors (Exact Wilcoxon test)

	One sided p-value
<b>Problem 1-Resource</b>	0.30
<b>Problem 2- Training and efficiency</b>	0.36
<b>Problem 3- Infrastructure</b>	0.08
<b>Problem 4- Working Environment</b>	0.21

Source: YUQS & Savezni zavod za standardizaciju, 2004-2005 Audit evaluation database of 103 companies from Serbia-Montenegro.

From the table 3, we can see that over the four types of problem there a significant difference (at the  $\alpha=0.1$  level of significance) between the manufacturing and the service sectors only concerning the infrastructure related problems (problem 3).

### 3. CONCLUSION

We have tried in this paper over an original data set, to quantify the problems faced by firms from Serbia-Montenegro during the implementation of ISO 9001 and to check statistically if firms from the manufacturing and the service sectors faced the same type of problems.

Two main results can be drawn from our paper. Firstly we show that firms from Serbia-Montenegro mainly faced «training and efficiency» related problems. This result makes sense since it seems that firms from Serbia-Montenegro unfortunately do not involved their employees in the certification process while it is one the main request of the 6.2.2 of the ISO 9001 standard.

Secondly, we show that (using the Exact Wilcoxon test) manufacturing and service firms faced the same types of problem except for the «infrastructure related problems» (problem 3). This result makes also sense since it reveals the fact that in Serbia-Montenegro, infrastructure is more present in manufacturing sector than in service one.

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