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IMPACT OF QUALITY AND SAFETY PRODUCT ON COMPETITIVENESS

Abstract: *This work should indicate how an integrated approach to continuous improvement of quality and safety of products affecting the competitiveness goals as product and company. The impact of Quality Management System (QMS) and compatibility with the requirements of the New Approach Directives (the CE mark) we conducted in three directions.*

First we developed a model that includes all the essential steps. By using the modeling method of the complex dynamic system, three macro variables are determined in the model. Each of the macro variables has its structure, variables in the in order to research the practical impact of QMS and CE mark on the competitiveness of enterprises in Serbia, we created a questionnaire on the basis of established models. On the results we apply methods of statistical analysis. In order to further research mentioned impacts on the competitiveness of products in Serbia, we have created a simulation software.

This paper presents some of the results that have a dominant impact on competitiveness. From all this we can conclude that the implementation of QMS and CE creates a positive image of the product on the market, and enables the growth of profits and the competitiveness of organization.

Keywords: *competitiveness, quality, safety, CE mark, QMS*

1. Introduction

This work should indicate how an integrated approach to continuous improvement of quality and safety of products affecting the competitiveness goals as product and company. The impact of Quality Management System (QMS) and compatibility with the requirements of the New Approach Directives (the CE mark Bently, 1999) we conducted in three directions.

First we developed a model that includes all the essential steps. By using the modeling method of the complex dynamic system, three macro variables are determined in the model. Each of the macro variables has its structure, variables in the in order to research the practical impact of QMS and CE mark on the competitiveness of enterprises in Serbia, we created a questionnaire on the basis of established models. On the results we apply methods of statistical analysis. In order to further research mentioned impacts on the competitiveness of products in Serbia, we have created a simulation software.

This paper presents some of the results that have a dominant impact on competitiveness (Chen et al., 2017; Kaplan and Norton, 2008,

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Stefanikova, 2015; Vandegrit and Duke, 2015). From all this we can conclude that the implementation of QMS and CE creates a positive image of the product on the market, and enables the growth of profits and the competitiveness of organization.

2. Background

Since the civilization, the man is a social being that lives in communities and who through the division of labor, executes one of the activities whether it is hunting, or making of tools, dishes and weapons... In all cases the user determines whether and to what extent its requirements are met, or to what extent the level of quality is achieved. The needs of the man or society, as a whole, are becoming bigger and bigger by the development of human civilization and his response becomes more complex.

Regardless of the current definition, the quality has evaluated over time and had the different meanings. All finished products would be controlled and all faulty products would be eliminated. Since the beginning of the Second World War, in 1940, the statistical quality control has been in use. The statistical quality control pioneers, Shewhart and Dodge, developed the idea that every productions process is subjected to a certain impact of natural variations, (stochastic - random) changes. Because of that the business of a manager, who is responsible for the quality control, is to detect the degree of changes by using statistical methods as well as to ensure the stability of the production process. In the 1960, except the production, the other function organizations were in charge and responsible for the quality and in that way the concept of integrated total quality control is launched.

The quality became the key phenomenon of the late 20 century and according to some opinions it became the basic paradigm of business. Its promoters have long been American scientists: V. Edvards Deming, J.

M .Juran, A. V. Feingebaum and Ph B. Crosby (Oakland and Oakland, 2004). In the mid-fifties of the twentieth century many companies realized that the effective manufacturing and strong production did not guarantee that the customs want, would buy the product. They realized that they must find out what customers want, and then to produce it, instead of producing the product first and then to try to adapt the needs and desires of the customer to what they produced. Instead of focusing on product selling, the company is been directed to meeting the needs and desires of customers. The best way to discover the customer needs is to become the customers ourselves. In a stunning percentage, people are buyers themselves. Being a user of an own product means to have a direct access to information, how the customer spends vis time, with what ne is unhappy and whole are his unsolved problems.

Nowadays, on the world market, the quality plays the key role in developing new markets and maintaining the existing ones. The basic customer requirements are related to the product quality and services that include suitability for use, safety and the proper value for money. However, providing true quality requires much more than good advertising, promise or good intention. The traditional ways of achieving light product quality are no longer acceptable. The streamlined, better, more efficient way, that is nowadays applied, is to establish a quality management system according to the standard ISO 9001:2015.

There was a widespread belief that the quality of the product is the only key to gaining competitive advantage. However, to respond to the requirements and challenges of customers, is necessary to increase the safety of the product until it ensures compliance with the applicable regulations and standards.

“The product safety” is related to the physical health and citizen’s safety with regard to non-food products, such as toys,

households, cars and cosmetics etc. Customers must be sure that the product, they use, consume or simply come into contact with them are safe and pose no danger to their health and physical safety.

New Approach Directives help manufactures to improve product reliability, and to deliver high quality products and finally give consumers confidence that the products they buy are safe and ready for use (Kettunen et al., 2015; Schuh et al., 2017). New Approach Directives advocate for the safety of consumers by helping to reduce and totally eliminate potentially unsafe products, before you can find them on store shelves or they arrive in our homes. Achieving this aim requires cooperation that goes beyond the responsibility of individual produce. Safe products can only be provided when all stakeholders work together (producer, Government, trades, consumer groups, as well as individual consumers).

There are many definitions of the product and safe product, but the most valid definition is given in the Directive on general product safety 2001/95/EC, according to which the mentioned terms have the following meanings:

- every product is a final product, including, the product in connection with the provision of services, that is supplied in performing activities or made available to consumers or some her user, with or without charge, regardless of whether it is new, used or rebuilt, except of the used product that is being delivered as antiques, as well as the product that should be repaired or remodeled before using, providing that the supplier in advance, clearly informs the person the person to whom supply such products;
- safe product means any product, which, under normal or reasonably foreseeable conditions of use including the period in which

the product is used, as well as commissioning, installation and maintenance requirements with respect to, when it's necessary, does not represent any risk or just represents the minimum risk that is appropriate to the product use and which is considered to be acceptable and compatible with the high level of protection of consumer health and safety and other users.

The product quality is a multidimensional term that includes: functionality, reliability, durability, accuracy, ease of operation, reversibility, and other properties that determine the ability of the product to meet the particular needs of consumers. Characteristics that determine the quality are also one of the most important instruments of product positioning in "Consumer minds". The quality is the one of the most important determinants of the company profitability.

The impact of product quality on competitive advantage is twofold. First, providing high product quality increases the value of such products in the eyes of the customers. This enables the customer loyalty, which is in direct proportion to the product quality. Loyalty to a particular product brand is highly effective barrier to other similar input producers, which leaves room for companies in the industry to increase the price of such products, especially since the products that are differentiated by quality that others, have lower price elasticity. Other high – quality impact on the competitive advantage of the company is derived from a high efficiency, and lower costs achieved from concerns about product quality. In fact, avoided costs due to poor product quality, such as reject, finishing, deadlock, re-inspection, repairs after complaints, legal responsibility for quality, loss of market share, loss of company reputation, and similarly, directly lower product cost.

Product safety can be seen as a partial goal in the context of business goals in companies and wider, in the selection of suppliers or within the supply chains and company networks. Modeling and analysis of product safety is done by using the appropriate information and communication technology, which includes mobile learning.

Therefore, safe and quality products contribute, in two ways, to the competitive company advantage: through the market company position, that provides a high sales price, and through internal efficiency, that provides low production cost (Liu et al., 2011; Mitani, 2014)

Under the present conditions of increased competition it isn't enough that product meets all consumer requirements, but the quality management is being looked for, which includes not only the inspection and maintenance of a fixed level of quality, but also a continuous improvement of both quality and product safety, preventing the occurrence of irregularities and non-compliance with the requirements of the directives and standards (Montgomery and Borror, 2007; Priede, 2012).

3. Development of a model quality and product safety in the function of competitiveness

Goal and framework

The goal of this work is to explain an integrated approach of continuous improvement of product quality and product safety impacts on competitiveness, the example of good practice and experience in a number of different organizations. This work may be relevant to all organizations which wish to adopt a continuous improvement of product quality and safety through the processes of design and production.

Basic hypothesis

Starting points for the development of this work are based on the application of systems theory, especially models and simulations of

certain dynamic, economic and organizational systems. Based on these grounds when writing this work the following hypothesis will be used:

- H1:** The improvement of product quality and safety through compliance with the applicable regulations and standards affecting the increase of competitiveness;
- H2:** Implementation of quality management system and compliance with the new Approach directive requirements affect the increase in the level of customer satisfaction, as well as the increase in the level of competitiveness, what makes a positive image of the company on the market and thereby enables an increase in revenues of the organization and increases the gross national income of Serbia industry.
- H3:** Investing resources in the implementation of the management system and obtaining the CE mark for goods, has a high rate of return.

Used methods

For the purpose of research, we developed a model of product quality and safety in the function of competitiveness. This model has become the subject of a review in practice.

Based on a model, a questionnaire is made. Methods statistical analysis are applied to the results. At the end of the research a simulation software was developed to determine the influence of product quality and safety on company competitiveness.

Model

With regard to the subject of research with a large number of aspects that need to be integrated, the need was identified to develop a Model to assess the impact of product quality and safety on product

competitiveness, as well as the competitiveness of our companies.

The model developing started from the fact that the buyer is not the only party to meet or “delivery” of excellence. The company must meet the needs of the community that surrounds it employees, society and the needs of countless other stakeholders (Sterman, 2000; Kline, 2011; Kaplan and Norton, 2008). In order to examine the impact of product quality and safety in competitiveness of Serbian products and the products in whole, and according to trained literature, there is a developed model that needs to point to the current level of competitiveness of enterprises, that have implemented international standards, and whose products are in compliance with the requirements of New Approach Directives.

By using the modeling method of the complex dynamic system, three macro variables are determined in the model, the

next:

- 1) The level of product quality,
- 2) The level of product safety,
- 3) The level of the competitiveness of enterprises.

Each of the macro variables has its structure, variables in the model. The model, shown in the figure 1, gives the impact of the setting of the ISO standards and New approach Directive on competitiveness of products and enterprises in whole, that is based on existing and accepted activities in the process of implementing quality system, and product compliance with the requirements of New Approach Directives and process of achieving CE mark. Model interprets the common elements - characteristics that companies should take into account in these processes. Model is based on empirical research, which provides details of all properties and relations involved in the model.

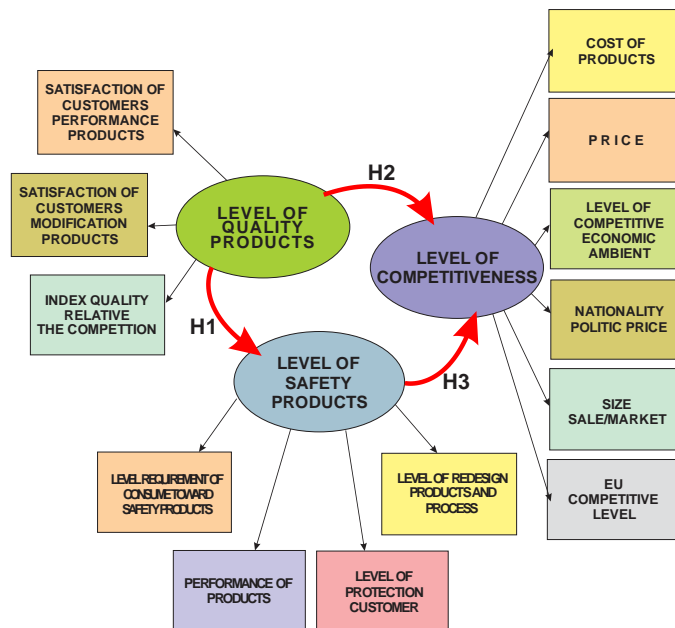


Figure 1. Model of the impact the quality products and safety products on the competitiveness of enterprises

After the problem had been identified, which is the subject of a research, variables were defined – characteristics that describes it,

their initial values, as well as depending relations among them. Based on the set model, weather parameters are chosen (10

year) as well as space parameters (Serbia), in which it will be considered the dynamic behavior of the system. Control variables are defined (the level of competitiveness, the level of product safety, the level of product quality), and then the model is reviewed in terms of simulation values and synergy.

When we compare simulation values to the

synergy of the level of competitiveness, we can conclude that it is the same form of curves depending on time (figure 2). The same conclusion can be reached when it comes to the level of product safety (figure 3) and the level of product quality (figure 4a, 4b).

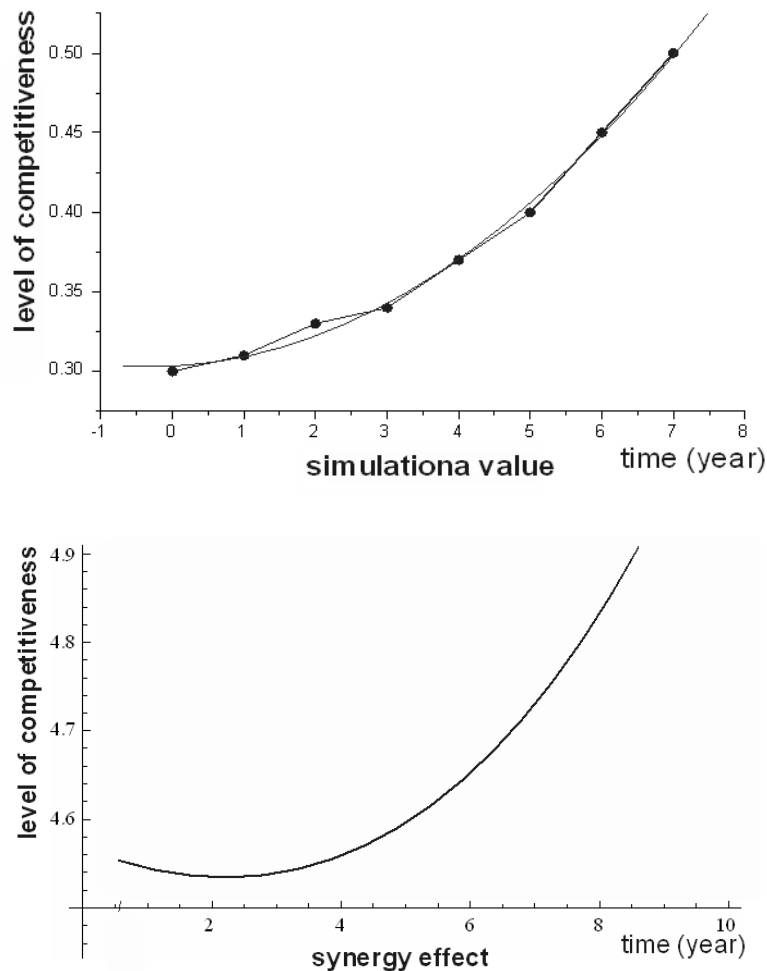


Figure 2. Simulation value and synergistic effect on the level of competitiveness

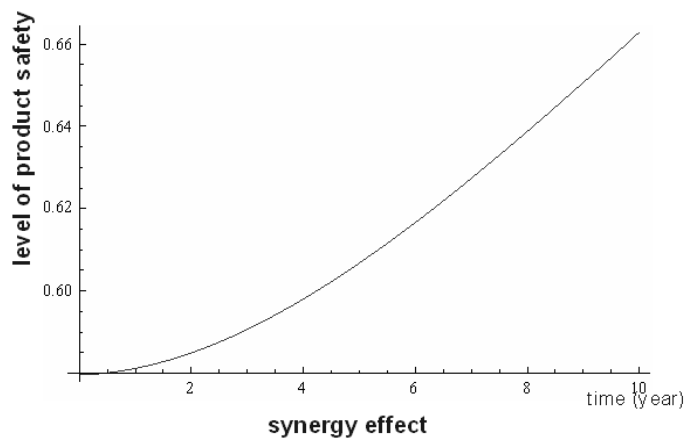
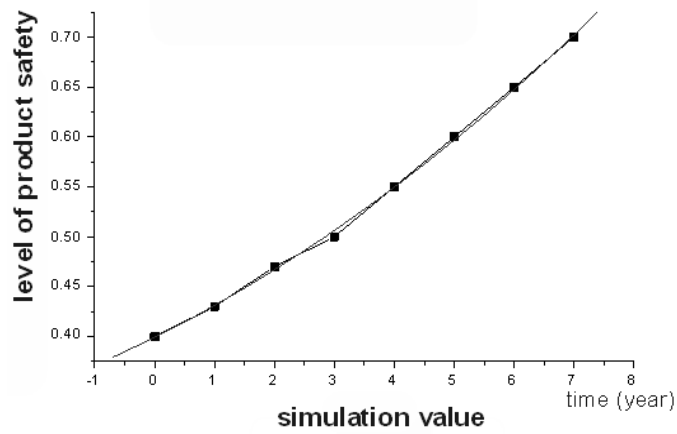


Figure 3. Simulation value and synergistic effect on the level of product safety

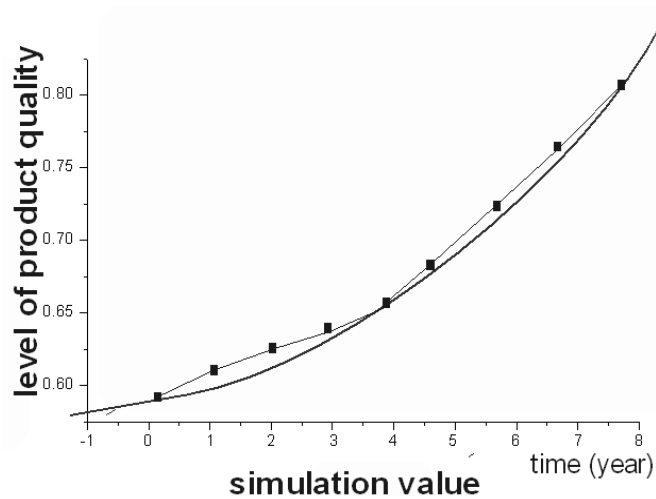


Figure 4a. Simulation value on the level of product quality

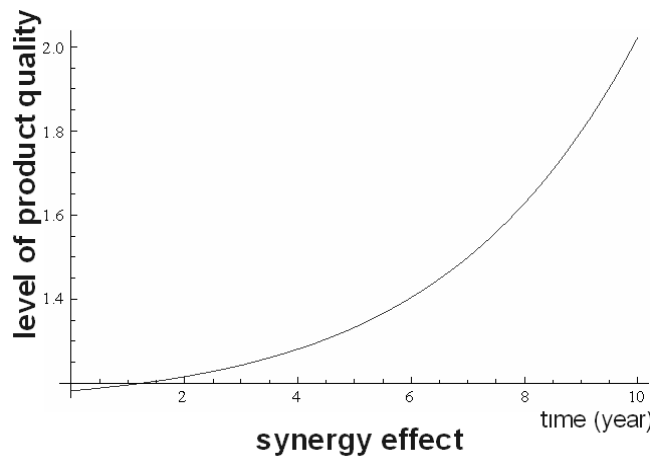


Figure 4b. Synergistic effect on the level of product quality

4. Proposed model verification

As the aim of work is to explain how an integrated approach to permanent improvement of product safety and quality. Continuously affect the competitiveness, in the case of good practice and experience in a number of different organizations, the research of effects of implementation of the quality management system and implementation of the new Approach to product and industry in Serbia, is conducted. Research can be defined as an empirical because it is carried out directly from the observation of selected segments of the real environment and the analysis of the collected data. The positivist paradigm, which lends to three levels of the research process, is used: data collection after which follow the processing and analysis, and the process of reasoning at the end.

For the collection of quantitative data it is used the method of interviewing. The questionnaire is designed to be rational (for the use and understanding), thorough and reliable, structured through issues, so that the filling does not require too much time. In

accordance with the requirements of the principles of empirical study it was attempted to ensure as much of the objectiveness of the collected data (non-interference of the researchers).

How the basis of our research is the impact of ISO 9000 standards, namely the quality and the Approach Directive on the product and enterprises competitiveness in a whole the analysis of the results was carried out for each represented feature in particular, and at the end of each analysis of the features of the model, the summary results are given.

- The characteristic of the level of product quality in our research was given an average grade 8.36 by surveyed companies (figure 5). Individual observed aspects of these characteristics were given the following ratings:
- Customer satisfaction with product performance – 8.63
- Customer satisfaction with product modification -9.16
- Quality index over the competition – 7.28

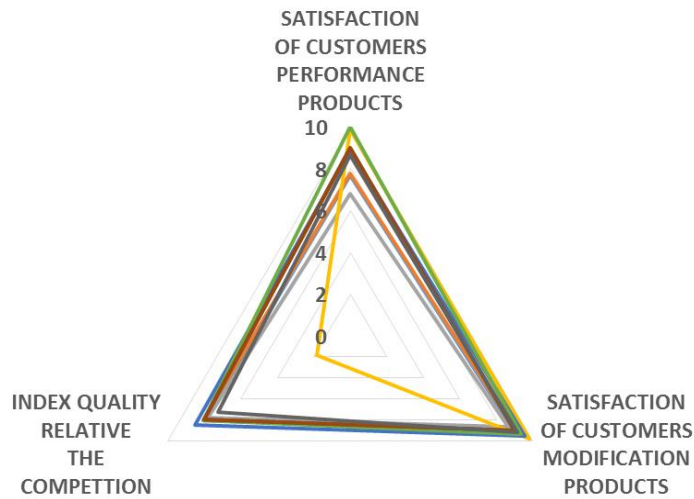


Figure 5. Level of product quality

After the analysis separately for each New Approach directive we can perform aggregate, the final results of the survey of the product safety level. After the surveyed

35 companies with 115 products can make a conclusion that the level of product safety, to the scale of 1 to 10, was rated with 8.59 (figure 6).

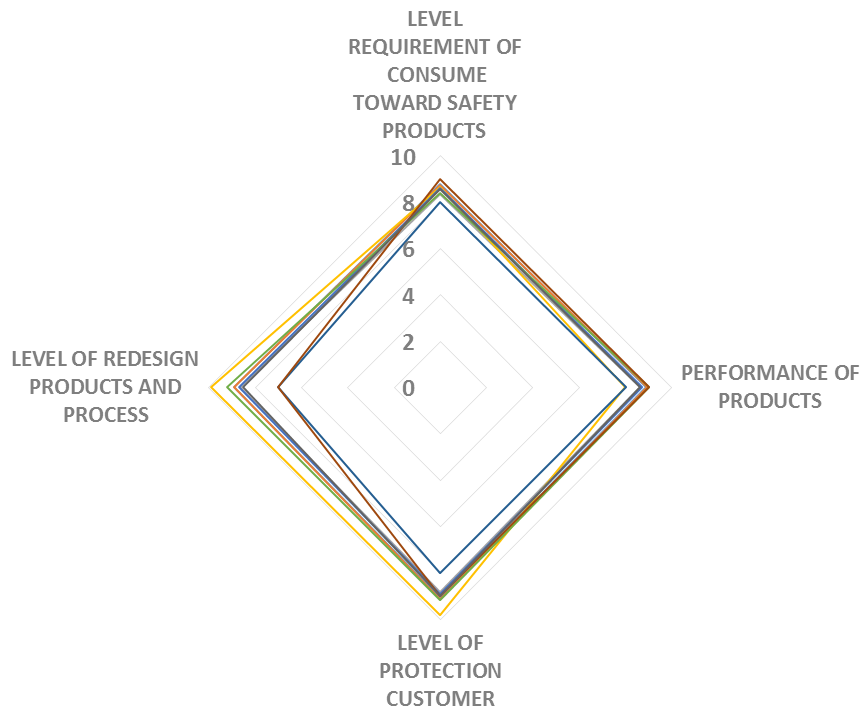


Figure 6. Level of product safety

We can to the following results by analysis of the results obtained during the evaluation of the characteristics that affect the level of product competitiveness:

- Cost price of the product is rated with 8.53;
- Product cost is rated with 9;
- Level of competitiveness of the economic environment with 9 too;

- National pricing policy with 8.53;
- Volume of sales / market with 8.88 and
- The level of EK competitiveness with 7.49

Is used the scale from 1 to 10, where 10 the highest score and 1 is the lowest score (figure 7).

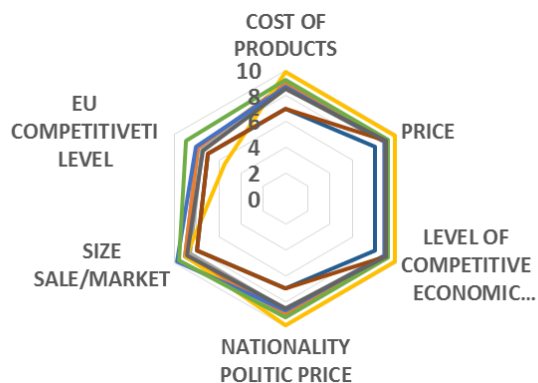


Figure 7. Level of product competitiveness

The mean value for the level of competition for manufactures who have implemented

quality systems and whose with the best in a class in EU, is shown in the (figure 8).

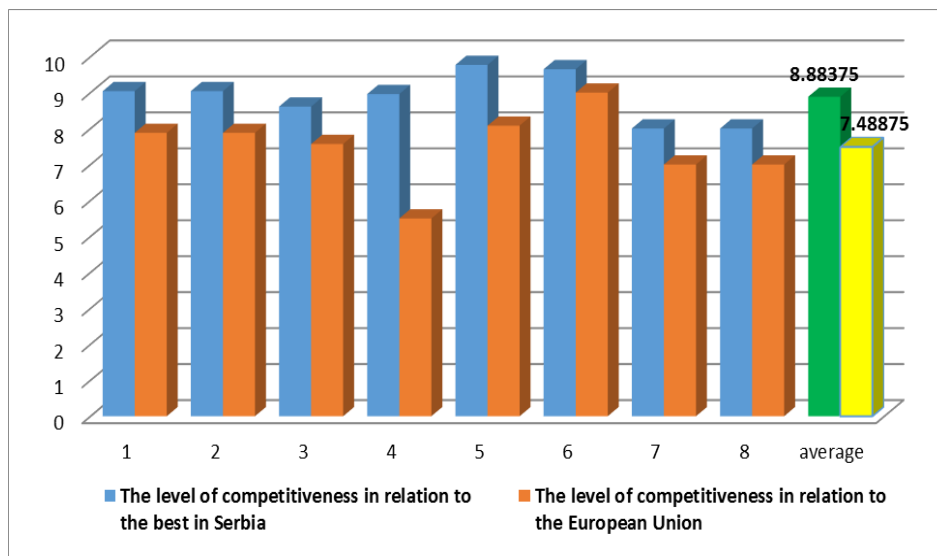


Figure 8. Level of competitiveness in relation to the best

From 35 of surveyed companies, only one company has not achieved the increase of competitiveness, which is 2.86 % of the studied sample (figure 9). With turnover increasing of the level of competitiveness is, 97.14% of surveyed companies (what

confirms hypothesis **H1**: The improvement of product quality and safety through compliance with the applicable regulations and standards affecting the increase of competitiveness).

Increasing the competitiveness (expressed in%)

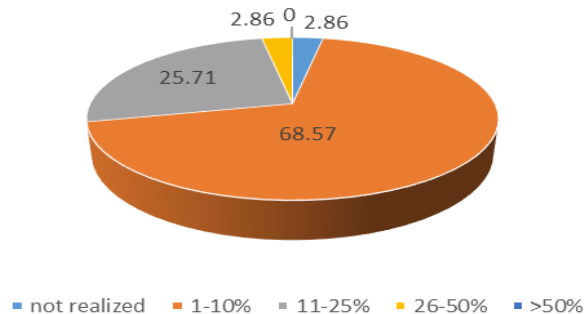


Figure 9. Display the percentage of increase in the level of competitiveness

The highest level of achieved increase of the competitiveness level is in a range of 1 -

10%, 24 companies, 68.57%, of samples (figure 10).

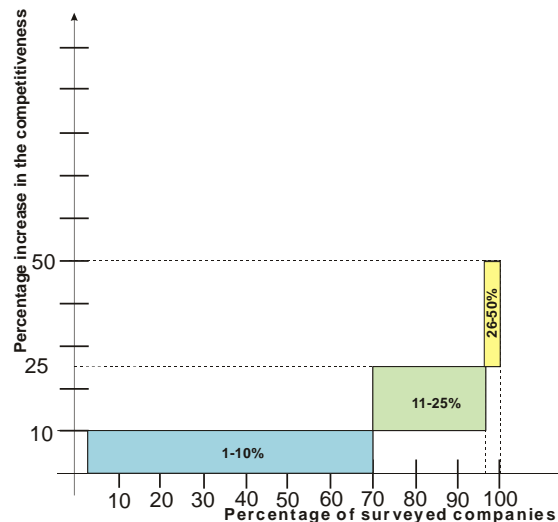


Figure 10. Percentage of increase in the level of competitiveness with respect to the examined company

Satisfaction customer (user) can be traced to the scale of complete dissatisfaction to delight. User will have experience with a certain level of satisfaction for a given set of

circumstances. These will be affected by three sets of factors: those that cause dissatisfaction, satisfaction and elation. Customer satisfaction cannot be accurately

predicted, but it can be monitored to detect opportunities for improvement. Until the customer satisfaction is the desired level, the decisive factor in business is “customer loyalty”. User can be satisfied but they don't buy the products from the same enterprise. Output economic benefit is achieved through customer satisfaction, which is demonstrated through his loyalty. Any market company cannot be blindly orientated towards the buyer if there is no data on customer satisfaction. Assessment of customer satisfaction may be given by using different approaches and models.

The factors that cause dissatisfaction may be ineffective processes or unwanted characteristics of a product. If they exist, customer satisfaction decreases significantly. If they don't exist, customer satisfaction decreases significantly. If they don't exist, customer satisfaction doesn't increase, it simply doesn't get worse. These factors are considered much more significant by customers in relation to the possibility of realization by the enterprise. Factors that cause satisfaction are expected characteristics of product processes. In fact, as regards these factors in many growing customer satisfaction.

It is obvious that the strategy for achieving customer satisfaction: Hold under the control factors that cause dissatisfaction with the customer, and at the same time to realize he key factors influential to the satisfaction of the customer. Factors that cause elation are features of products or severe or process that are not expected to be specified and the customer of product / services features are positively related to the others when they meet.

Obtaining CE Mark for products, all surveyed companies have made the increase of the level of customer satisfaction, as well as the level of competitiveness (which confirms the hypothesis **H2**: Implementation of quality management system and compliance with the New Approach Directive requirements effect the increase in the level of competitiveness, what makes a positive image of the company on the market and thereby enables an increase in revenues of the organization and increases the gross national income of Serbia industry.

The highest increase of the level of customer satisfaction is in the range of 1 --10% (27 enterprises, 77.14% of samples), as with competitiveness (figures 11 and 12).

Increase customer satisfaction (expressed in %)

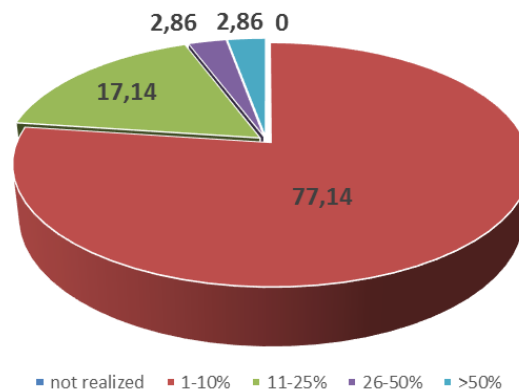


Figure 11. Preview increase customer satisfaction in a sample

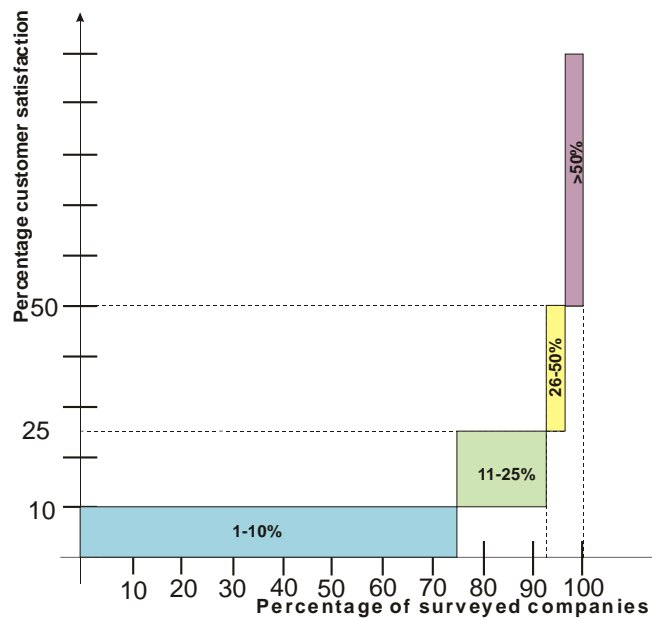


Figure 12. Increase in the level of customer satisfaction in relation to the surveyed companies

When we view from a comparative view of increasing the level of competitiveness and an increase of customer satisfaction (figure

13), it can be concluded that in both cases, the highest level of achieved increase is in a range of 1 - 10%.

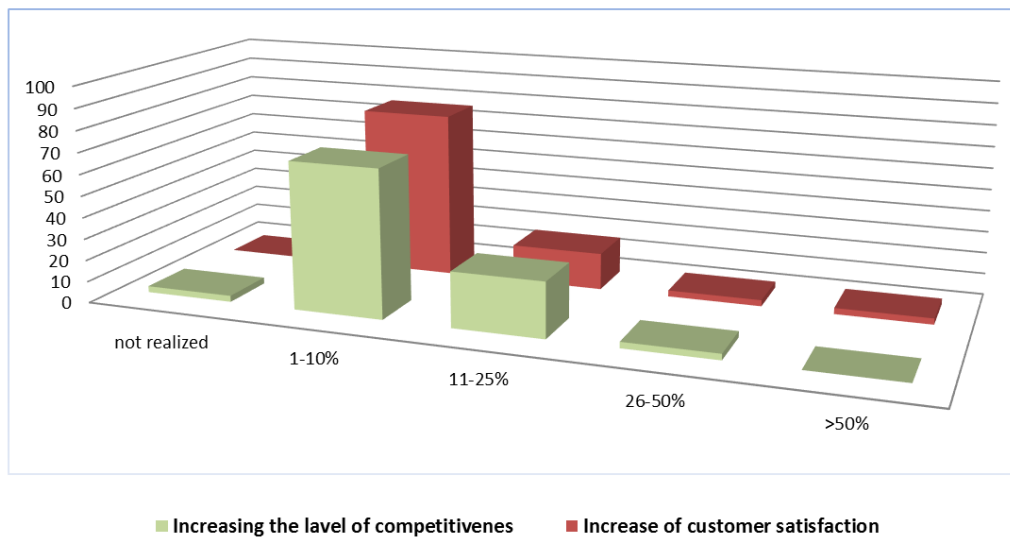


Figure 13. Comparison of increasing the level of competitiveness and increase of customer satisfaction

The achieved level of competitiveness increase as well as the increase of customer

satisfaction (for companies in research), are shown in the table 1. When we compare the

relation between the competitiveness and the level of customer satisfaction, based in researched samples, it can be concluded that

these two characteristics are interdependent (figure14).

Table 1. Increase competitiveness and customer satisfaction

Increasing	COMPETITIVENESS (Number of enterprises)	% sample	CUSTOMER SATISFACTION (Number of enterprises)	% sample
Not achieved increase	1	2.86	0	0
Increase: 1-10%	24	68.57	27	77.14
Increase: 11-25%	9	25.71	6	17.14
Increase: 26-50	1	2.86	1	2.86
Increase: >50%	0	0	1	2.86

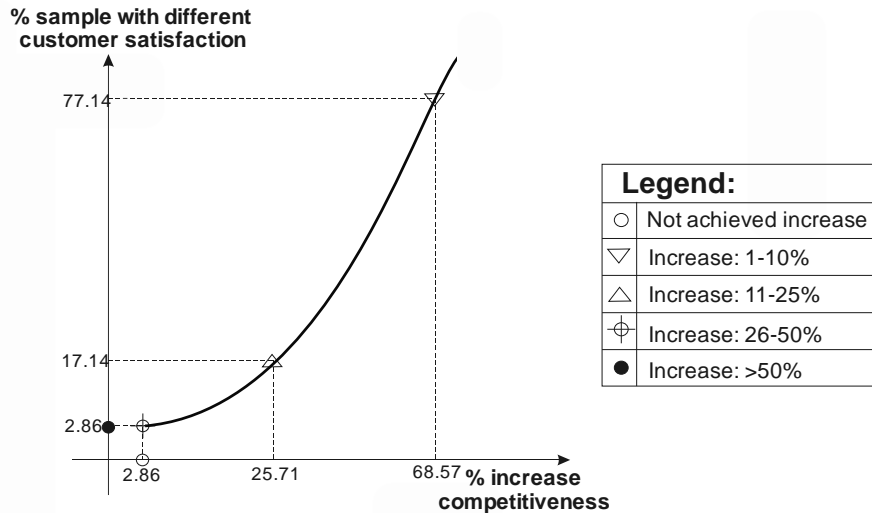


Figure 14. Dependence of the competitiveness of companies and the level of customer satisfaction

The reasons for the implementation of the management system and the CE mark are shown in the figure 15. Enterprises as the main motive for the implementation of the management system and achieving CE mark for its production led produced export (100% of surveyed companies). The following reasons are customer requirements (83.33%

of surveyed companies). “A new” law on public procurement also motivated companies to the project of implementation management system and achieving CE mark (which indicates that the one of the reasons – “better” passage of tenders, 66,67% of respondents led).

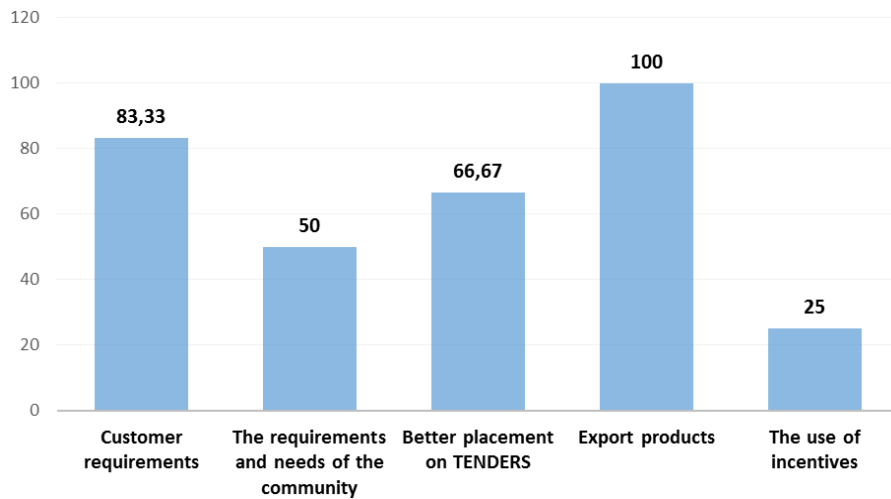


Figure 15. The main reasons for the implementation of the quality management system and the CE mark

On the question on the perceived benefits of the implementation management system and achieving CE mark for their products, enterprises could opt for one or more answers. They could write themselves too, if

they considered that some of the possible answers is omitted. In the figure 16 the achieved results after the analysis of the questionnaire, are shown.

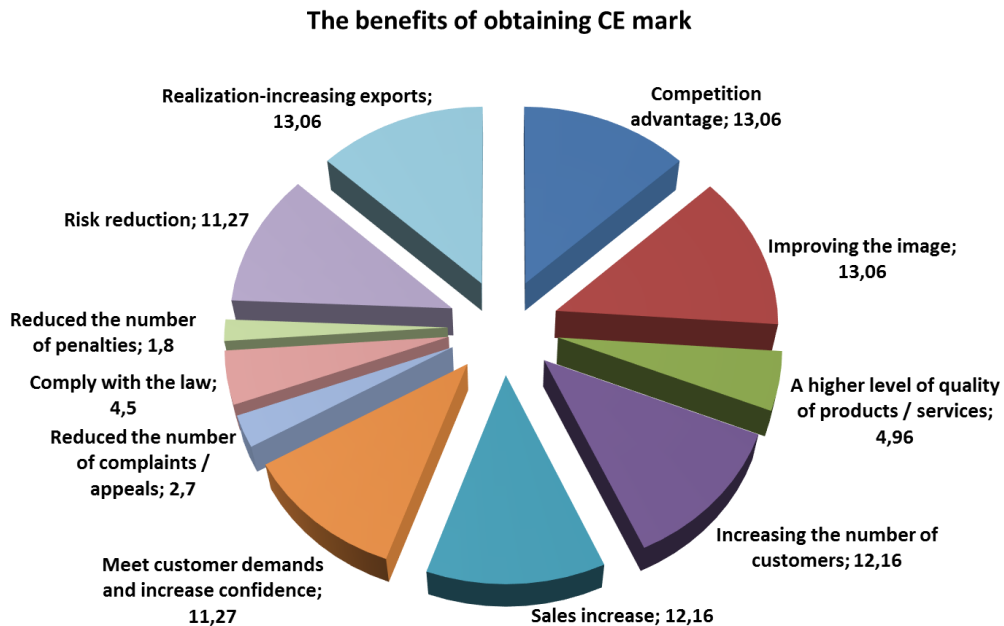


Figure 16. The observed benefit from the implementation of the quality management system and obtaining the CE mark

Justification of investment in the implementation of the management system and achieving CE mark for their product is evaluated in relation to the generated effects (figure 17). Enterprises evaluated the investing, on a scale of 1 to 10, by score

from 2 to 10. The mean score for justification is high, and it is 8.48 (figure 18). The majority of enterprises opted for reviews 9 (12 enterprises) and 8 (12 enterprises).

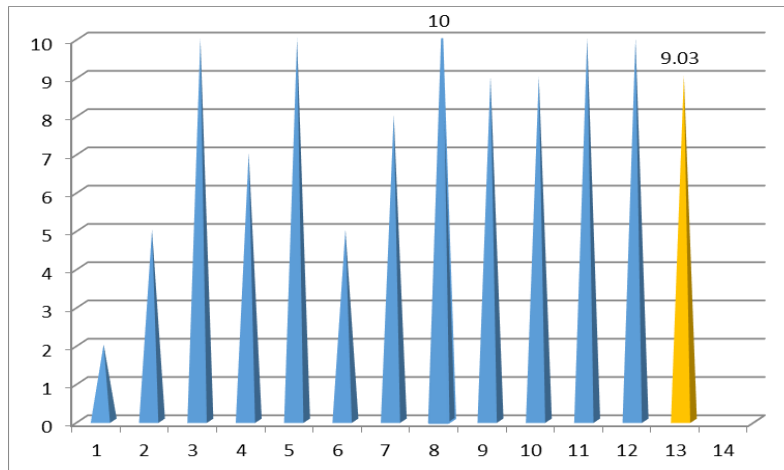


Figure 17. The justification of investment in the implementation of quality management systems and obtaining the CE mark

All of the above confirms the hypothesis **H3**: Investing resources in the implementation of the management system and obtaining the CE mark for goods, has a high rate of return.

5. Conclusions

The main subject of this work is research of impact of quality management system and the New Approach Directives on enterprise competitiveness. There isn't any competitive national economy without fulfilling the most essential conditions such as competitive products that meet all technical, safety requirements and quality requirements set by the market. The aim of this work is to indicate the benefits and justification of investment in the implementation of the management system of quality and harmonization of the planning and production to the requirements of the New Approach Directives.

Research facility, as we have already said, are the companies in Serbia which in its production program has the products that are complied with all New Approach Directive requirements that they are subjected to, and that achieve CE Mark as well as that have implemented management systems of quality. In the research, 35 enterprises have participated with 115 products.

With respect to the subject or research with large number of aspects that need to be integrated, it is developed – model to assess the impact of the New Approach and management. Systems on product quality and safety, as well as enterprise competitiveness, the simulation showed that the changes in the other elements of the model are the most sensitive elements: the level of competitiveness, the level of consumer requirements concerning the product safety and the level of consumer requirements concerning the quality. The obtained results confirmed the starting hypothesis in the following way.

Hypothesis H1 was related to the increase in competitiveness as a result of the implementation of quality management systems and achieving CE Mark. After 35 surveyed enterprises with 115 products we can conclude that the level of product competitiveness a scale from 1 to 10 is rated with 8.72. The level of competitiveness in relation to the best in Serbia is 9.65, and in relation to the best in EU is 7.79. With turnover increased of the level of competitiveness there is 97.14% of surveyed enterprises, what confirms the hypothesis HA: Between the ISO standards and CE Mark at one side and the competitiveness on the other side. There is a significant relation.

Hypothesis H2 is the presupposition that implementation of quality management system and the compliance with the New Approach Directive requirements impact on the increase of the level of customer satisfaction, as well as on the increase of the level of competitiveness by achieving CE mark for its product, and by the implementation of the quality management system, and all surveyed enterprises have gained. The level of customer satisfaction, and the increase of competitiveness level. The highest increase of the level of customer satisfaction is in a range of 1 10% (27 enterprises, namely 77.14% of samples), as well as of the competitiveness (24 enterprises, namely 68.57% of samples). By this the hypothesis H2 is proved: implementation of quality management system and compliance with the New Approach Directive requirements the increase in the level of competitiveness,

what makes a positive image of the company on the market and thereby enables an increase in revenues of the organization and increases the gross national income of Serbia industry.

Hypothesis H3: investing resources in the implementation of the management system and obtaining the CE mark for goods, has a high rate of profitability. All companies as the main motive for the implementation of the management system and achieving CE Mark for its products led product export (100% of surveyed companies). The next reason is the customer requirements 83.33% of surveyed companies). The „New“ Law on public procurement motivated companies to the project of implementation management system and achieving CE Mark (That indicates the fact that one of the reasons – better passage of tenders, said 66.6 of respondents). The mean score for the justification of investment in ISO standards and CE marking is light and it is 8.48. A large number of companies have chosen the rate 9 (to a scale from 1 to 10) and the rate 8. Profitability of the key and most numerous products in relation to all the products that participated in the survey is high. All that proves the hypothesis H3: investing resources in the implementation of the management system and achieving CE mark for goods, has a high rate of profitability.

This work may be relevant to all organizations that wish to adopt a continuous improvement of product quality and safety through the processes of design and production.

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