

The Impact of CE Marking on the Competitiveness of Enterprises

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For providing a free flow of commodities the European Union develops specific mechanisms. New approach directives have had the most important place among these mechanisms. The mechanisms needed for the acting of a free flow of commodities depend upon the preventing of new obstructions arising in trade, mutual acknowledgement of examination results and certificates and technical harmonization.

Many industrial and consumer products which are being sold in Europe must comply with the CE conformity mark. CE Marking on a product is a manufacturer's declaration that the product complies with the essential requirements of European technical regulations ("Directives"), related to European health, safety and environmental protection legislation.

This work should indicate the current level of quality, safety and competitiveness of products which have obtained the CE mark. Research on the impact of the new approach directives on the competitiveness of Serbian industry; was conducted in three directions. First we developed a model that includes all the essential steps in the process of obtaining the CE mark. In order to study the practical impact of the new approach directives on the competitiveness of enterprises in Serbia, we created a questionnaire on the basis of established models. On the results we applied methods of statistical analysis. In order to investigate the impact of the CE mark on competitiveness, we created simulation software.

This paper presents some simulation solutions that have a dominant impact on competitiveness. From everything mentioned above we can conclude that the use of new approach directives and the CE mark created a positive image of products on the market and enable the growth of profits and the competitiveness of organizations.

Utjecaj CE oznake na konkurentnost poduzeća

Izvornoznanstveni članak

Europska unija je razvila određene mehanizme za osiguranje slobodnog protoka robe. Među tim mehanizmima najznačajnije mjesto zauzimaju direktive novog pristupa. Mehanizmi koji su potrebni za djelovanje slobodnog protoka robe se oslanjaju na sprečavanje nastajanja novih prepreka u trgovanju, na međusobnom priznavanju rezultata ispitivanja i na tehničku harmonizaciju. Mnogi industrijski i potrošački proizvodi koji se prodaju u Europi moraju biti u skladu s CE oznakom. CE oznaka na proizvodu je Izjava potrošača da je proizvod u skladu s osnovnim zahtevima Europskih tehničkih propisa ("direktivama"), koji se odnose na Europsko zakonodavstvo vezano za zaštitu zdravlja, osiguranja i zaštitu životne sredine.

Ovaj rad ukazuje na postojeći nivo kvaliteta, osiguranja i konkurentnost proizvoda koji su dobili CE znak. Istraživanje utjecaja direktiva novog pristupa na konkurentnost industrije Srbije sprovedeno je u tri pravca. Prvo smo razvili model koji uključuje sve bitne korake u procesu dobijanja CE znaka. U cilju praktičnog istraživanja utjecaja direktiva novog pristupa na konkurentnost preduzeća u Srbiji, napravili smo upitnik na osnovu utvrđenog modela. Na rezultate su primijenjene metode statističke analize. U cilju istraživanja utjecaja CE znaka na konkurentnost proizvoda u Srbiji, napravili smo simulacioni softver.

U ovom radu su prikazana neka od simulacijskih rješenja koja imaju dominantan utjecaj na konkurentnost. Iz svega navedenog možemo zaključiti da primjena direktiva novog pristupa i CE znak stvara pozitivan imidž proizvoda na tržištu i time omogućuje povećanje prihoda i konkurentnost organizacije.

1. Introduction

A free flow of commodities is one of the basic principles in the European Union besides a free flow of services, capital and work force. This freedom significantly contributes a greater supply and simultaneously induces competency. For providing a free flow of commodities, the European Union develops specific mechanisms. The New approach directives have had the most important place among these mechanisms. The mechanisms needed for the acting of a free flow of commodities depend upon the preventing of new obstructions arising in trade, mutual acknowledgement of examination results and certificates and technical harmonization [1].

Many industrial and consumer products which are being sold in Europe must comply with the CE conformity mark. CE Marking on a product is a manufacturer's declaration that the product complies with the essential requirements of European technical regulations ("Directives"), related to European health, safety and environmental protection legislation. With the CE Marking being like a passport for the EEA (European Economic Area) it allows manufacturers to freely circulate their products throughout the EEA. Instead of adapting the products for each national market according to their regulations, there is now only one set of requirements and procedures in designing and manufacturing a product within the EEA [2]. For consumers, CE Marking has the benefit that products will be safer and therefore damage and liability claims will be reduced. CE marking brings substantial cost savings for producers and provides safety for all EU consumers. CE marking is based on the harmonization of national regulations for consumer and industrial products through the "New Approach" directives [3]. These directives were developed from 1989 to stimulate the free movement of goods in the internal market. The application of harmonized standards remains voluntary. A manufacturer may still apply other technical specifications to meet the requirements; however this is usually more expensive and time consuming. The manufacturer, or company who is placing the product on the market, is fully responsible for product compliance. Product compliance is confirmed through a risk assessment of the product. specifications to meet the requirements; however this is usually more expensive and time consuming. The manufacturer, or company who is placing the product on the market, is fully responsible for product compliance. Product compliance is confirmed through a risk assessment of the product.

The aim of the paper is to investigate the impact of the new approach directives on the safety and competitiveness of our products through the prism of requirements, needs and expectations of both producers and markets.

To improve such a complex scientific task a method of modeling complex dynamic systems has been

implemented. This method will be integrated into various phases of methods of statistical analysis and simulation.

This work should indicate the current level of competitiveness of companies whose products get the CE mark and the significant impact on competitiveness of Serbian enterprises [4-6].

2. Proposed framework

The basic subject of this work is a model of the impact of the new approach on quality, safety and competency of our companies. There is no competitive national economy without the discharging of the most important condition which is competitive products that satisfy technical and safety market requirements. This work should indicate existing quality reserves and product safety, the level of possible improvement in competency and the increasing of profit by discharging the new approach directives requirements.

2.1. Basic hypotheses

The starting Points in the preparation of this paper are based on the application of systems theory and especially of certain models and simulations of dynamic economic systems. Based on these grounds, it will use the following initial hypotheses:

- H1: Application of New Approach directives effect the level of competitiveness,
- H2: Organizations that have an established management system (QMS, OHSAS) with small investments are ready to implement the New Approach directives,
- H3: Investing resources in obtaining the CE mark for the products has a high rate of return,
- H4: Implementation of the New Approach directives creates a positive image of an organization in the market, thus enabling organizations to increase revenue and increase gross national income of Serbian industry.

2.2. Methods used

For the aim of the research we have developed a model for assessing the impact of the New Approach directives on the competitiveness of products and companies as a whole. This model has become the subject of a review in practice.

On the basis of this model, we have made a questionnaire. On the results we have applied methods of statistical analysis.

At the end of our research we developed simulation software to determine the impact of the New Approach directives on the competitiveness of enterprises.

3. Model of the impact of CE marking on competitiveness

Given the subject of research, with a number of aspects to be integrated, the need to develop a model for

assessing the impact of the new approach directives was identified [7]. The basic method to be used in the making of this work is a method of modelling dynamic complex systems [8].

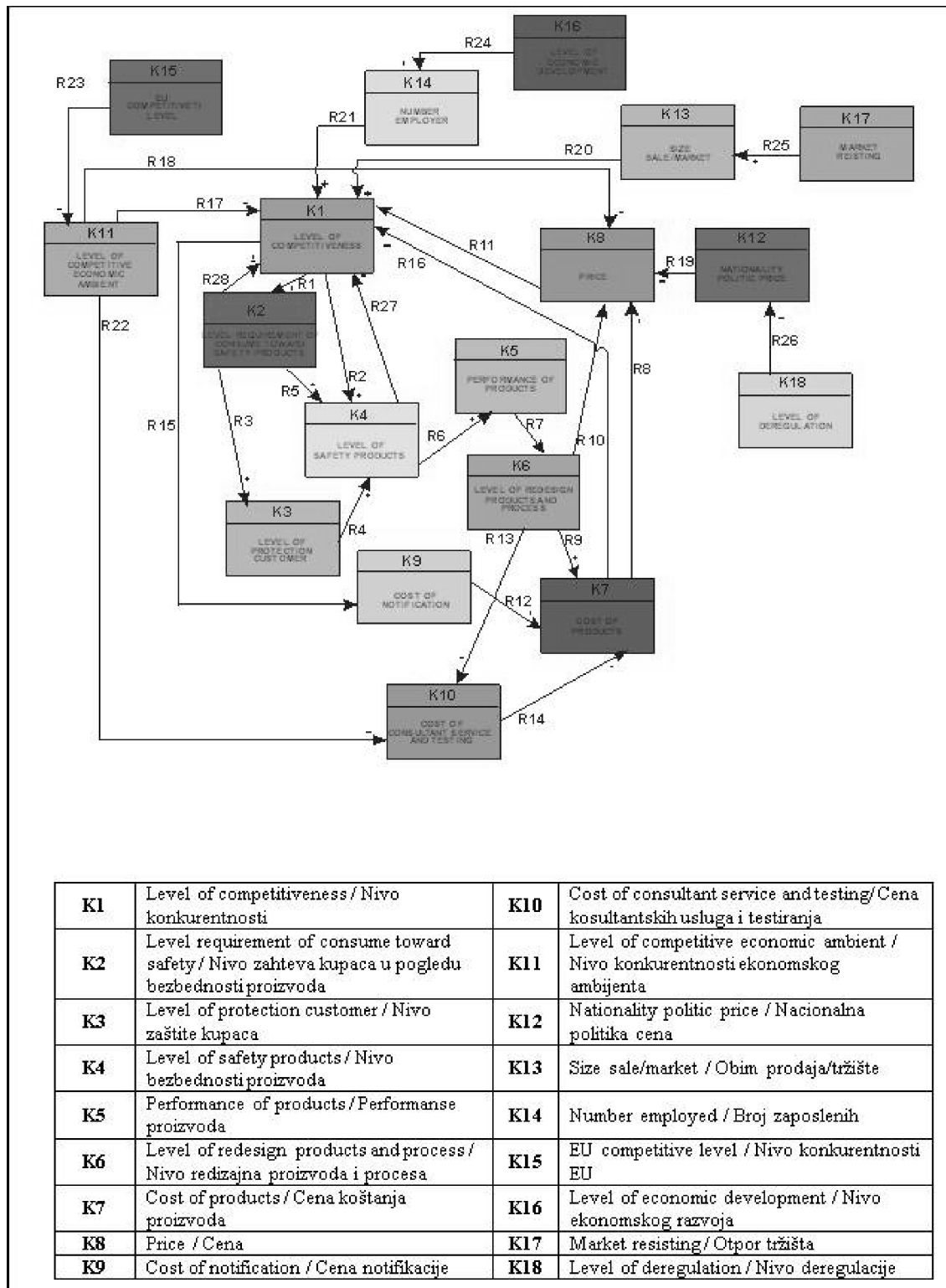


Figure 1. Model of the impact of CE marking on competitiveness

Slika 1. Model uticaja CE znaka na konkurentnost

The model shown in Figure 1 provides the new approach directives influence on the competitiveness of products and companies as a whole, which is based on existing and accepted activity in the process of establishing conformity of products with the requirements of the new approach. The model interprets the common elements - characteristics that organizations should take into account in the process of obtaining the CE mark for a product. The model is based on empirical research, that provides details on all characteristics (K1-K18) and the relations (R1-R28) included in the model [9].

Sensitivity analysis for initial values K_i (Figure 2a) and values K_i after the first iteration (Figure 2b) shows that the factors K8 – product price and K1 – level of competitiveness has the biggest sensitivity and then follows the factor K7 – cost of product.

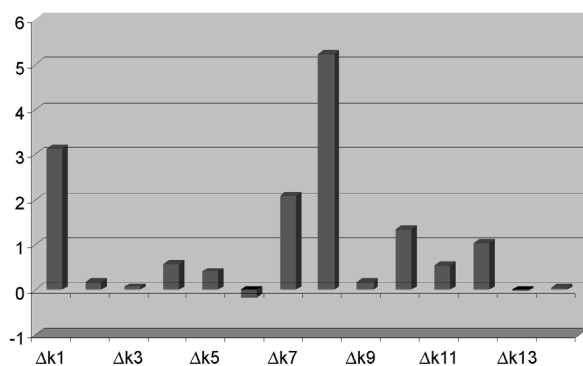


Figure 2a. Sensitivity analysis for initial values K_i

Slika 2a. Analiza osetljivosti za početne vrednosti K_i

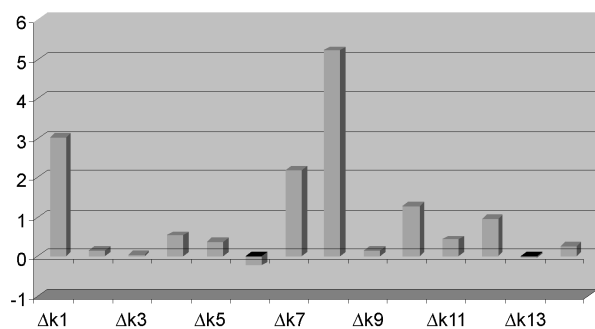


Figure 2b. Sensitivity analysis for values K_i after the first iteration

Slika 2b. Analiza osetljivosti za vrednosti K_i nakon prve iteracije

Product price, as well as product cost price has a dominant impact on the level of competitiveness (Figure 3).

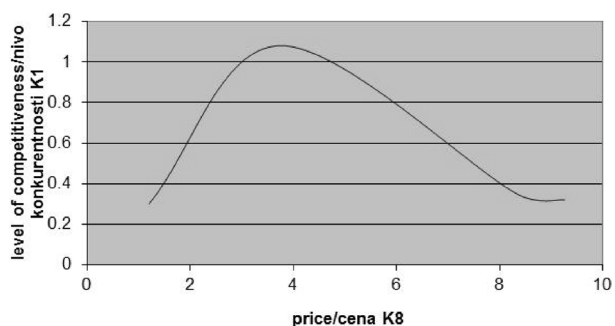


Figure 3a. Relationship between level of competitiveness and price

Slika 3a. Veza zavisnosti izmedu nivoa konkurentnosti i cijene

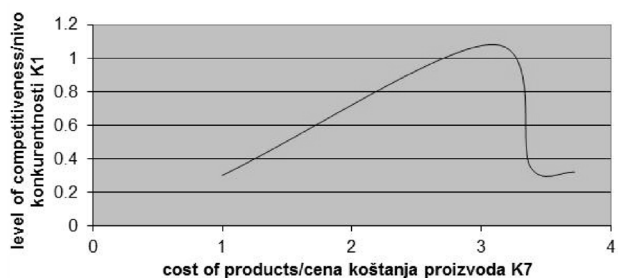


Figure 3b. Relationship between level of competitiveness and cost of products

Slika 3b. Veza zavisnosti izmedu nivoa konkurentnosti i cijene koštanja proizvoda

4. Research on the impact of CE marking on competitiveness

A model of the impact of the new approach directives on the competitiveness of products and companies in Serbia has become the subject of review in practice. With the purpose of researching the impact of the new approach directives on the competitiveness of enterprises in Serbia, and on the basis of the set models, we have made a questionnaire. The questionnaire has been sent to all companies whose products have the CE mark [11].

Based on the results obtained so far, we have come to the conclusion that the majority of surveyed companies have products that are subject to the directives for low-voltage equipment, the directives for electromagnetic compatibility and the directives for machinery (Table 1).

An analysis of the results shows that the CE mark has the most dominant influence on the level of competition (Figure 4 and Figure 5).

Table 1. Distribution of products by new approach directives

Tablica 1. Raspodela proizvoda po direktivama novog pristupa

DIRECTIVE / DIREKTIVE	PRODUCTS / PROIZVODI																																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35		
Generally product safety / ...	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
LVD (low-voltage equipment / nisko-naponaka oprema)	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
EMC (electromagnetic compatibility / elektromagnetna kompatibilnost)	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
MD (machinery Safety / bezbednost mašina)	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
MDD (medical devices/ medicinska oprema)	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
CP (construction products / građevinski proizvodi)	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
Toys safety / bezbednost igračka	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█

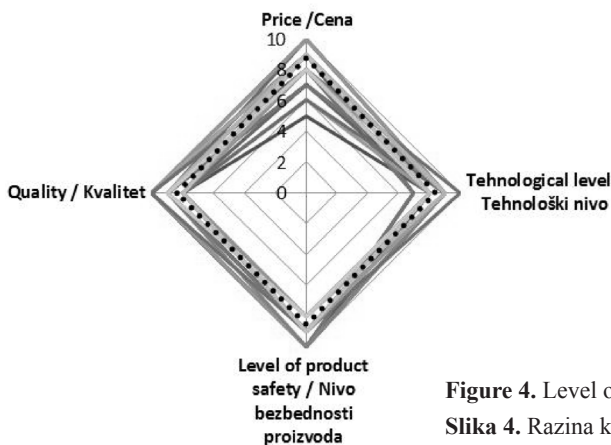


Figure 4. Level of competitiveness
Slika 4. Razina konkurentnosti

When you look at the graphics shown we can say that the competitiveness of the companies surveyed as a whole rated 8,5 on average. The average of the enterprises competitiveness of the assessed levels relative to the best in class in Serbia is 9,65, in relation to the European Union, 7,79.

The CE mark has a significant impact on the level of product safety (Figure 6), as well as the price of the product (Figure 7).

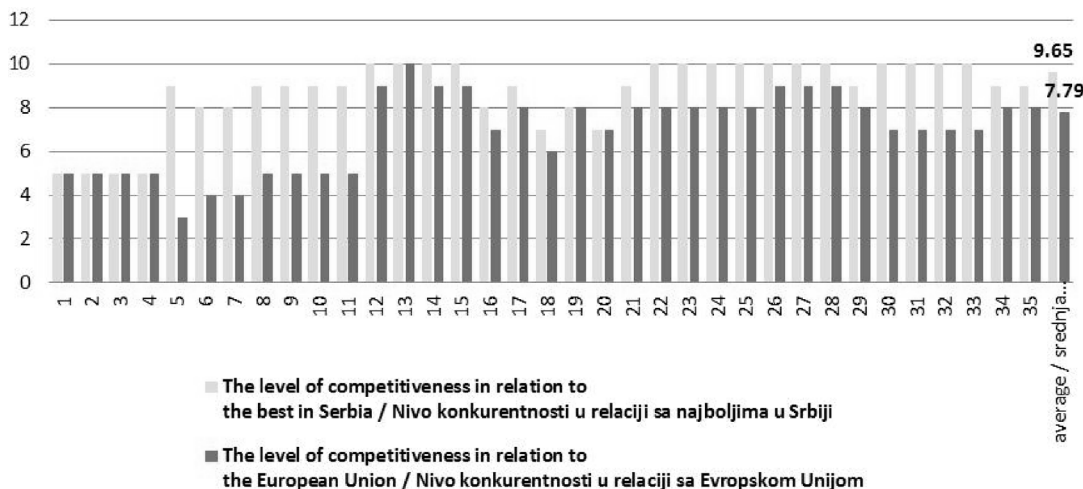


Figure 5. Level of competitiveness in relation to other (on a scale of 1 to 10)
Slika 5. Razina konkurentnosti u odnosu na druge (na skali od 1 do 10)

- █ The level of competitiveness in relation to the best in Serbia / Nivo konkurentnosti u relaciji sa najboljima u Srbiji
- █ The level of competitiveness in relation to the European Union / Nivo konkurentnosti u relaciji sa Evropskom Unijom

Level of safety products / Nivo bezbednosti proizvoda

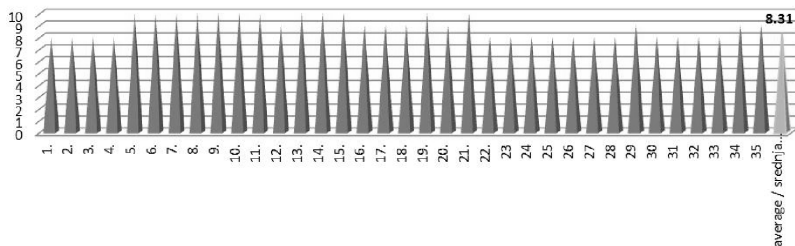


Figure 6. Level of safety of products (on a scale of 1 to 10)

Slika 6. Nivo bezbednosti proizvoda (na skali od 1 do 10)

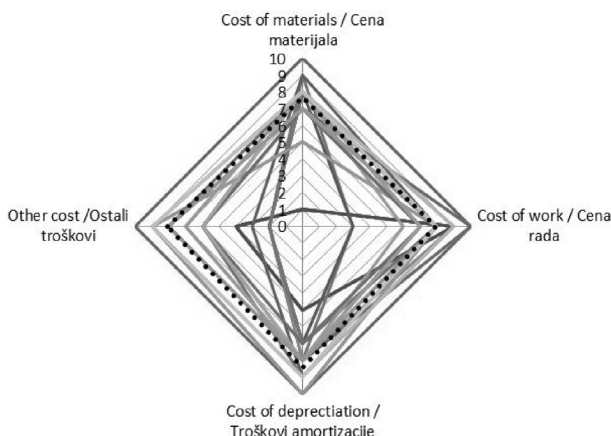


Figure 7a. Cost of products

Slika 7a. Cene koštanja proizvoda

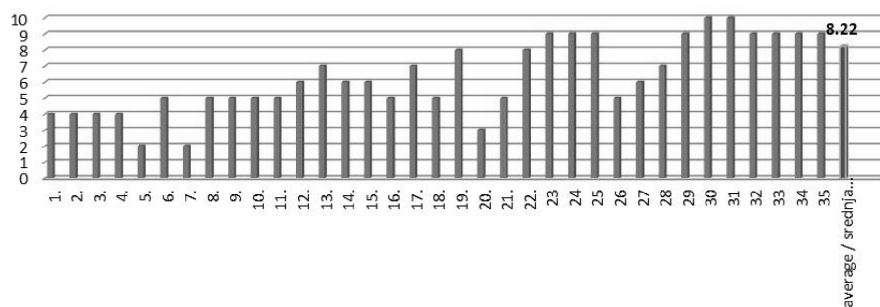


Figure 7b. Price distribution

Slika 7b. Cena prodaje

In further analysis of the questionnaire we created a survey of the correlation characteristics of our model (Figure 1). Observing the results we can conclude that the new approach directives and CE marking have had an impact on us the essential features - the competitiveness, safety and cost of products. In this work has been shown some of the most important correlations.

Considering that the aim of this work is based on experiences from practice evidence that there is increased competitiveness of enterprises in meeting the requirements of the new approach, we will first show the level of competitiveness as a capital characteristic of our model.

Relationship between the level of competitiveness of enterprises and the level of requirements of consumers towards product safety is shown in Figure 8. One of the most significant correlations between the level of competitiveness and the level of safety of products

as a basis of the CE mark is shown in Figure 9. When we talk about competitiveness, we must not forget the relationship between the level of competitiveness and the cost of products and prices (Figure 10 and Figure 11).

The level of the competitive economic environment K11 is also characteristic of the dominant influence on competitiveness, particularly in that area (Figure 12).



Figure 8. Relationship between level of competitiveness and level of requirements of consumers towards of product safety

Slika 8. Veza između nivoa konkurentnosti i nivoa zahteva kupaca u pogledu bezbednosti proizvoda

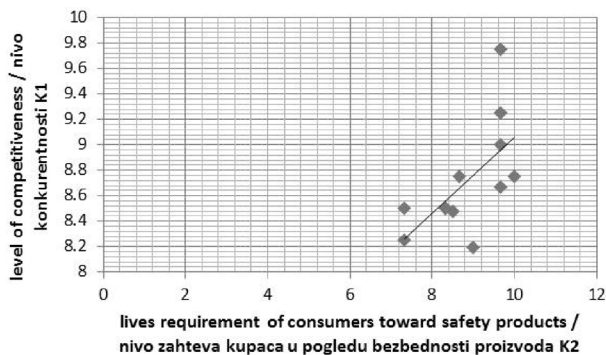


Figure 9. Relationship between level of competitiveness and level of safety of products

Slika 9. Veza između nivoa konkurentnosti i nivoa bezbednosti proizvoda

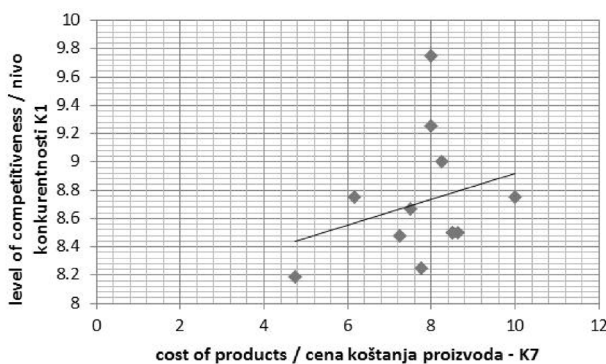


Figure 10. Relationship between level of competitiveness and cost of products

Slika 10. Veza između nivoa konkurentnosti i cene koštanja proizvoda

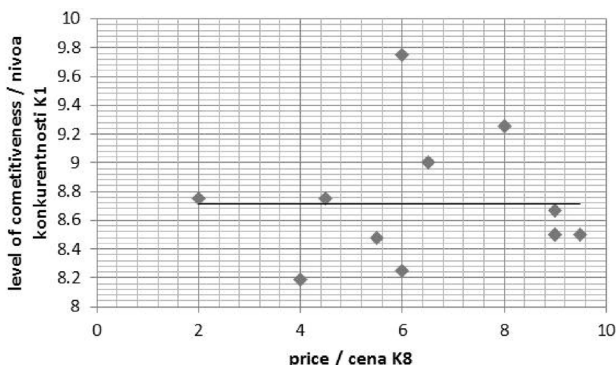


Figure 11. Relationship between level of competitiveness and price

Slika 11. Veza između nivoa konkurentnosti i cene proizvoda

5. Description of software solutions for determining the impact of CE marking on competitiveness

The system, whose behaviour is needed to be defined by a series of experiments, is defined by a mathematical model whose source of data consisted of forty (48)

elementary proportions from which an additional eighteen variables (figure 1) are generated. Only the program’s result is done Microsoft Excel, first of all because of easy input and the manifold correction of the basic proportions of the influential values [12, 13].

The show of initial values of variables is obtained according to the results of the poll’s questionnaire shown in Table 2.

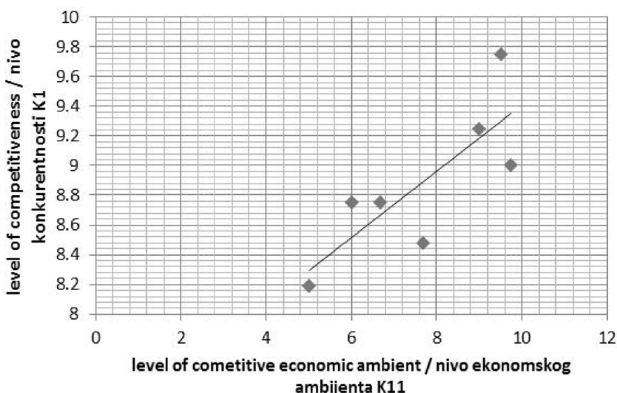


Figure 12. Relationship between level of competitiveness and level of competitive economic ambient

Slika 12. Veza između nivoa konkurentnosti i nivoa konkurentnosti ekonomskog ambijenta

The concrete values of variables within all modules and competitiveness are obtained by the use of a weighted middle on the basis of an analysis of the existing state and conducted polls. An algorithm from which the global model functioning can be noticed, is shown on the next picture. The dynamic nature of the model, by which changes in the system on a time scale are being followed, can be noticed from the algorithm. Iterations on the time scale for the chosen time intervals (for example: one, two, or five years) are being performed by what each future condition is dependent upon from the previous system’s condition. In this way the model copies casually consecutive relations in the modelling system. Levels of variable proportions that compose system’s structure and the definite connections of the mutual influences between separate proportions have the key role of casually consecutive connections’ modelling.

During the experiment the conducting models values change at different intervals. In the next step the program calculates the mutual intensity of variable proportions on the level of each of the six modules and puts them into adequate tables. Apart from the tabular show of results the program also creates a graphic show of results on the basis of the obtained results.

In continuation of this work, the results of the simulation are shown as the influence of the change of each characteristic (Ki) on the other characteristics.

Table 2. The show of initial values of variables is obtained

according to the results of the poll's questionnaire

Tabela 2. Prikaz početne vrednosti promenljivih, dobijenih na osnovu rezultata iz Anketnog upitnika

Variabl/ Promenljiva	Zero value/ Početna vrijednost	Variabl/ Promenljiva	Zero value/ Početna vrijednost
K1	6,500	K10	4,620
K2	6,435	K11	5,000
K3	5,940	K12	5,610
K4	6,000	K13	5,150
K5	4,875	K14	5,445
K6	5,500	K15	6,000
K7	5,125	K16	5,500
K8	5,000	K17	5,250
K9	5,000	K18	4,500

The influence of the change in competitiveness K1, in relation to the change in other important characteristics the model (level of requirement of consumers towards safety of products - K2, level of safety of products - K4, cost of products - K7, price - K8, and level of competitive economic ambient - K11) is shown in Figure 13. The influence of the change in competitiveness which is most insensible is the influence on the change in the safety of products, and the most sensible influence is the influence on the change in the cost of products and price.

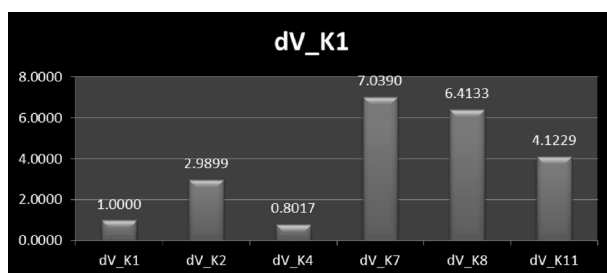


Figure 13. View of changes in competitiveness K1, due to the change of other sizes

Slika 13. Promena konkurentnosti K1, u odnosu na promenu drugih veličina

The program enables the calculation and show of a specific dependence for characteristic proportions as well as the percentage growth of adequate variables for the change of the basic variable from - 30 % to + 30 %. After the tabular show, the program also enables the graphic show of proportions.

Level of competitiveness of enterprises and the level of requirements of consumers towards product safety are in correlation (Figure 14). Competitiveness and cost of products are not in correlation. With the growth of the cost of products, competitiveness declines (Figure 15). It is the same case with the price, with the growth of price products competitiveness declines (Figure 16).

When we talk about competitiveness we should not neglect that with the influence of the economic ambient the competitiveness also grows (Figure 17).

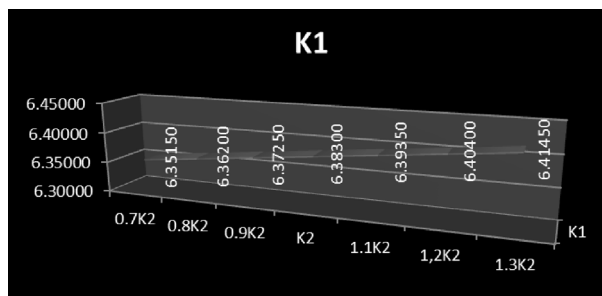


Figure 14. Change in competitiveness K1 with the changing level of requirements of consumers towards product safety K2

Slika 14. Promena konkurentnosti K1 sa promenom nivoa zahteva kupaca u pogledu osiguranja proizvoda K2

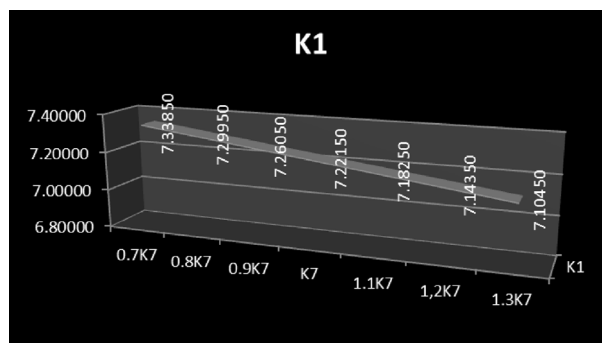


Figure 15. Change in competitiveness K1 with the changing cost of product K7

Slika 15. Promena konkurentnosti K1 sa promenom cijene koštanja proizvoda K7

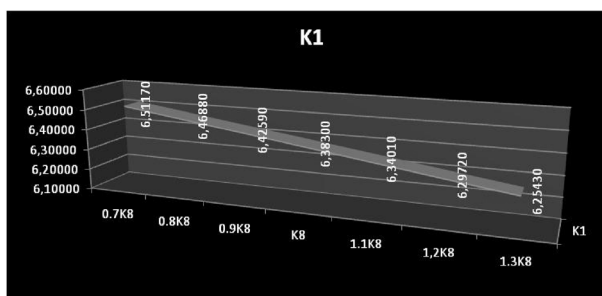


Figure 16. Change in competitiveness K1 with the changing price K8

Slika 16. Promena konkurentnosti K1 sa promenom cijene proizvoda K8

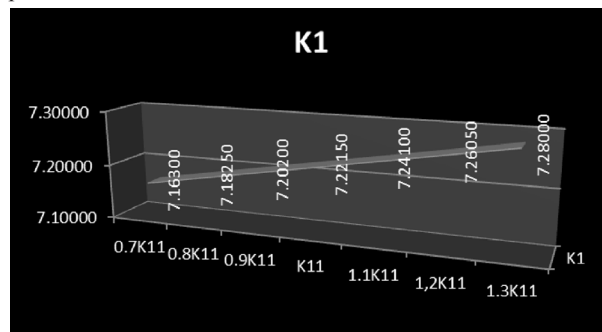


Figure 17. Change in competitiveness K1 with the changing competitive economic ambient K11

Slika 17. Promena konkurentnosti K1 sa promenom konkurentnosti ekonomskog ambijenta K11

6. Conclusion

This work represents a real hypothesis on the basis of experts experiences, in regard to the infrastructure of using new approach directives which had not been examined until now, it is not known which products or industries of Serbia have succumb to the directives of the new approach and CE mark, and it is not known which are the effects of the use of the CE mark.

The model for assessing the impact of the new approach directives on access to quality, safety and competitiveness of products and competitiveness of our enterprises has been stabilized, and has had feedback. The model includes the most relevant factors. According to the given results we can conclude that the new approach directives have a dominant impact on product competency, the level of safety of products and the cost of products, and thereby on competitive enterprise.

The results of the researches have theoretical and applicative character. Looking at the theoretical nature, are particularly significant results related to the model of safety, quality and competitiveness of products.

Based on the results obtained by processing the survey questionnaires the following conclusions can be drawn:

- The impact of the new approach directives on the competitiveness of enterprises is having a lot of attention. The competitiveness of companies in relation to the best in class in Serbia on a scale of 1 to 10 is estimated to be 9.65; in relation to the European Union score 7.79. This finding leads us to the conclusion that the competitiveness of enterprises in Serbia, whose products have the CE mark is at a high level.
- The level of safety of products that are conformation with the requirements of the new approach directives and are marked with the CE mark is rated at an average of 8.31 (on a scale of 1 to 10), which is proof that the new approach directives have a dominant impact on the safety of product

On the basis of the results obtained by simulation we can make the following conclusion:

- The influence of the change in competitiveness which is most insensible is the influence on the change in the safety of products, and the most sensible influence is the influence on the change in the cost of products and price.
- Competition and the cost of products are not correlated. With increasing cost competitiveness of products decreases. The same is true of price.
- Competitiveness and competitive economic ambient are in correlation. With the growth of the competitive economic ambient the competitiveness grows as well.

From everything mentioned above we can conclude that the use of new approach directives and the CE mark create a positive image of products on the market and enable the growth of profits and the competitiveness of organization.

This work should indicate the current level of quality, safety of products and competitiveness of Serbian industry, with the hope that it will soon be possible to establish a strategy for the improvement of competitiveness of companies in the meeting of the requirements of the new approach directives.

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