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## **DEVELOPMENT OF SOFTWARE SIMULATION FOR DETERMINING THE IMPACT CE MARK ON COMPETITIVENES PRODUCTS**

**Abstract:** *In order to investigate the impact of the CE mark on the competitiveness of products in Serbia, we created software simulation. This paper presents some simulation solutions that have a dominant impact on competitiveness.*

*From the above we can conclude that the application of New Approach Directives and CE Mark creates a positive image of the product; the market and allows you to increase revenue and competitiveness.*

**Keywords:** *directives of new approach, CE mark, competitiveness, quality of product, safety of products, price, simulation*

### **1. INTRODUCTION**

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 the European technical regulations ("Directives"), related to European health, safety and environmental protection legislation [1]. 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 the regulations, there now is 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 costs 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; <http://www.newapproach.org/>. These directives were developed from 1989 to stimulate the free movement of goods in the internal market. The application of harmonized standards remains voluntary. Manufacturer may always 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 the product compliance. Product compliance is confirmed through a risk assessment of the product [3].

The subject of this paper is to present software simulation to determine the impact of the CE mark on the relevant product's performance.

Aim of the software is primarily to indicate the enhanced competitiveness of products have CE mark [4, 5, 6].

## 2. OF THE IMPORTANT RESEARCHES

Given the subject of research with a number of aspects to be integrated, identified the need to develop a model for assessing the impact of the CE mark in product [7]. The model (Figure 1) interprets the common elements - characteristics that organizations should take into account in the process of obtaining the CE mark for the product. The model is based on empirical research, that provide details on all characteristics (K1-K18) and the relations (R1-R29) included in the model [8, 9].

Model the impact of the new approach directive on the competitiveness of

products in Serbia has become the subject of review in practice. With the purpose of researching the impact of the CE mark on the competitiveness of products and enterprises in Serbia, and on the base of the set models, we have made a questionnaire. The questionnaire has been sent to all companies whose products have the CE mark.

In analysis of questionnaire we created 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 noticed the impact on us the essential features - the competitiveness, safety and cost of products. In this work show some of the most important correlation..

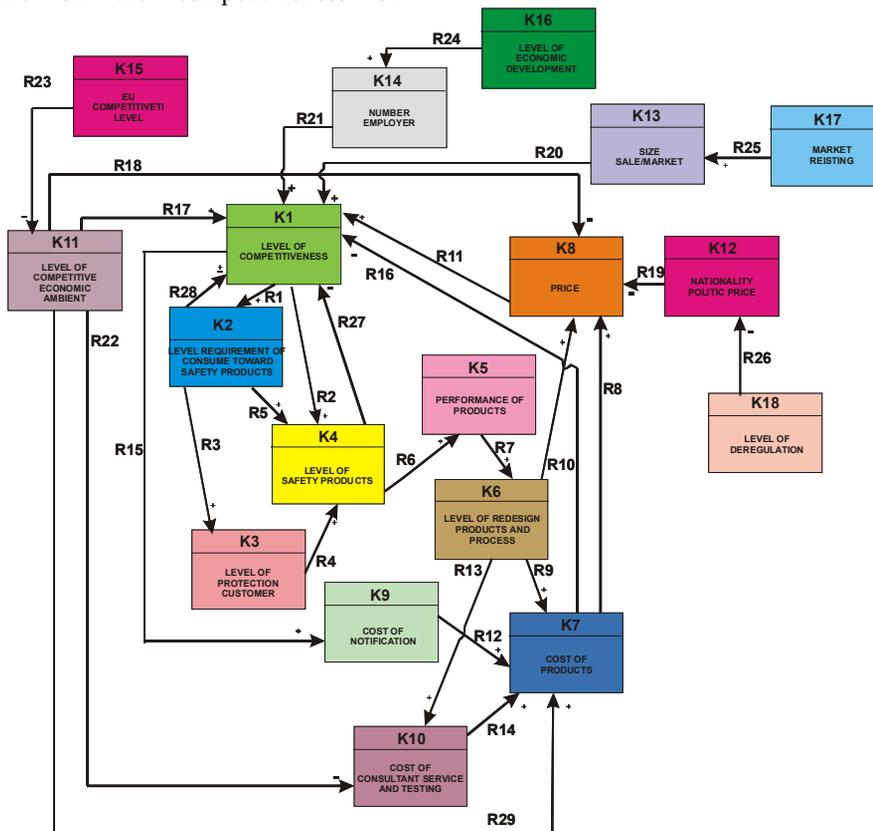
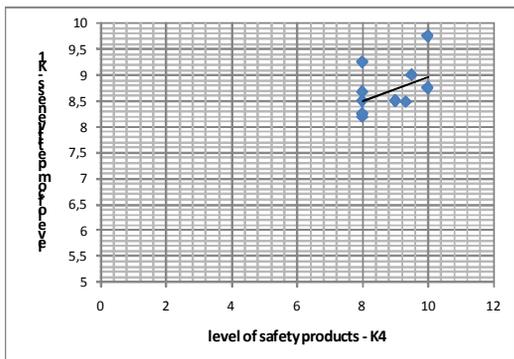


Figure 1 – Model impact of CE marking on competitiveness

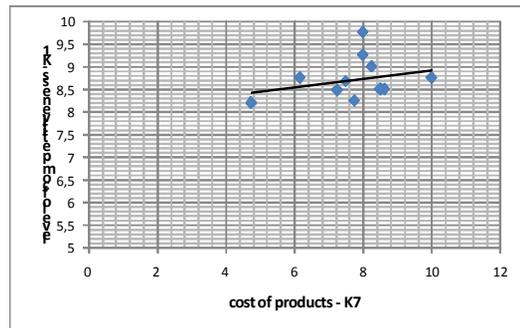
Relationship between level of competitiveness of enterprises and level requirements of consumers toward of product safety shown is in Figure 2. One of the most significant correlation between the level of competitiveness and the level of safety products as a base CE mark shown is in Figure 3 [10]. When we talk about competitiveness, we must not forget the relationship between level of competitiveness and cost of products and prices (Figure 4 and Figure 5). Level of competitive economic environment K11 is also characteristic of the dominant influence on competitiveness, particularly in the area (figure 6) [11].



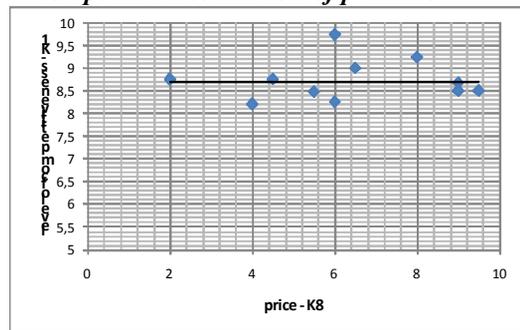
**Figure 2 – Relationship between level of competitiveness and level requirements of consumers toward of product safety**



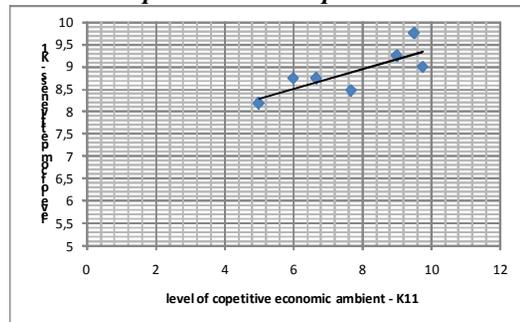
**Figure 3 – Relationship between level of competitiveness and level of safety products**



**Figure 4 – Relationship between level of competitiveness and cost of products**



**Figure 5 – Relationship between level of competitiveness and price**



**Figure 6 – Relationship between level of competitiveness and level of competitive economic ambient**

### 3. DESCRIPTION OF SOFTWARE SOLUTIONS FOR DETERMINING THE IMPACT CE MARKING ON COMPETITIVENESS

The system, which behavior is wanted to be defined by series of experiments, is

defined by mathematical model whose source of data is consisted of forty (48) elementary proportions from which additional eighteen variables (figure 1) are generated. Just program's result is done into Microsoft Excel surrounding, first of all because of easy input and manifold correction of as basic proportions so influential values [12, 13].

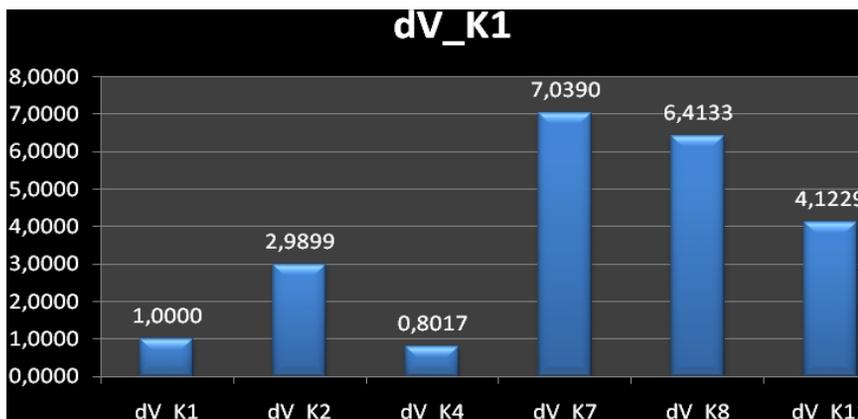
The show of initial values of variables is obtained according to the results of poll's questionnaire shown in the Table 1.

**Table 1**

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

During the experiment conducting models values change on different intervals. In the next step the program calculates the mutual intensity of variable proportions on the level of each six modules and puts them into adequate tables.



**Figure 13– View changes competitiveness K1 due to the change of other sizes**

Except the tabular show of results the program as well creates a graphic show of results on the basis of obtained results.

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

other characteristics.

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

The program enables the calculation and the 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 enables the graphic show of proportions, too.

Competitiveness and cost of products aren't in correlation. With the growth of cost of products competitiveness declines (figure 14). It is the same case with the price, with the growth of price products competitiveness declines (figure 15).

When we talk about competitiveness we should not neglect the influence of economic ambient the competitiveness grows as well (figure 16).

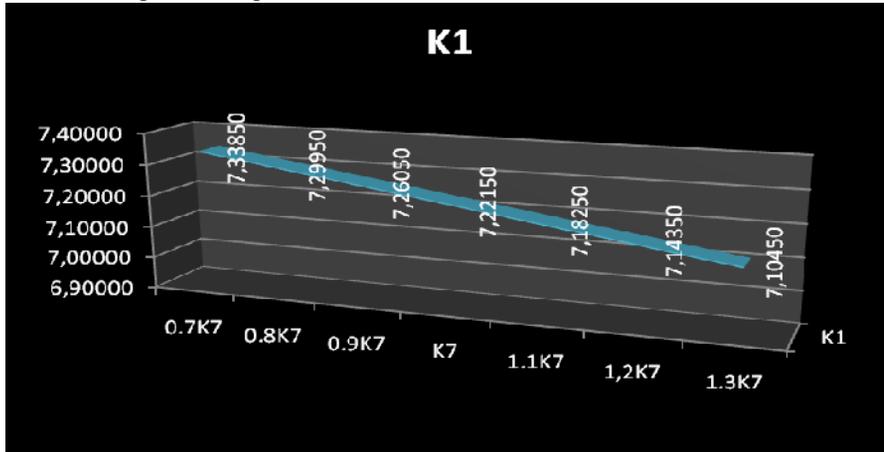


Figure 14 – Change competitive K1 with the changing cost of product K7

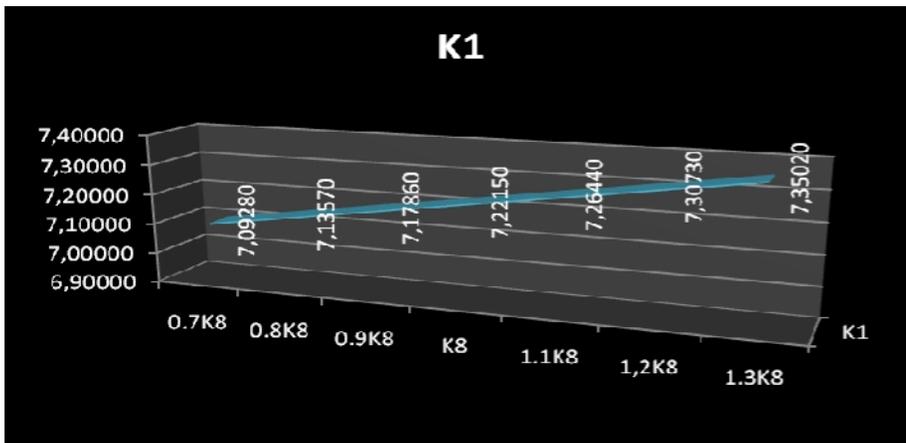


Figure 15 – Change competitive K1 with the changing price K8

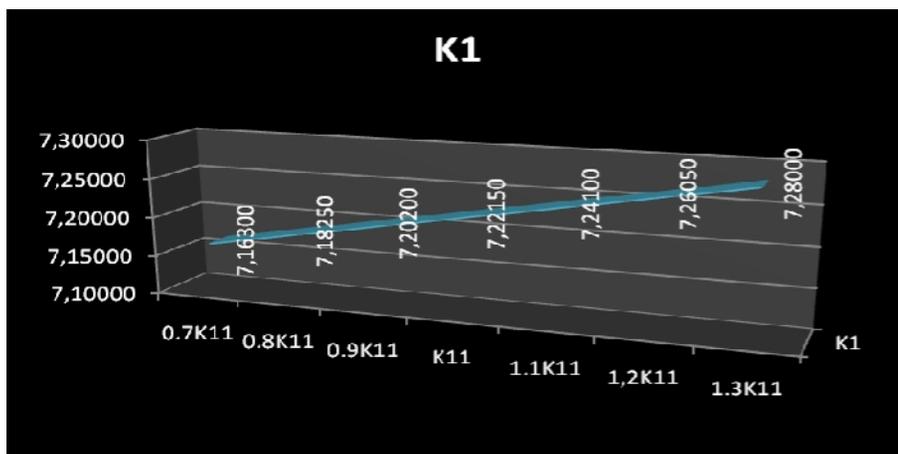


Figure 16– Change competitive K1 with the changing competitive economic ambient K11

#### 4. CONCLUSION

The starting bases about performance of this work are established in the use of the theories of the system and especially in models and simulations. Being grounded on these bases, by realization of this work the following starting hypotheses were used:

- The use of new approach directives influences on the growth of competitiveness
- Investment of resources in getting CE mark for products has a high rate of profitability.

On the base of the results obtained by simulation we can make the next

conclusion:

The most insensible influence of the competitiveness change is the influence on the change of safety of products, and the most sensible influence is the influence on the change of cost of products and price. The 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 CE mark make a positive image of products on the market and enables the growth of profits and the competitiveness of organization.

#### REFERENCES:

- [1] Tricker R., *CE Conformity Marking and New Approach Directives*, Butterworth Heineman, Oxford, 2000.
- [2] Lin W.T., Chen S.C. and Chen K.S., *Evaluation of performance in introducing CE marking on the European market to the machinery industry in Taiwan*, International Journal of Quality & Reliability Management, Vol. 22. No. 5, 2005, pp. 503-517
- [3] <http://www.newapproach.org/>.
- [4] Barringer, Bruce R., *Entrepreneurship: successfully launching new ventures*, Pearson Prentice Hall, Inc, New Jersey, 2006.
- [5] McGrath R. G., MacMillan I., *The entrepreneurial mindset*, Harvard Business School Press, USA, 2000.
- [6] Bodde D. L., *The intentional entrepreneur*, M.E. Sharpe, Inc., New York, 2004.

- [7] Soos L., *Modeling the Impact of New Approach Directives on Competitiveness of enterprise*, International Journal for Quality Research, Vol. 2. No. 3, pp. 169-176, 2008
- [8] Ruth M., Hanman B., *Modeling Dynamic Economic Systems*, Springer-Verlay, INC., New York, 1997.
- [9] Arsovski S., Kanjevac Milovanovic K., *Modeling the impact of new approach directives on competitiveness of enterprise*, International Journal for Quality Research, Vol. 2. No. 2, pp. 85-92, 2008
- [10] Arsovski S., Kanjevac Milovanovic K., *Extended model of competitiveness through application of new approach directives*, International Journal for Quality Research, Vol. 3. No. 1, pp. 1-6, 2009
- [11] Questionnaire *Researching the impact of the new approach directive on the competitiveness of enterprises in Serbia*
- [12] Pidd M., *Computer Simulation in Management Science*, John Wiley&sons, INC., New York, 1992.
- [13] Ross S., *Simulation*, Elsevier Academic Press, INC., USA, 2006.

Acknowledgment: Research presented in this paper was supported by Ministry of Science and Technological Development of Republic of Serbia, Grant III-44010, Title: Intelligent Systems for Software Product Development and Business Support based on Models.

