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## **IMPACT CE MARK ON THE COMPETITIVENESS OF MACHINE**

***Abstract:** This work should indicate the current level of competitiveness and safety machines that have obtained the CE mark, and the competitiveness this sector industry in Serbia. Research on the impact of machinery 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. Then we created a questionnaire on the basis of established models. The third step was an analysis of the results of questionnaires.*

*This paper presents some of the obtained solutions, which have a dominant effect on the competitiveness of the machine. From all this we can conclude that application of New Approach Directives and CE mark creates a positive image of the product on the market and thus can increase revenue and competitiveness.*

***Keywords:** Competitiveness, CE mark, Safety, Directive, Machine*

### **1. INTRODUCTION**

The competitiveness represents the ability and possibilities of an enterprise to create products and successfully sell them on domestic and foreign markets, to achieve success of competitive struggle. A great number of different factors and activities at different levels impact on the competitiveness. The task is to, starting from competitive struggle requirements, define and conduct those activities that by given and available factors will be prepared in the best way for the most successful participation in the competitive struggle. One of those activities is the coordinating of the project process and the production with the new approach directive requirements and placing CE Mark on a product [1, 2].

*The new approach* and European standardization significantly contributed to the development of the unique market and

facilitated free movements of goods on the international market of European Union. The legislation of the new approach primarily provided a high level of protection for consumers. Since 1987 directives have been gradually created as the basis of *the new approach* system, and set requirements for the product safety. Today there are more than twenty of such directives. Each directive covers a range of wide consumption products and sets the basic safety requirements which products have to meet before they are placed anywhere in European Union. Products covered by one or more directives have to meet all requirements defined in directives so that CE Mark (Conformite European) would be set on them, what means that they meet safety standards that are valid in all European Countries. The goal of the directives of *the new approach* is achieving of the unique and undisturbed goods` movement of the required quality

and safety in using [3].

The basic subject of this work is the research and analysis of the new approach directive impact and CE Mark on safety and the competitiveness of our products in machine areas through the prism of requirements, needs and expectations primarily of producers, but of the market as well [4-6].

The first key directive for machine was accepted on June the 14<sup>th</sup> in 1989 – Council Directive 89/392/EEC Council Directive on June the 14<sup>th</sup> in 1989 on the approximation of the laws of the Member States relating to machinery. The Directive 89/392/EEC was supplemented by three additional directives 91/368/EEC, 93/44/EEC, and 93/68/EEC. In European Union the mentioned directives are mandatory from January the 1<sup>st</sup> in 1995, and CE Mark from January the 1<sup>st</sup> 1997. Directives 89/392/EEC, 91/368/EEC and 93/68/EEC are joined in the unique *Directive for machines 98/37/ EC* on the 22<sup>nd</sup> June 1998. In accordance with technical changes and in order the certain technical refinements, this directive underwent more changes and additions. Thus the new directive for machines was drawn up.

The new Directive for machines 2006/42/EC was announced on June the 14<sup>th</sup> in 2006 and it came into force on June 29<sup>th</sup> in 2006 [1], and since 2009 only the new Machinery directive (MD) has begun to have effect. The revised hasn't introduced any radical changes for machines, but thanks to it [7, 8]

❖ Borderline between The Directive for machines safety and The Directive for low – voltage equipment was clarified. The difference won't be made anymore on the basis of the term " the main risk ". Instead, the new Directive for machines quotes the six categories of electrical machines that are the subject of the Directive for the low – voltage equipment.

❖ Border with the Directive for elevators is also clarified. A new text change the scope of the Directive for elevators so that the elevators, with a travel speed no more than 0,15 m/s, will be excluded from the Directive for elevators and so they will be the subject of the Directive for machines.

❖ A range of security components that are the subject of the Directive for machines, is clarified. The indicative list of security components is given in a new annex.

Requirements for essential health and safety requirements were not the subject of great changes, though some of them are revised. Among the significant changes are:

- requirement relating to risk assessment, is made clearer;
- there are new requirements for risks in connection with the machines that are used in construction and in machines that are installed in slow moving elevators;
- certain conditions that are currently apply to mobile machines or the machines for lifting, are applicable requirements to all machines for which we can predict risk;
- requirements relating to noise and vibrations are more accurate

## 2. FRAMEWORK

Today an enterprise can't be considered competitive if its products are not sold on the market of European Union (EU). The first condition to be found on the market of European Union is to satisfy all safety and security requirements. In other words, to have CE Mark.

This paper should indicate the current level of security and competitiveness of machines that have the CE mark, and the competitiveness of the companies that produce them.

**2.1 Basic assumptions**

During the realization of this work the following assumptions are used:

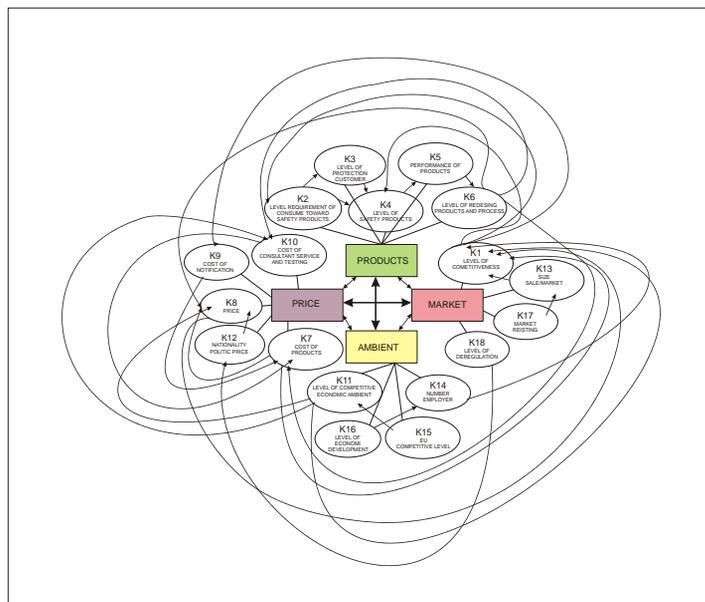
- H1: Coordinating of products with the requirements of the new approach Directive and achieving CE Mark impact on increasing of the competitiveness. Application of New Approach directives effect the level of competitiveness.
- H2: CE Mark impacts on increasing of safety products.
- H3: Investing resources in obtaining the CE mark for the products has a high rate of return.
- H4 The level of customer / user satisfaction is increased by achieving CE Mark.
- H5: 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.

**3. MODEL IMPACT CE MARK ON THE COMPETITIVENESS**

In order to examine the impact CE Mark on the competitiveness of machines and enterprises, we developed the new approach model impact on the competitiveness. The method that is used at this model setting is the modeling method of complex dynamic systems [9, 10].

At the model setting shown in the figure 1. it is started from characteristics (K1 – K18), wherein characteristics` levels and relation dependence forms between the same ( R1 / R26 ) are determined based on experiences in the process of product coordinating with the directive requirements [11, 12].



**Figure 1 – Model of the impact of CE marking on competitiveness**

Since problems, that are the subject of the research, are identified, variables are defined – characteristics that described them, their initial values, as well as dependence relations between them. On the basis of the set model, time (ten years) and space (Serbia) parameters are chosen, in which dynamic system behavior will be observed. The control variables (level of the competitiveness, product security, product price) were determined, then the model was re – examined in terms of sensitivity analysis, simulation values, and synergistic effect.

#### **4. CE MARK IMPACT RESEARCH ON THE COMPETITIVENESS FOR MACHINE**

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 basis for the preparation of the questionnaire was represented by set model (figure 1). The questionnaire has been sent to all companies whose products have the CE mark [13].

The study included a total of 35 companies, with a different number of products. From total 111 products, even 33 products (what is 30 %) are subjected to the requirements of the Directive for machines. Therefore in this work just analysis of the results for these products will be shown.

Analysis of obtained results shows that CE Mark has the dominant impact on the competitiveness. Beside of the competitiveness CE Mark has noticeable impact on product security, but on product price as well. We can see it in this work [14, 15].

##### **4.1.1 Level of the competitiveness**

As it is known that the basic activity of any enterprise for increasing of the

competitiveness level is the coordinating of the project and production process with the directive requirements and setting CE Mark on the product. In terms of mentioned activities the basis for the product competitiveness is the price, technological level, security level and product quality.

By the analysis of the results for the products that are subjected to the requirements of the Directive for machines (MD) we come to the following results:

1. the price is evaluated with 8.36,
2. technological level is evaluated with 8.64,
3. product security level is evaluated with 8.85,
4. product quality is evaluated with 8.64,

on the scale from 1 to 10, where the highest mark is 10, and the lowest mark is 1 (figure 2). It follows from this that the competitiveness level for the products that are subjected to MD Directive is 8.62. It is interesting that technological level and quality got the same marks, as well as that product security level in this case got the highest mark 8.64.

##### **4.1.2 Level of the competitiveness relating to the best**

In the previous chapter we showed the results and marks of the competitiveness level in terms of the basis for the competitiveness. Besides, the competitiveness is evaluated with the marks from 1 to 10 relating to the best in the class. Comparative results of the competitiveness level are shown graphically in comparison to the best in the class I Serbia as well as in European Union.

The medium value of the competitiveness level for the products that are subjected to the best in Serbia is 8.61, while relating to the best in European Union is 7.57 (figure 3).

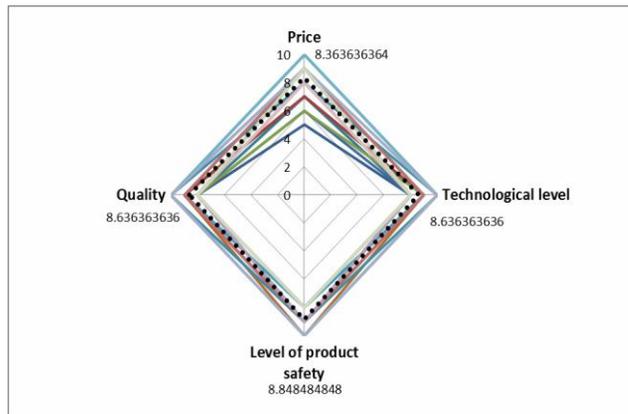


Figure 2 – Level of competitiveness of products subject to Directive MD

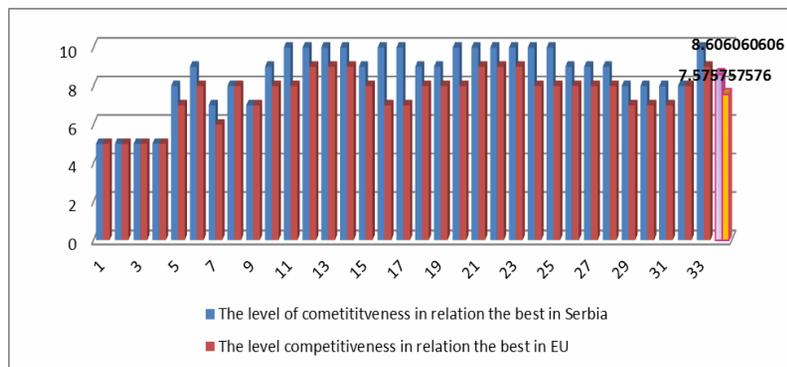


Figure 3 - Level of competitiveness compared to the best of products subject to Directive MD

#### 4.2 Market requirement level in terms of product security

Product security plays a key role in consumers who daily buy and use different products. Consumers expects that the product will work in a reliable and safe way. Therefore the product security has to be seriously considered in early stages of the research and the development (R and D). In the conducted research consumer requirement level was examined, that is, markets in terms of product security.

Market requirement level in terms of product security for the products that are subjected to the Directive MD, is evaluated with the medium mark 8.57. If we reflect individual examined requirements we come to conclusion that

the essential security got the mark 8.88, product security in exploitation got the mark 8.54, while speed of response in hazardous situations got 8.30 (figure 4).

#### 4.3 Product security level

Producer is obliged to put a safe product on the market. Therefore the product security is taken into account still in the design phase. CE Mark is the confirmation that the product is safe for the use. The conducted research includes 111 products that fulfilled all new approach Directive requirements and got CE Mark.

Respondents have the task to evaluate the product security level on the scale from 1 to 10 (figure 5).

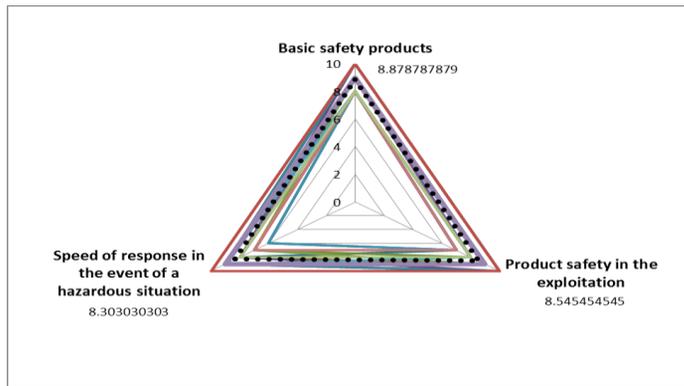


Figure 4 - Level of market demand in terms of product safety for products subject to Directive MD



Figure 5 - Level of security products subject to Directive MD

#### 4.4 Cost of product

The product competitiveness doesn't depend only upon the product security or its quality. The very important characteristic, when comes to the competitiveness, is the product price on the market. The basis for the pricing of each product is primarily his cost of product. Therefore it is included as one of important characteristics of this research. The cost price is evaluated with regard to the best in a class, from the aspects of the following indexes:

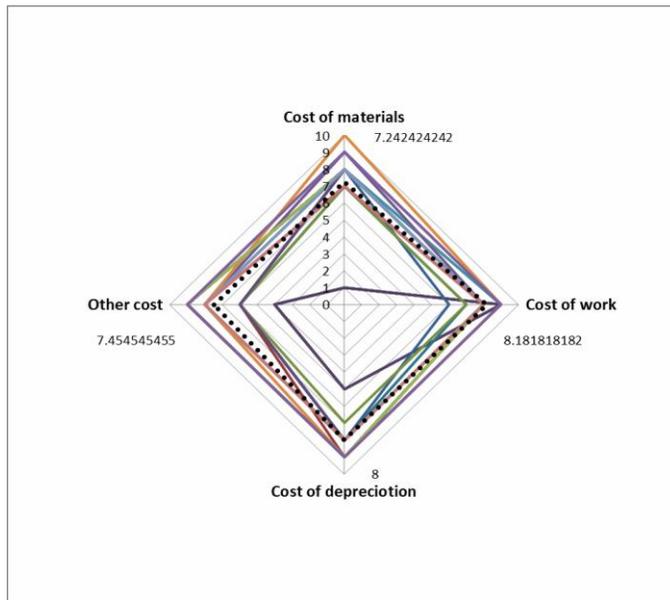
- Cost of material price,
- Cost of work,
- Costs of depreciation, and
- Other cost.

The cost price of products that are

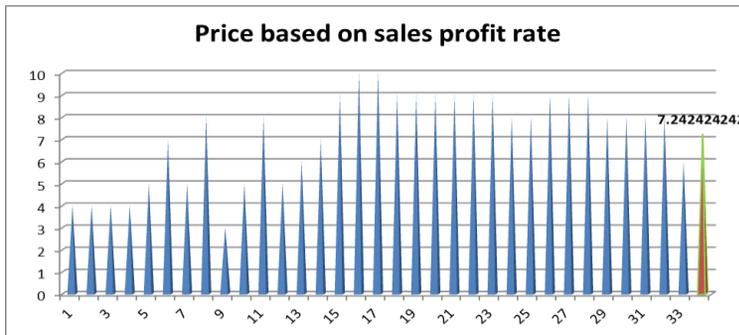
subjected to the Directive MD is 7.71 (figure 6). The cost price indexes for these products got the marks from 7.24 to 8.18. The cost of work got the highest mark, while the lowest mark belonged to the material price.

#### 4.5 The selling price

The price according to which a product is placed on the market is very important and an influential characteristic when it comes to the product competitiveness. The selling price on the basis of profit rate for the products that are subjected to the Directive MD is 7.24 (figure 7). Marks are very varied, the lowest mark for this directive price is 3, while the highest is 10.



**Figure 6 - Cost of products subject to Directive MD**



**Figure 7 - Price of products subject to Directive MD**

**5. ADVENTAGES OF CE MARK**

**5.1 The benefits of obtaining a CE mark**

On the question about perceived advantages of obtaining a CE Mark for its products, enterprises could chose one or more offered answers. They could also write it alone if they thought that one of the potential answers was omitted. The results obtained after the questionnaire analysis are shown in the table 1. According to the observations of all

obtained results we came to conclusion that the highest benefits of CE Mark from the group of commercial (competitive advantage, selling increase, risk reduction, the realization of risk increase) and marketing benefits (improving the image, increasing the number of customers, satisfying of customer requirements and confidence increase).

Regulatory benefits (compliance with the law, reduced number of penalties, reduced number of reclamation/complaints) are minimum.

**Table 1 Benefits of obtaining a CE mark**

N <sup>o</sup>	Perceived benefits of obtaining CE mark	number of responses	% of responses
1.	Competitive advantage	29	13.06
2.	Improving the image	29	13.06
3.	The higher the quality of products / services	11	4.96
4.	Increasing the number of customers	27	12.16
5.	Increase sales	27	12.16
6.	Meeting the demands of customers and increase confidence	25	11.27
7.	Reduced number of complaints / appeals	6	2.70
8.	Complying with the law	10	4.50
9.	Reduced number of ``punishment ``	4	1.80
10.	Reducing the risk	25	11,27
11.	The realization of increase in export	29	13.06
<b>TOTAL:</b>		<b>222</b>	<b>100</b>

### 5.2 The increase of the customer competitiveness and satisfaction of obtaining CE mark

Current level of the competitiveness increase achieving the CE mark as well as the increase of customer satisfaction (at the enterprises in the survey) are shown in the table 2.

**Table 2a Increase competitiveness with the obtaining a CE mark**

Increase	competitiveness (number of companies)	% of sample
It is not the increase	1	2,86
Increase: 1-10%	24	68.57
Increase: 11-25%	9	25.71
Increase: 26-50%	1	2.86
Increase: >50%	0	0

**Table 2b Increase customer satisfaction with the obtaining a CE mark**

Increase	customer satisfaction (number of companies)	% of sample
It is not the increase	0	0
Increase: 1-10%	27	77.14
Increase: 11-25%	6	17.14
Increase: 26-50%	1	2.86
Increase: >50%	1	2.86

From 35 of the surveyed enterprises, just one enterprise didn't achieve the competitiveness increase, what is 2.86 % of the studied samples. There is 97.14 % of the surveyed enterprises with the increase of the competitiveness level (what confirms the hypothesis H1 – between the CE mark and the enterprise competitiveness there is a significant relation).

The highest level of the increased level of the competitiveness is in the range from 1 to 10 %, 24 enterprises, 68.57% of samples.

Obtaining CE Mark for their products all surveyed enterprises achieved the level increase of customer satisfaction (What confirms the hypothesis H4 – achieving CE Mark increasing the level of customer / user satisfaction). The highest level increase of customer satisfaction is in the range from 1 to 10 % (27 enterprises, that

is 77.14 % of samples), as well as of the competitiveness (figure 8).

When we reflect the comparative review of the competitiveness level increase and the customer satisfaction increase (figure 9), we see that in both cases the highest level of achieved increase is in the range from 1 to 10 %.

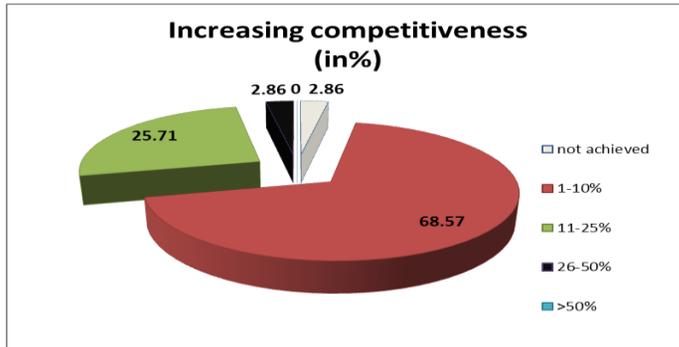


Figure 8 - The percentage increase in view of the customer satisfaction

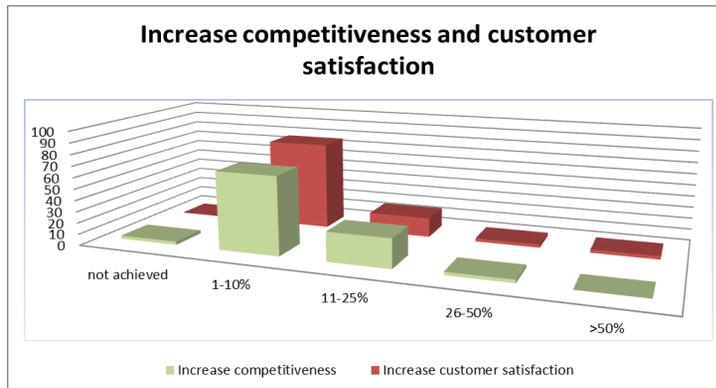


Figure 9 - Comparison of increase in competitiveness and increase customer satisfaction

### 5.3 Justification for investment in CE mark

Justification for investment in CE Mark was assessed in relation to achieved effects. Enterprises are justification for investment on the scale from 1 to 10 evaluated with marks from 2 to 10.

the medium mark for justification for investment in CE Mark is high and it is 8.48 (figure 10). The great number of

enterprises chose the marks 9 (12 enterprises) and the marks 8 (10 enterprises).

Marks from 1 to 5 are chosen by 3 enterprises what represents only 8.57 % of the tested samples and it can be considered negligible.

The maximum score 10 was chosen by 9 enterprises, what represents 25.71 % of the tested samples.

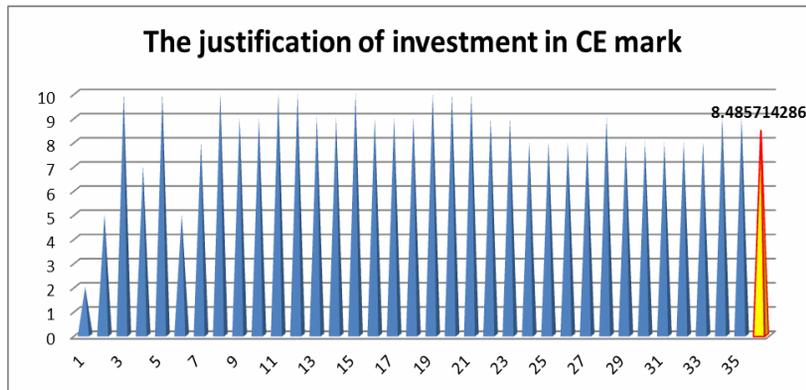


Figure 10 - Justification of investments in the CE mark

## 6. CONCLUSION

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, and includes the most relevant factors. 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 8.61; in relation to the European Union score 7.57. 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 8.57 (on a scale of 1 to 10), which is proof that the new approach directives have a dominant impact on the safety of product

According to the shown results it can be concluded that this work indicates to the existing level of quality, security of machines and the competitiveness of this Industry of Serbia, with hope that the strategy of possible improvement of enterprise competitiveness will be determined while meeting requirement of the new approach directive.

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