

## Analysis Results of the Justification of Investments into Quality, Environment Protection and Products Safety in Šumadija and Pomoravlje Region

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**Abstract:** *Within the project "Improvement of quality and environment protection in Šumadija and Pomoravlje", financed by EU, "The study on vindication investments into quality improvement and environment protection in Šumadija and Pomoravlje" has been made. This paper discusses the results of cost/benefit analysis that includes SME from metal-processing industry, industry for non-metallic materials production and manufacturing, agriculture and food-processing industry, tourism and catering industry. The paper also includes the indicators of total economic benefits and costs that may be the result of QMS, EMS and HACCP initiation, as well as of CE mark for the products obtaining. We illustrated necessary financial investments in relation to predicted percentage of certified SME in the region in five years period, and on this basis financial indicators of justification of investments and the proof of those investments through calculated net present values (NPV).*

**Keywords:** *quality, benefits, costs, justification of investments, cost/benefit analysis, small and medium enterprizes (SME).*

### 1. INTRODUCTION

Regarding the fact that quality is one of the first elements of balanced regional development (through quality infrastructure) and starting point of regional development (through competitiveness and effects on life quality), the regional quality aspect must be significant segment of regional development politics [1] and even wider through the relations between the region and the environment and between entities within the region. There are numerous studies concerning the field of regional politics and development strategies, but within them quality field is not adequately represented. One of the reasons for that is the fact that creators of regional politics have not recognized the quality as significant factor and

the result of development.

Term quality in the region has many meanings. Primarily, it involves all entities in region quality level (organizations, local state administration, banks, universities, health organizations) and even wider through the relations between the region and the environment and between entities within the region. It means that quality in the region has been reduced to the quality of entities and the relations of the entities within and out of the region. Basic problems in the region related to quality infrastructure analysis can be reduced to the following:

- there is no data basis with certified organizations and certifying bodies that working in Šumadija and Pomoravlje region,

- there are no research studies on infrastructure quality, environment protection and products safety,
- there is not defined the relation among investing into quality, environment protection and products safety, and competitiveness increase and economic efficiency (i.e. economic benefit derived from it).

Research results indicate that there is:

- low level of education for quality (there are less than 10% quality professionals),
- minority of established quality systems,
- minority of accredited laboratories and few certifying bodies operating in the region,
- low level of products quality (CE mark is registered for few products, with fulfilment of minimal conditions for other products certification, primarily from food-processing and automotive industry),
- low technological level (seen in the usage of outdated technologies).

The goal of the paper is to represent cost/benefit analysis results managed on the basis of:

- known SME structure in Šumadija and Pomoravlje region in the field of metal- processing industry, industry for non-metalic materials production and manufacturing, agriculture and food-processing industry, tourism and catering industry,
- gained indicators of total economic benefits and costs that may be the result of QMS, EMS and HACCP initiation, as well as of CE mark for the products obtaining.
- assumed financial investments in five years period.

## 2. STRUCTURE OF SME IN THE REGION AND ASSESSMENT OF NECESSARY FINANCIAL INVESTMENTS

In Šumadija and Pomoravlje there are 3.481 active small and medium enterprizes (SME), out of which 118 medium and 3.363

small [2]. Viewed in sections, the most SME are in the processing industry (867) and trade (1660), which is 72,6% of total businesses. The most present industry subsectors are: metal-processing industry and machine-building industry, production of non-metalic materials (including wood-processing industry), food products production, chemical and textile industry.

According to the number of active enterprizes in certain industrial sectors of Šumadija and Pomoravlje metal-processing industry (13,26%), food-processing industry (18,79%), as well as industry for non-metalic materials production and manufacturing (26,1%).

Basis of benefit/cost method is determinating and relating all of the costs and benefits made by the realisation of a certain process. In this case that process is the initiation of ISO 9001, ISO 1400 and ISO 22000 (HACCP) and obtaining the CE mark for products, for small and medium businesses (SME) in the region of Šumadija and Pomoravlje. The analysis has been done for the five years period and included SME from the following fields:

- metal-processing industry and industry for production and manufacturing of non-metalic materials,
- agriculture and food-processing industry,
- tourism and catering industry.

In cost/benefit analysis (CBA) most often is the use of Net Social Benefit (NSB) which is:

$$NSB = SB - SC$$

**SB** – Social Benefits (here **UK**)

**SC** – Social Costs (here **UT**).

In this analysis, total economic benefits and costs that may be the result of initiation of QMS (**UK<sub>Q</sub>** and **UT<sub>Q</sub>**), EMS (**UK<sub>E</sub>** and **UT<sub>E</sub>**), HACCP (**UK<sub>H</sub>** and **UT<sub>H</sub>**) as well as of obtaining the CE mark for the products (**UK<sub>C</sub>** i **UT<sub>C</sub>**) have been given in percentages. This has been done for three possible alternatives: optimistic, medium (realistic) and pesimistic. After arranging the analysis results, we get the following indicators [3]:

- Total economic benefits and costs that result from QMS initiating:

Total economic benefits (**UK<sub>Q</sub>**)

(**UK<sub>Q</sub>**)<sub>O</sub> = 49,1% - optimistic value

(**UK<sub>Q</sub>**)<sub>S</sub> = 40,3% - medium (realistic) value

(**UK<sub>Q</sub>**)<sub>P</sub> = 24,3% - pesimistic value

**Total economic costs (UT<sub>Q</sub>)**  
 (UT<sub>Q</sub>)<sub>O</sub> = 24,8% - optimistic value  
 (UT<sub>Q</sub>)<sub>S</sub> = 31,4% - medium (realistic) value  
 (UT<sub>Q</sub>)<sub>P</sub> = 44,4% - pesimistic value

- Total economic benefits and costs that result from EMS initiating:

**Total economic benefits (UK<sub>E</sub>)**  
 (UK<sub>E</sub>)<sub>O</sub> = 41,5% - optimistic value  
 (UK<sub>E</sub>)<sub>S</sub> = 29,9% - medium (realistic) value  
 (UK<sub>E</sub>)<sub>P</sub> = 16,6% - pesimistic value

**Total economic costs (UT<sub>E</sub>)**  
 (UT<sub>E</sub>)<sub>O</sub> = 9,4% - optimistic value  
 (UT<sub>E</sub>)<sub>S</sub> = 14,0% - medium (realistic) value  
 (UT<sub>E</sub>)<sub>P</sub> = 19,1% - pesimistic value

- Total economic benefits and costs that result from HACCP initiating:

**Total economic benefits (UK<sub>H</sub>)**  
 (UK<sub>H</sub>)<sub>O</sub> = 47,7% - optimistic value  
 (UK<sub>H</sub>)<sub>S</sub> = 38,0% - medium (realistic) value  
 (UK<sub>H</sub>)<sub>P</sub> = 25,4% - pesimistic value

**Total economic costs (UT<sub>H</sub>)**

(UT<sub>H</sub>)<sub>O</sub> = 23,9% - optimistic value  
 (UT<sub>H</sub>)<sub>S</sub> = 31,3% - medium (realistic) value  
 (UT<sub>H</sub>)<sub>P</sub> = 39,4% - pesimistic value

- Total economic benefits and costs that result from obtaining the CE mark:

**Total economic benefits (UK<sub>C</sub>)**  
 (UK<sub>C</sub>)<sub>O</sub> = 45,9% - optimistic value  
 (UK<sub>C</sub>)<sub>S</sub> = 36,2% - medium (realistic) value  
 (UK<sub>C</sub>)<sub>P</sub> = 21,1% - pesimistic value

**Total economic costs (UT<sub>C</sub>)**  
 (UT<sub>C</sub>)<sub>O</sub> = 26,0% - optimistic value  
 (UT<sub>C</sub>)<sub>S</sub> = 32,8% - medium (realistic) value  
 (UT<sub>C</sub>)<sub>P</sub> = 39,8% - pesimistic value

In table 1. is presented the illustration of SME from metal-processing industry and industry for production and manufacturing of non-metalic materials, agriculture and food-processing industry, tourism and catering industry, where there are SME's number, size (small and medium) and personnel.

**Table 1. SME's number, size and personnel**

	Businesses	Small	Medium	Personnel
<b>Metal-processing industry and industry for production and manufacturing of non-metalic materials</b>	341	325	16	303 bus. ≤ 10 10 < 32 bus. ≤ 50 6 bus. > 50
<b>Agriculture and food-processing industry</b>	163	152	11	145 bus. ≤ 10 10 < 15 bus. ≤ 50 3 bus. > 50
<b>Tourism and catering industry</b>	65	61	4	58 bus. ≤ 10 10 < 6 bus. ≤ 50 1 bus. > 50
<b>Σ</b>	569	538	31	506 bus. ≤ 10 10 < 53 bus. ≤ 50 10 bus. > 50

In table 2. is demonstrated assessments of necessary financial investments (for initiating ISO 9001, ISO 14001, HACCP and obtaining the CE mark), which refer to consultant services, certification and investments. The assessments have are given in relation to the personnel number in SME. Also,

the assessments of certified businesses at the end of five years period has been given In table 3. we have demonstrated (using the data from table 1. and 2.) necessary financial investments in relation to predicted percentage of certified SME after five years (for ISO 9001, ISO 14001, HACCP and the CE mark)

**Table 2. Necessary financial investments and percentage of certified enterprizes after five years**

	ISO 9001	ISO 14001	HACCP	CE mark/product
Personnel ≤ 10	5.000	3.000	6.000	One product = 5.000
10 < personnel ≤ 50	10.000	6.000	12.000	Two products = 10.000
Personnel > 50	20.000	10.000	25.000	Three products = 15.000
Percentage of certified enterprizes	80%	30%	100%	40%

Note: necessary financial investments are in euros (€)

**Table 3. Necessary financial investments in relation to the percentage of certified SME**

	Certified enterprizes percentage	Necessary financial investments
ISO 9001	80%	2.608.000
ISO 14001	30%	514.800
HACCP	100%	1.125.000
CE mark	40%	770.000

Note: necessary financial investments are in euros (€).

Table 3. has been formed according to the assumption that in five years time (see table 2.):

- ISO 9001 will initiate 80% of total SME,
- ISO 14001 will initiate 30% of total SME from metal-processing industry and industry for production and manufacturing of non-metalic materials, SME from agriculture and food-processing industry,
- HACCP will initiate 100% of SME from the field of agriculture and food-processing industry,
- 40% of SME products from metal-processing industry and industry for production and manufacturing of non-metalic materials will obtain the CE mark.

Necessary financial investments (table 3.) are

the basis for establishing the total economic benefits (UK) and costs (UT) that may result (in five years period) from initiation of ISO 9001, ISO 14001, HACCP and CE mark for SME products obtaining in the region of Šumadija and Pomoravlje.

If we multiply percentage of total economic benefits (UK) and costs (UT) and necessary financial investments from table 3., we will get the financial indicators of justification of investment into quality improvement, environment protection and products safety in Šumadija and Pomoravlje, regarding SME from analysed fields of economy (table 1.).

**Table 4. Financial indicators of justification of investment**

	ISO 9001	ISO14001	HACCP	CE mark	Total
(UK) <sub>O</sub>	1.280.528	213.642	536.625	353.430	<b>2.384.225</b>
(UK) <sub>S</sub>	1.051.024	153.925	427.500	278.740	<b>1.911.189</b>
(UK) <sub>P</sub>	633.744	84.456	285.750	162.470	<b>1.166.420</b>
(UT) <sub>O</sub>	646.784	48.391	268.875	200.200	<b>1.164.250</b>
(UT) <sub>S</sub>	818.912	72.072	352.125	252.560	<b>1.495.669</b>
(UT) <sub>P</sub>	1.157.952	98.326	443.250	306.460	<b>2.005.988</b>

Note: all of the values are in euros (€).

Analysing the data from table 4. we can deduce that realistic value of total

economic benefits (UK)<sub>S</sub> is greater than realistic value of total economic costs (UT)<sub>S</sub>, in

individual observations (especially for ISO 9001, ISO 14001, HACCP and CE mark) as well as in summary (22%).

Also, we can be seen from the table that the summary of maximum total economic benefits  $(UK)_o$  is 15,9 % greater than the summary of maximal total economic costs  $(UT)_p$ . This statement refers also to individual maximal total economic benefits and costs, but in different percentual amounts.

One of the conclusions is that the summary of minimal total economic benefits  $(UK)_p$  is inconsiderably greater than the summary of minimal total economic costs  $(UT)_o$  – just 2%. However, that is not the case with individual analyses of total economic benefits and costs.

The most negative version would be with minimal  $(UK)_p$  or realistic  $(UK)_s$  version of total economic benefits and maximal total economic costs  $(UT)_p$ . In that case we would have negative indicators of vindication investment into quality improvement, environment protection and products safety, which is hardly possible with regard to the experience of the EU countries.

We can conclude, from the previous analysis, that investing into quality improvement, environment protection and

products safety in SME of Šumadija and Pomoravlje is greatly acceptable and profitable. In other words, the assumption that, in an analysed five years period, total economic benefits will be greater than total economic costs, is realistic one.

Figure 1. demonstrates net effects of investing into quality improvement, environment protection and products safety for optimistic version, with data from table 4.

Figure 2. demonstrates net effects of investing in the case of realistic (medium) version, which can be assumed the most probable.

### 3. ESTABLISHING THE JUSTIFICATION OF INVESTMENT BASED ON NET PRESENT VALUE (NPV)

We shall assume that total benefits  $(UK)$  and costs  $(UT)$  will increase within the five years period according to quadrant function, which is, of course, the simplification of the problem (figures 1. and 2.). If we accept this assumption, then:

$$y = a + b \cdot x^2$$

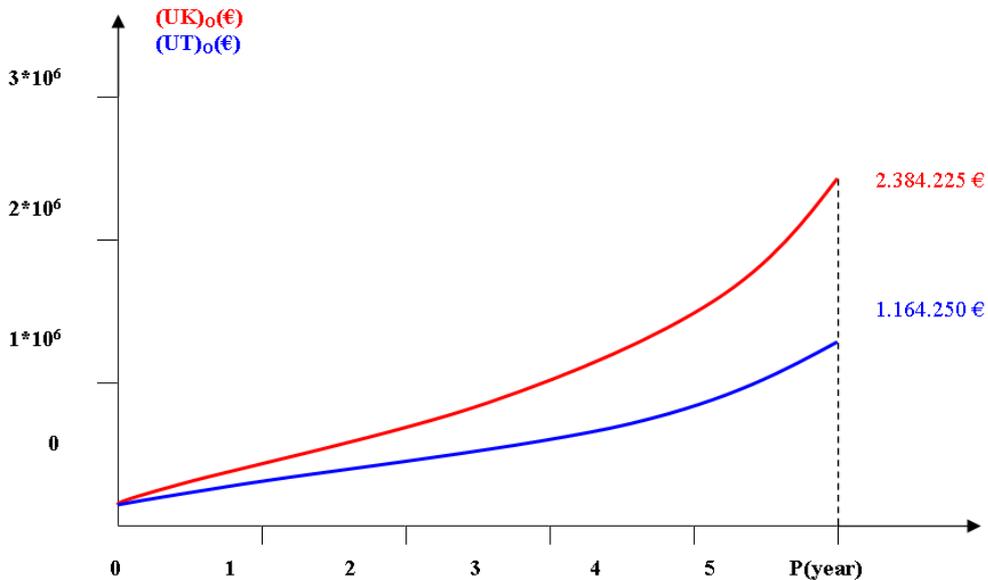


Figure 1. Net effects of investing into quality improvement, environment protection and products safety for optimistic version

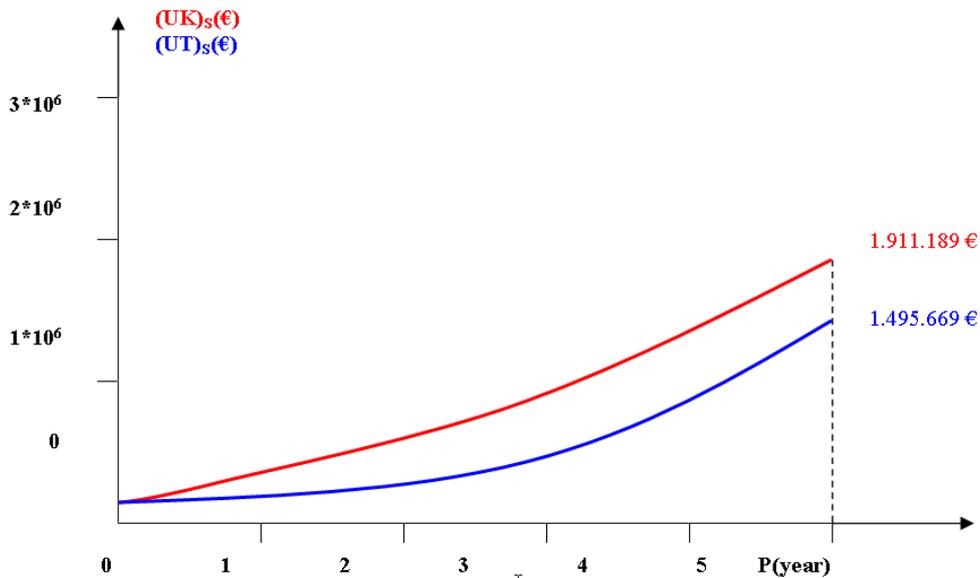


Figure 2. Net effects of investing into quality improvement, environment protection and products safety for medium (realistic) version

We shall determine net present value (NPV) only for medium (realistic) version, because if its value is positive, then it is certainly positive for optimistic version as well. In that case we have:

$$(UK)_s = a_1 + b_1 * x^2$$

$$(UT)_s = a_2 + b_2 * x^2$$

We shall assume that the starting year from which investment effects are analysed is year 2007. Assuming that, in that moment, total economic benefits and costs are equal and amount, for example, 200.000 €, then the coefficients  $a_1$  and  $a_2$  are equal, so  $a_1 = a_2 = 200.000$  €.

On figure 2. we can see, from the previous analysis, approximate total economic benefits and costs at the end of five years period:

$$(UK)_{55} = 1.911.189 \text{ €}$$

$$(UT)_{55} = 1.495.669 \text{ €}$$

With these data it is easy to find coefficients  $b_1$  and  $b_2$ , which are:

$$b_1 = 68447,56$$

$$b_2 = 52826,76$$

Using the formula [4]:

$$PVB = \sum_{t=0}^n \frac{B_t}{(1+s)^t}$$

$$PVC = \sum_{t=0}^n \frac{C_t}{(1+s)^t}$$

- **PVB** – net present value for average version of total economic benefits  $(UK)_s$
- $B_t$  – total economic benefits  $(UK)_t$ , for each year separately
- **PVC** – net present value for average version of total economic costs  $(UT)_s$
- $C_t$  – total economic costs  $(UT)_s$ , for each year separately
- $s$  – interest rate assumed to be 12%
- $t$  – years,  $t = 0$  to  $t = n = 5$

Since we have all necessary data it is easy to get **PVB** i **PVC**:

$$PVB = 3.305.778,9 \text{ €}$$

$$PVC = 2.726.668,3 \text{ €}$$

$$NPV = PVB - PVC$$

$PV = 579.095,6 \text{ €} > 0$ , which means that investing into quality, environment protection and products safety in SME of Šumadija and Pomoravlje region, with all previous assumptions, is acceptable and profitable and should be accomplished [5].

#### 4 CONCLUSION

The results of cost/benefit analysis (CBA) presented in net present value (NPV)

proved that investing into quality improvement, environment protection and products safety in SME of Šumadija and Pomoravlje region, is greatly profitable and accepted. In other words, the assumption that, in an analysed five years period, total economic benefits will be greater than total economic costs, is realistic. This will have positive impact on economic efficiency as

well as on competitiveness of enterprises in the region. Before all, this refers to an export orientation of businesses and demands of business partners from EU, as well as to the improvement of working processes in organizations, therefore to the level increase of products and services quality

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