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INTEGRATION OF SUSTAINABLE DEVELOPMENT AND QUALITY ON ORGANISATIONAL AND REGIONAL LEVEL

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Abstract: Subject of the article is an integration of quality management and sustainable development, with the basis of considerations of sustainable development and the structure of the key quality factors pointed to the possibility of achieving synergy of action on the most important variables, as well as the established model of integration of these two complex concepts. Areas of our study were 83 organizations in the region of Central Serbia. The study was based on questionnaires which contained 50 questions about the level of quality and sustainable development in the companies surveyed. Results of research highlights the most influenced variables in condition of constraints related to transition economy characteristics.

Keywords: sustainable development, quality, company, region

1. Introduction

In theory and practice, the relationship between quality and sustainable development is distinguishing, but also face an almost complete lack of research approaches and connection of problems in these areas. As the absence of multidisciplinary research in this area, so in practice of work of relevant institutions at all levels, cooperation is missing. On the other hand, there is a problem that relates to the availability of data, even if they exist they are usually outdated, once collected, and available only for the general population at the level of the Republic. For this reason, monitoring and analysis of trends is more difficult on the regional level.

Those proposed models were established based on the analysis of the existing

literature, domestic and foreign existing models and empirical assessment of the importance of the characteristics. Thus, the proposed model of sustainable development contains 18 characteristics relating to the environmental aspect, 15 relating to the economic, and the other 10 characteristics relating to the social aspects of sustainable development (Prescott-Allan, 1997; Drabo, 2016). In the article based introduction are given: (1) model of sustainable development and quality, (2) research results of sustainable development and quality of the level of organization and region, (3) simulation model and simulation results, and (4) conclusion.

2. Model of sustainable development and quality

Quality model is still subject of many research (Arsovski, 2016). Quality is related

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to other paradigmes. In the article is emphasized paradigm of sustainable development, ICT support, resilience, eco-aspect, quality and safety of products.

Quality model contains eight characteristics that to a greater or lesser extent, affect the level of quality in the organization. So far in literature in this area it is mainly addressed the quality level of the organization, a very rare it is regional or national level (Ávila *et al.*, 2015; Kadlubek and Graber, 2015; Zimon, 2015; Savoia *et al.*, 2016).

Avila *et al.* (2015) analyzed different models for supplier selection. In their proposed empirical model they analyze criteria and sub-criteria for model generating, i.e: (1) quality system, (2) financial system, (3) sinergies sistem, (4) cost system, and (5) production system.

Kadlubek and Grobora (2015) analysed customers' expetations and experiences as better for logistic customer service quality. In one Plish province they tested proposed model using statistical technique.

Zimon (2015) analyzed the impact of quality management system operating cost on the organaziting and find that cost of QMS implementation is relative high and in more than 43% of cases employes thought that it has impact on quality of service.

Savoia *et al.* (2016). Analyzed technical competences and human resources in purpose of sustainable technological development with emphasize on coherence Adriatic area with cross-border strategies and added value of the cross-border cooperation.

In stable operating conditions aspect of quality is very important, which is analyzed et in (Tadić *et al.*, 2013; Tadić *et al.*, 2014; Arsovski *et al.*, 2012; Stefanović *et al.*, 2015; Tadic *et al.*, 2015).

Tadic *et al.* (2013) defined and tested model for evaluation of quality goals by using fuzzy AHP and fuzzy TOPSIS methodology. This paper is possible to apply on regional development.

Tadic *et al.* (2014) analyzed organizational resilience factors by using a two-step Fuzzy AHP and Fuzzy TOPSIS. This proposed and tested methodology is suitable for regional development aspect.

Arsovski *et al.* (2014) analyzed different aspects of development of quality management in Serbia and after deep analysis concluded that overall level of quality management is not satisfy and it is one of reason for low level of Serbian competence.

Tadic *et al.* (2015) analyzed performance of the project for business process' quality improvement by using fuzzy approach.

Sustainable development and the quality of the region is affected by many factors. The first group of factors relate to the ability of the organization to regain performance after their sharp drop (Aleksić *et al.*, 2013; Arsovski *et al.*, 2009a; Aleksić 2014; Arsovski *et al.*, 2015).

Aleksic *et al.* (2013) analyzed organizational resilience potential in SMEs by using fuzzy approach and found factor which determine level of resilience and possibilities for its improvement.

Arsovski *et al.* (2009a) analyzed aspect of manufacturing planing and scheduling using simulation techniques (Petri Nets). They find a high amount of unused capacity of production resources as base for improvement of productivity and process quality.

Aleksic *et al.* (2014) analyzed model for assesment of organizational vulnerability based on wide approach of organizational vulnerability and proposed and tested this model.

Arsovski *et al.* (2015) analyzed organizational resilience in a cloud-based enterprise in supply chain as factor for achieving more innovative SMEs in supply chain.

In addition, the quality and sustainability of the growing influence of the ICT, which is especially highlighted in the papers (Kalinic

et al., 2011; Arsovski *et al.*, 2012a; Arsovski *et al.*, 2012b; Stefanovic *et al.*, 2012).

Kalinic *et al.* (2011) analyzed aspect of using of mobile learning application in enterprizes in purpose for achieving higher level of effectiveness and cooperativeness among partners.

Arsovski *et al.* (2011) analyzed characteristics and performance of supply chains in automotive industry as basis for development of appropriate information systems.

Arsovski *et al.* (2019) analyzed relations among sustainable development and quality of life.

Eco aspect of sustainability is gaining importance, and within this group is especially significant recycling process (Pavlovic *et al.*, 2011; Curcic *et al.*, 2011; Djordjevic *et al.*, 2011). The sustainability of the organization and the region largely depends on the quality and safety of products, which has been identified in the works (Arsovski *et al.*, 2009b, Nestic *et al.*, 2015; Slavkovic *et al.*, 2012; Kanjevac *et al.*, 2011; Arsovski *et al.*, 2009).

3. Investigation of sustainable development and quality at the level of organization and region

Based on previous investigation of author (Kokic Arsic, 2012) and review of teoretical approaches related to sustainable development (Choucri, 2007; Stimson *et al.*, 2006; Arsovski *et al.*, 2009) is defined base model of sustainable development (SD) which is integrated with quality on two levels: (1) organizational level and (2) regional level. For each level are analized factors influenced on SD and quality. This base model is in next step analyzed using three kind of investigations: (1) literature review, (2) in field analysis using statistical tools and (3) simulations.

Statistical analysis of the questionnaire investigated the level of sustainable development and quality in Central Serbia in the last five years. This paper presents some of these results.

If we start from the parameters relating to the economic aspects of sustainable development, the analysis shows that the GDP in the last 6 years. in Central Serbia grew at an average annual rate of 4.8%. The main growth drivers were the service sector: trade, transport, storage and communication, financial intermediation services, postal services and telecommunications (Kokic Arsic, 2012). In addition, the agriculture and manufacturing, to some extent, contributed to the economic growth and competitiveness.

On the other hand, the percentage of GDP allocated to innovation is also minimal. In 62.7% of the surveyed enterpris didn't innovation. while the remaining 37.3% of the company was realized by an innovation, as shown in Figure 1. The reason for this lies in the most outdated scientific and technological infrastructure, NIIR disproportionately high concentration of resources in basic research compared to applied and development research, and all this combined with poor funding of NIIR activities, a large deficit demand of industry and business in general to applied and development research and human resources are relatively elderly human resource in NIIR system faced with the negative effects of internal and external "brain drain".

Investments are structurally divided into investments in equipment, investment in the purchase of new technological equipment, investments in the acquisition of ICT and investment in construction. (Table 1.)

Figures, diagrams and charts must be cited in consecutive numerical order in the text and referred to in both the text and the caption as Figure 1, Figure 2, etc.

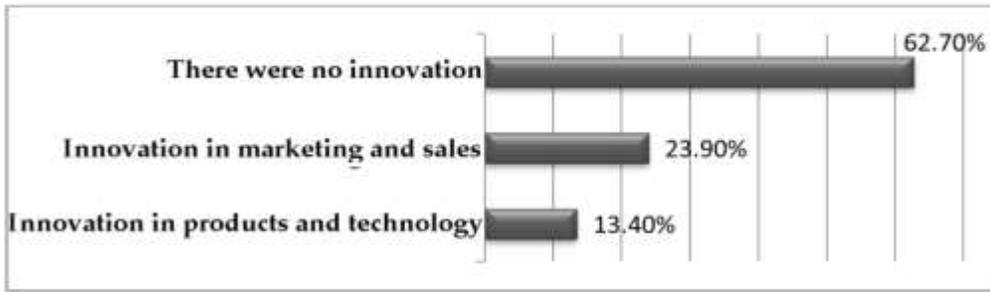


Figure 1. Percentage of surveyed companies that have made innovation

Table 1. Structure of investments in the investigated companies

Investments in product development	% companies
Investments in equipment	42,5%
Investment in the purchase of new technological equipment	17,5%
Investment in the procurement of ICT	22,5%
Investments in construction	17,5%

It can be seen, from Table 1, that most percentage is of the equipment investment and the purchase of information and communication technology, a slightly smaller percentage is of investment refers to the purchase of new technological equipment and construction.

Less than a third of the analyzed company has its own product development and technology, while professional tool for market research and development staff has half of the firms. (Table 2.) This is an average of 1.5 in the shift with about 60% of production capacity (Kokic Arsic, 2013).

The average age of the equipment is about 12 years, with the age of the industrial equipment for over 25 years, the reason is mostly poor financial situation in the sector. The equipment of the latest generation is mainly identified in small enterprises, where information and communication technology dominates.

Table 2. Structure of investments in their own development in the investigated companies

Investing in their own development	Percentage companies
Product development	28,9%
Technology development	26,3%
Market development	49,4%
Personnel development	55,4%

Condition of certification of investigated enterprises by different standards is given in Figure 2. As seen in the figure, most of the surveyed companies have implemented standard ISO 19001: 2008, while the number of certificates obtained for other standards are much lower. Almost a quarter of the companies shown in the figure has introduced an integrated management system with two or more management standards. This high degree of certification, does not fit the average statistics for Central Serbia, and can be explained by the fact that these companies were willing to cooperate in completing the questionnaires.

If we look at the environmental aspect, the survey shows a huge lack of environmental awareness in all aspects of environmental protection and resource conservation.

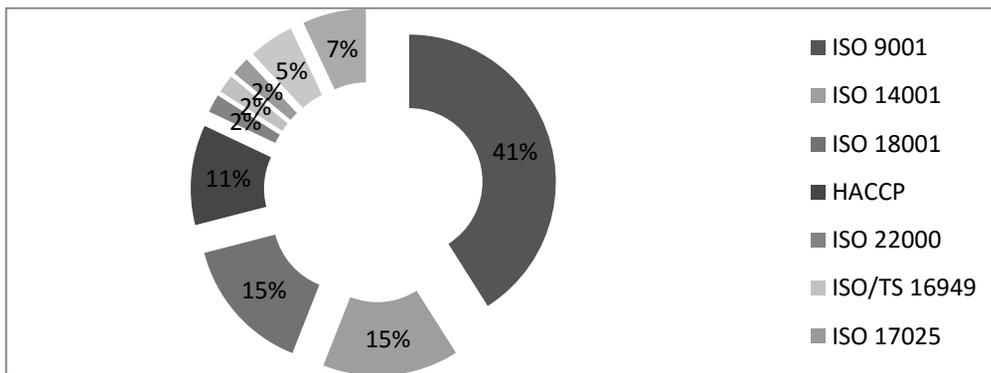


Figure 2. Certification status of investigated companies

Among the companies analyzed, only 1.2% use renewable energy unless we take into account the fact that electricity in Serbia with about 20% is produced by hydro power, and in this instance electricity is from renewable energy sources. When you take into account that the EU set a target that 12% of the energy used come from renewable sources by 2010, it can be said that the Central Serbia is only at the very beginning in this endeavor. Improving legal and institutional framework in the energy sector is of particular importance for the improvement of the environment. Slightly less than half of the surveyed companies use coal as the main energy source for heating, 18% of companies use natural gas, and rest of them oil, wood or electricity.

A negligible number of companies surveyed, 1.2% of them use some form of renewable energy for heating its premises. Consumption of A negligible number of companies surveyed, 1.2% of them use some form of renewable energy for heating its premises. Consumption of electricity and water consumption varies according to the company's activities.

Manufacturers spend far more than the service sector, as well as those companies that use electricity for heating.

Statistics also showed that less than 5% of companies in Central Serbia invests in equipment for environmental protection, which is primarily a result of the economic

crisis and the weak financial situation, rather than a lack of awareness for protection of environment.

There is not enough paid attention on recycling issue. In the previous period, total industrial production recycling accounted for 0.3%, while on the other hand, Western countries recycling is classified as strategic industries, so that the share of recycling in the economy of these countries is up to 35%. The growing consumption of resources, economic growth, and increased consumption of goods have resulted in the emergence of large quantities of various types of waste generated. Even 78% of businesses perform selection and categorization of waste and the proceeds from the sale of waste achieved 63% of firms. Procurement Plan of recyclable materials has only 5% of companies. Even 80% of the investigated company provides its generated waste to recycling, of which more than half of these companies provides for recycling of all waste generated in their production processes. In the case of hazardous waste, it is seen in 26% of the analyzed companies, of which this waste is treated and stored in a legally prescribed manner for more than two-thirds of respondents. Regarding the management of machines and management at the end of life, 33% of companies give their old equipment for recycling, while the rest disposed of in a landfill.

Waste water is present in the process in 61% of companies. Presented analysis of the collected data clearly shows that a large number of companies in the region that do not perform fully their legal obligations in terms of measuring the quantity and quality of discharged wastewater. Worrying is, that in most cases, wastewater is discharged into the sewer.

When analyzing the state of emissions, 74% of companies measure the concentration and it is within acceptable limits, while other companies neglect the concentration of sulfur dioxide, nitrogen oxides, particulate matter, soot, ammonia, heavy metals and other harmful substances that occur in the production process, combustion of fossil fuels or in traffic. Filters for air purification benefits 72% large, 34% medium and 25% small enterprises. In 17% of surveyed companies were happening accident situations that have had a negative effect on the environment, such as fires, explosions, spills of hazardous substances. The plan of response in case of accidents has 54% of the surveyed companies and they are mainly large and medium-sized enterprises.

If we take into account the social aspect of sustainable development in companies in

central Serbia, the number of days in a year spent on sick leave in recent years has decreased compared to the previous period, but not for more effective implementation of safety and health at work. The reasons for this are mainly the fear of job loss, fueled by the economic crisis, salary cuts and the fact that in the meantime, the unemployment rate rose. Data on the number of days spent on sick leave are difficult to access and often inconsistent, and vary significantly according to the methodology of monitoring within different organizations. In addition, research on a sample of enterprises in Central Serbia showed that the percentage of employees who are on sick leave (either due to illness or injury at work) about 6%, while this percentage in the EU amounts to a maximum of 3.5% (Kokic Arsic, 2012). As for the age structure of employees in the surveyed companies, the largest number of workers between the ages of 36 and 50 years (43%), a negligible number of employees are under 20 or over 65 years of age (Figure 3). The qualification structure shows that most employees with secondary education (57%), a concern is the fact that the percentage for not enough skilled and unskilled labor is barely below 20%.

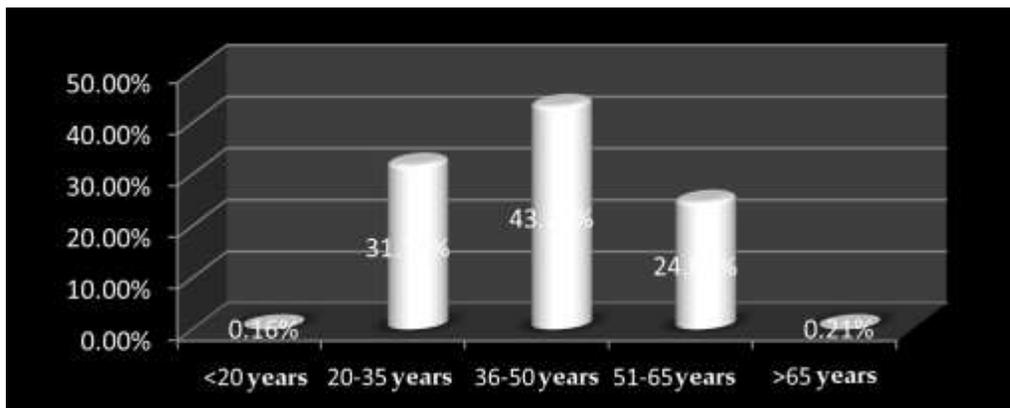


Figure 3. Age structure of employees

Overall employee satisfaction in the investigated companies on a scale from 1 to 10 is about 7, and as far as reported cases of

mobbing, their number is almost negligible, it is to less than 0.5%.

4. Simulation model and simulation results

Existing models were used further for the development of simulation models (Figure 4) and also as the basis for defining the level of sustainability and quality of the region (Afgan *et al.*, 2009). The program provides to user , tabular and graphical (Figure 5) the value of the IN and OUT.

Thus, the figure 6. notes that the ratio V1 which refers to the waste water has the highest number of variables that affect the calculation of (16), while, on the other hand, V7 pertaining to the purchase of equipment for environmental protection has the highest number which is directly related to (21), followed by the coefficients V3 and V13 relating to renewable energy sources and control of machines at the end of the life cycle.

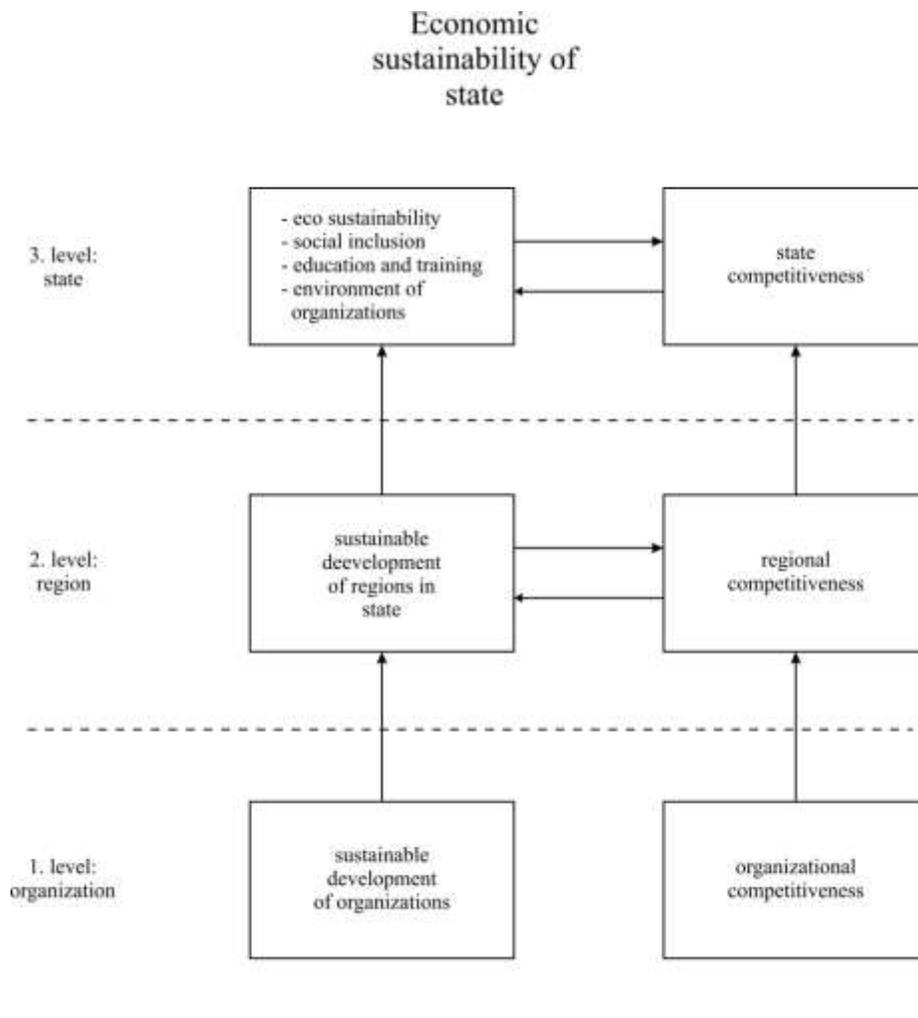


Figure 4. Simulation model of economic sustainability of state

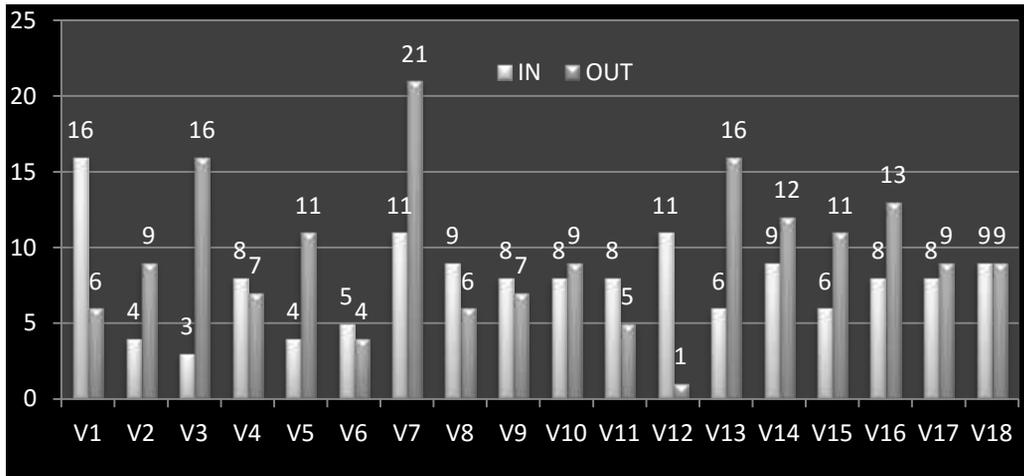


Figure 5. Intensity correlation with the size of EKO module

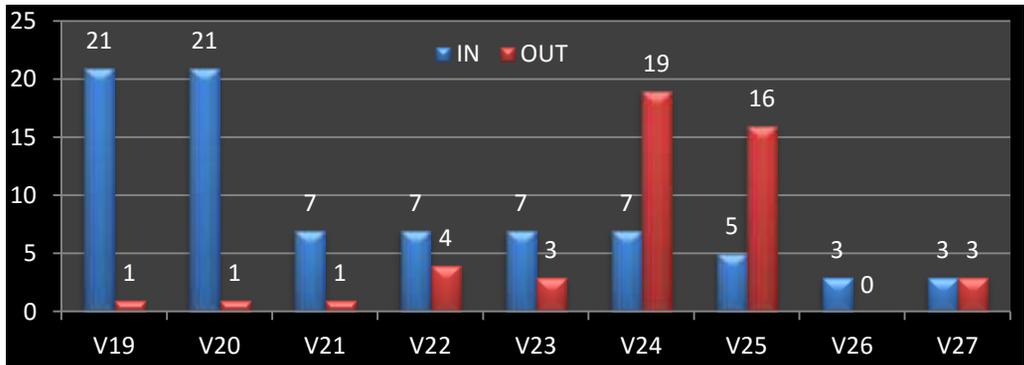


Figure 6. Intensity correlation with the size of SOC module

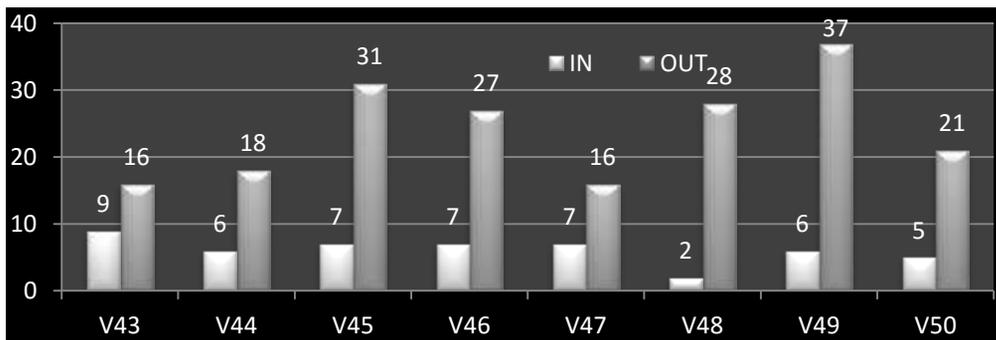


Figure 7. Intensity correlation module KVA

From Figure 6 it can be seen that the coefficients V19 and V20 which represent the gross national product per capita gross

national product per employee have the largest number of variables that the calculation of the given size. V24 and V25

pertaining to the training of personnel and qualification structure of the company have the largest number of values with which they are directly related, indicating a profound influence on the level of human resources for sustainable development and competitiveness. On Figure 7 it can be seen that in addition to the quality of the process, the level of competitiveness and sustainable development have a major impact on quality level of the organization, the level of management processes, the level of investments in organization and process flexibility (Atkinson *et al.*, 2007; United nations, 2008).

5. Conclusions

If we take into account the results obtained and compared with the level of quality characteristics and sustainable development of enterprises in the EU, it is clear that the position of the company in Central Serbia is

significantly lower than the EU. On the other hand, survey results show that the level of existing infrastructure Central Serbia does not provide sufficient support for the sustainable development and competitiveness. The transition in Serbia is still in progress, and the success of this process is best confirmed by the basic macroeconomic indicators, particularly low per capita GDP, high inflation, unemployment, debt, high deficit of the current account deficit, high public spending and inefficient state administration. All the above listed, have impact on low productivity and competitiveness of the national economy, and its "final epilogue" has the low living standards of the population, which Serbia has in comparison to neighboring countries.

Results of simulation proved based hypotheses about impact of quality variables on competitiveness on organizational and regional level.

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