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Clusters in the Function of Innovative Activities and Competitiveness of Enterprises[4]

Abstract*: Development and diffusion of innovations in order to achieve competitive advantage of enterprises is one of the key reasons of forming clusters in the contemporary business. The paper emphasizes the importance of clusters for strengthening innovativeness of enterprises, as well as the significance of clusters for the economic development of the regions/countries in which they exist. The paper will attach special significance to the importance of clusters for strengthening innovativeness and competitiveness of the Serbian economy. The Serbian Automotive Cluster will be discussed in detail. Clusters enable Serbian enterprises to remove constraining factors of their growth through cooperation. The presented data in the paper show that the enterprises increased their innovative activities when they joined the cluster, which also affected the increase of the enterprises' income after launching new and modified products.*

Key words*: innovative activities, enterprise, clusters, competitiveness, automotive industry*

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Klasteri u funkciji inovativnih aktivnosti i konkurentnosti preduzeća

Apstrakt. *Jedan od ključnih razloga formiranja klastera u savremenim uslovima poslovanja je razvoj i difuzija inovacija u cilju postizanja konkurentske prednosti preduzeća. U radu se ističe značaj klastera za jačanje inovativnosti preduzeća, kao i njihov značaj za ekonomski razvoj regiona i zemalja u kojima posluju. U radu će se posebno ukazati na značaj klastera za jačanje inovativnosti i konkurentnosti privrede Srbije. Posebno će se razmotriti poslovanje Automobilskog klastera Srbije. Klasteri omogućavaju preduzećima u Srbiji da kroz kooperaciju uklone ograničavajuće faktore svog rasta i razvoja. Podaci prezentirani u radu pokazuju da preduzeća povećavaju nivo svojih inovativnih aktivnosti nakon ulaska u klaster, što takođe utiče na povećanje prihoda nakon lansiranja novih i modifikovanih proizvoda.*

Ključne reči: *inovativne aktivnosti, preduzeće, klasteri, konkurentnost, automobilska industrija*

1. Introduction

Due to intensive global competition in the past twenty years, networks have become not only the phenomenon that has been investigated by a lot of scholars but a popular organizational form through which strategic partners join forces to strengthen their competitive position (Moller & Halinen, 1999; Wilkinson & Young, 2002; Parkhe & Ralston, 2006; Stefanović, 2010). In network organizations, companies' boundaries become blurred since the processes and activities are performed inside the network and they cross the firms' organizational boundaries. Clusters are the form of networking various enterprises and organizations with the aim of increasing innovativeness and developing new products/brands, increasing quality of operations and, consequently, creating sustainable competitive advantage of its members. Clusters increase effectiveness and efficiency of their members' operations and contribute to the total economic development of the region/country (Porter, 1998).

The subject of this paper are the ways and possibilities of applying innovative activities of cluster members in order to create new products and services which strengthen their competitiveness. Namely, competitiveness of clusters does not only depend on the existing products, their quality and price, but also on the speed at which cluster members can introduce new or technically more superior products, that is, on their innovation potential (Cappellin & Wink, 2009). Innovation, as a way of achieving competitive advantage, involves, in its broadest sense, new technology as well as the new way of performing

operations, new product design, new production process, new market approach and new forms of staff training (Back, Enkel & Krogh, 2007). Although innovation activities include both product and process innovation as well as innovation in non-technological areas such as organization, marketing and management (Kijek, Lisowski & Starzynska, 2013), the paper mainly focuses on the introduction of new or improved and modified products and services.

Innovation is one of the basic factors of enterprises' development and competitiveness. The primary aim of the paper is to point to the ability of enterprises to strengthen innovative activities by joining the cluster. Cluster represents a favorable environment for the development of innovations. In the contemporary business environment, innovation, i.e. innovative products and services are considered the most important factors that can lead to sustainable competitive advantage. Therefore, we have recognized the importance of clusters for enhancing innovation and, consequently, the competitiveness of the domestic economy. The purpose of this study is to analyze, on the basis of available indicators, the Serbian Automotive Cluster as the driver of innovativeness and to point out the significance of joining clusters for Serbian enterprises. Namely, the author's intention is to create a clear picture of innovative activities of domestic enterprises and their scope and effects before and after joining the cluster. The contribution of this paper lies in the fact that it pointed to a clear link between the entry into cluster and growth of innovativeness of cluster members, measured by the number of innovative products, as well as the competitiveness of enterprises. The originality of the work stems from efforts to show how greater commitment of the cluster members to innovative activities affects their increased performances, as measured by the increase in operating income, exports, etc.

The underlying assumption of the paper is that in the modern business environment clusters stand for one of the basic drivers of innovative activities of any involved enterprise and organization and, consequently, the driving force of strengthening their competitive advantage. Clusters, which attempt to create value for the customers, realize innovative activities intensely, which means that they represent the drivers of their members' innovative activities. This assumption has been the basis for formulating hypotheses that underpin our work. Namely, with respect to the focus of the study, it can be stated that intensive establishment of clusters by Serbian enterprises contributes to the increase of innovative activities and the creation of new products/services resulting from those activities. With the purpose of achieving better position on the existing and new markets, Serbian enterprises are recommended to join clusters.

Furthermore, another hypothesis of this paper is that joining clusters increases the income of its members. Namely, joining clusters and realization

of innovative activities enables enterprises to create innovative products that significantly change the market position of that enterprise and affect the increase in revenue.

However, it is evident that the majority of domestic enterprises do not realize innovative activities due to constraining business conditions, which is why their competitive position is very difficult. By joining clusters, Serbian enterprises would improve their innovative potential as well as the outcomes of innovative activities. Networking of companies and other organizations in clusters and other forms of agglomeration should help in overcoming the problems caused by unfavorable macroeconomic environment, underdeveloped institutions and major economic lag behind developed market economies.

Lastly, one of the propositions of the paper is also that clustering enables knowledge transfer, which again increases innovative activities of cluster members. New knowledge is obtained by exchange of knowledge among cluster members. Therefore, the actual number of cluster members' employees who are engaged in innovative activities is very important, as well as the fact whether they exchange knowledge among themselves. Transfer of resources and knowledge among partners enables future concentration of much higher business strength than the current one.

With respect to the hypotheses, qualitative and quantitative research methodology will be used in the paper. The first part of the paper will provide theoretical background, that is, the review of the most important theoretical studies on the role and significance of networking of market participants and clusters development, and their role in strengthening entrepreneurship and innovativeness. Research part of the paper will analyze the significance of establishing the Serbian Automotive Cluster in order to increase its members' innovative activities and to improve their competitiveness. Statistical hypothesis testing method will be used in that part of the paper. Analysis will be conducted by using the Statistical Package for Social Sciences (SPSS) software, version 17.0. The final part of the paper will focus on concluding remarks and implications for managers in Serbia and beyond.

2. Literature review

One of the key issues in strategic management is how firms achieve competitive advantage. In trying to answer this question or point to the sources of competitive advantage, Pillai (2006) summarizes the key conceptual frameworks and paradigms in this field. These paradigms range from the Porter's concept of five competitive forces through the resource-based view of the firm and the approach based on dynamic capabilities and

competences to the relational view. Citing the study conducted by Dyer and Singh (1998), Pillai (2006, p. 131) suggests that "investing in relation specific assets, substantial knowledge exchange, combining complementary resources and capabilities result in joint creation of unique new product and services and lowering transaction costs, which enables firms in relationship to develop capabilities over and above those afforded by arm's length exchanges". Conceptual framework of network theory is based on understanding the ways in which cooperative relationships contribute to the achievement of competitive advantage.

The starting point of the paradigm based on the relational view, which also stands for the foundation of the network theory, is that cooperation with strategic partners leads to creation of value that ensures competitive advantage; this value is generated through access to technology, access to markets and access to information (Sharma & Sheth, 1997). In the final sense, in cooperative relationships, the value is created through the generation of knowledge and organizational learning. Due to the exchange of information, knowledge and resources, strategic partners are able to realize innovations and more quickly respond to opportunities that arise on the market (Stefanović, 2010), that is, take advantage of the "window of opportunity" that has been figuratively mentioned in the theory of strategic management, and that is opened for a short time and then closes forever.

In recent decades the establishment of clusters as forms of business networking has become a generally popular trend all over the world. Michael Porter (1998) reduces the concept of cluster to the comparative analysis of international competitiveness of the countries' economy.

It can be stated, on the basis of the above-mentioned considerations, that clusters stand for a specific form of organizational networking of enterprises and other organizations in a particular geographical area. Namely, clusters are regarded as "geographic concentrations of interconnected companies and institutions in a particular field" (Porter, 1998, p. 78). With the purpose of achieving competitive advantage of a particular product/brand, clusters have to include organizations from a range of connected sectors and industries. They have to include suppliers of components and parts, providers of information, communication and other infrastructure, marketing agencies, financial organizations and the like. Besides, they can also include governmental and other agencies and institutions such as universities, standardization agencies, staff training and education agencies which provide specialized training, education, information, research and technical support and assistance (Porter, 1998). Clusters include a lot of networked members whose task is to create and launch recognizable product brands. Products from particular geographical areas in which clusters exist are specially valued and recognizable by the customers. An important feature of clusters is the

simultaneous existence of competitive relations and cooperation among members (Stefanović, 2010).

Enterprises associated in clusters generate cost savings (for example, through joint marketing and branding), higher labor productivity, faster responses to market demands, training and further education of employees, and the like. Particularly important is the role played by universities and research centers in terms of education of the needed staff, and support to innovation (Bošković & Jovanović, 2009). Due to the role that scientific research organizations have within clusters, they are able to continuously improve the quality of existing products and to develop new products and services and thus take the lead over the competition.

The formation of clusters comprised partners who pool resources aims at creating, maintaining, and increasing competitive ability. Clustering is associated with the determinants of competitiveness. The whole concept of the cluster represents one side of the "Porter's diamond of competitiveness", i.e. the so-called allied and supporting activities, as cited by Mićić (2010, p. 63), and it relies on the assumption that competitive advantage contained in the diamond better develops within clusters than inside the same number of unassociated enterprises.

Porter (1998, p. 80) argues that clusters affect competitiveness in three ways: by increasing the productivity of resource exploitation, by directing innovations in a particular field, and by stimulating new business ventures. On the basis of Porter's discussions of the ways in which clusters increase the firms' competitiveness, it can be stated that by spotting the customers' needs and demands, clusters come up with swiftly conceived innovations and gather the critical mass of resources with the purpose of implementing innovations and developing new products/services.

The advantage of grouping of enterprises is reflected in the processes of knowledge creation and learning. Specifically, clusters facilitate the transfer of knowledge among members through frequent contacts (Eisingerich, Bell & Tracey, 2010). The results of trainings in a cluster are manifested through spillovers of acquired knowledge among members in the cluster (Dhewanto, Prasetio, Ratnaningtyas, Herliana, Chaerudin, Aina, Bayuningrat & Rachmawaty, 2012). Training and education of employees, which are implemented in a cluster in order to acquire new knowledge, serve as a driver of innovativeness of cluster members, which has a positive impact on the overall performance of enterprises. The basis for creating innovation lies in the application of thus acquired knowledge (Charterina & Landeta, 2013).

Creating innovative products, introduction of innovative processes, and application of modern technology with qualified staff lead to increased cluster performance. By monitoring the cluster performance, managers receive

feedback on the effectiveness of the activities in the cluster, based on which they are ready to act. In order to analyze the cluster performance and implement measures for its improvement, some of the following indicators should be considered (Carpinetti, Gerolamo & Galdámez, 2007):

1. Macroeconomic indicators, with the help of which the impact of clusters on the local environment should be determined.
2. Within the cluster, the results of growth and competitiveness should be monitored through financial and non-financial performance indicators.
3. The ties that exist between enterprises in the cluster and the ties between enterprises and the environment.
4. Social interactions that are primarily related to trust and cooperation among cluster members.

There are a number of ways in which the achieved cluster performance can be measured, and in which the level of achieved competitive advantage, on the basis of the results obtained, can be determined. These performances are: the product success rate, share in total sales, profitability of the product, product rating, sales and profits, success in meeting sales targets, monitoring the overall business success of the enterprise. From all the above mentioned performances, the most appropriate and most widely used is the share of new or modified products in total sales, which clearly shows whether the new product has been accepted on the market, and whether it, as such, contributed to increasing competitive advantage (Pullen, Nederhof, Groen, Song & Fisscher, 2009).

Lastly, the most important challenges are the ones related to the financing of cluster organization. With respect to the financing of clusters (Cluster Agroindustrial Ribatejo, 2012; Project Zukunft & European Creative Industries Alliance & Institute for Innovation and Technology, 2012), it is claimed that the majority of clusters have very diversified sources of funding which, in addition to membership fees, include public funds, sponsoring and donations and project and services fees, venture capital, business angels, local banks loans etc. Although the needs for financial support are prevalent in the early stages of cluster development, they also increase with the increase in innovative activities in the cluster, that is, in relation to the R&D projects that require significant financial resources that the cluster members do not have or cannot easily find (Cluster Agroindustrial Ribatejo, 2012). Therefore, the lack of financial support for innovative clusters is a significant constraint to their development.

3. Methodology and hypotheses of the research

It is widely held that the long-term development of Serbian economy cannot be sustained without cluster development[5]. There are more than 50 clusters operating in the Republic of Serbia (PKS, 2012). However, that number is changing, as a result of great interest in the establishment of new clusters in Serbia. However, clusters in Serbia are still weak in terms of their economic power and do not have sufficient critical mass that could increase their significance both at national and international level.

The Serbian Automotive Cluster (AC Serbia) is the network of Serbian enterprises and institutions, which operate in the automotive sector and act as the suppliers of automotive parts and equipment or provide services in this sector[6]. The Serbian Automotive Cluster was founded in 2005, as the first cluster in Serbia, and its main office is located in Belgrade. The cluster is dedicated to supporting the members in the process of improving their competitiveness and achieving a profitable position in the international automotive supply chain. In addition, this cluster indirectly affects the improvement of economic situation of the whole industry[7].

With the purpose of obtaining the necessary indicators, the authors have carried out research in the form of a survey of companies in the sample of the Serbian Automotive Cluster in the period from December 2012 up to February 2013. With the aim of providing answers to research questions and verifying the starting and additional hypotheses, the authors used the structured questionnaire and surveyed the companies belonging to the Serbian Automotive Cluster. The questionnaire was structured in such a way that it included three groups of questions: 1) general information about enterprises,

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[5] Cluster development in Serbian economy was first mentioned in 2003 in the scope of the 'Strategy for the development of SMEEs 2003-2008', which was followed by the 'Strategy for the development of innovative and competitive small and medium enterprises in the period 2008-2013' (Government of the Republic of Serbia, 2003 and 2008). In these strategies the Serbian Government provided a model for forming clusters in Serbia.

[6] At the time when the survey was conducted, the Serbian Automotive Cluster included 33 firms. In the meantime, the number of cluster members has increased (according to the recent data, AC numbers 50 members and 15 supporting institutions) (The Serbian Automotive Cluster, 2013), which results from the fact that new members join the cluster in the same way as some members leave the cluster.

[7] Serbia is a traditional and significant producer of car parts. However, the establishment of the Serbian Automotive Cluster was seen as a good solution for competitive entry into the foreign market that is dominated by cluster organizations. The formation of this cluster was accompanied by long process of preparation and gathering of potential members. The entry of Fiat (Italy) into the Serbian market in the form of strategic partnership with Zastava Car Factory from Kragujevac gave a strong impetus to the development of the Serbian Automotive Cluster and the automotive industry in general.

2) data on innovative activities of enterprises before joining the cluster and 3) data on innovative activities of enterprises after joining the cluster. The questionnaire was filled with the data from the surveyed enterprises' internal documentation. The research included 33 enterprises – members of the cluster. Scientific research and supporting organizations (five of them), which are also members of the Serbian Automotive Cluster, were not surveyed as they deal with scientific work. With regard to the size of the enterprises belonging to the automotive cluster (measured by the number of employees[8]), the data have shown proportional percentage of all three types of enterprises in the cluster (small, medium and big), equaling 33.3%. Out of this number, 12 cluster members responded to the questionnaire. That means that the response rate equaled 40%.

According to the initial assumption of the study on the basis of which in the contemporary business environment, clusters stand for one of the basic drivers of involved enterprises' and organizations' innovative activities and, consequently, the driving force of strengthening their competitive advantage, the research has been based on the following starting hypotheses:

H1. More intensive clustering affects the increase of innovative activities and the creation of new products/services resulting from those activities.

H2. More intensive innovative activities in the process of cluster networking result in the increase of involved members' income, which strengthens the cluster members' competitive position.

H3. The number of full-time employees in the firms – cluster members who are committed to innovative activities affects the growth of the cluster members' innovativeness and, consequently, their competitiveness.

With the purpose of verifying the hypotheses that were set in the research, the statistical hypothesis testing method was used. The analysis was conducted by using the Statistical Package for Social Sciences software, version SPSS 17.0 for Windows. Research results will be presented below.

4. Research results, discussion and implications for managers

4.1. Research results on innovative activities

How innovative activities are organized is an important indicator of significance that is given to those activities. The analysis started with possible

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[8] In the Republic of Serbia national statistics classifies enterprises according to the size measured by the number of employees in the following way: small enterprises – from 1 to 49 employees, medium enterprises – from 50 to 249 employees and big enterprises – more than 250 employees.

organizational forms of research and development (R&D) such as laboratories, R&D sector, but also innovative activities within some other business sectors or functions as well as with some enterprises that do not have organized forms of research and development. Enterprises characterized by more developed organizational forms of research and development are more innovative. Data on the organization of innovative activities can be seen in Fig. 1. Judging by the data presented in Fig. 1, it can be stated that two forms of those activities dominated the sample: R&D sector (41.6%) and laboratories (33.3%).

Figure 1. Organizational forms of innovative activities in enterprises
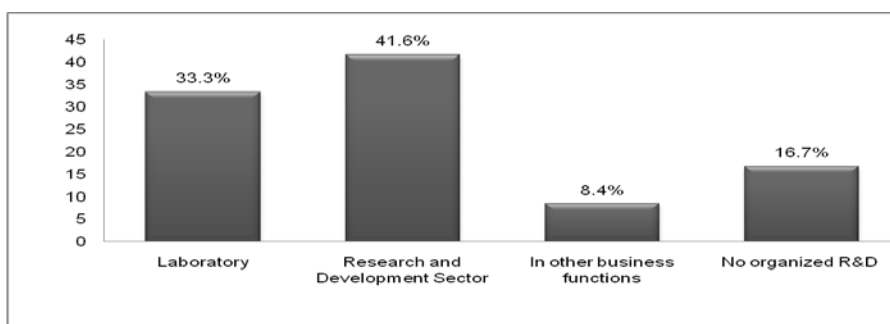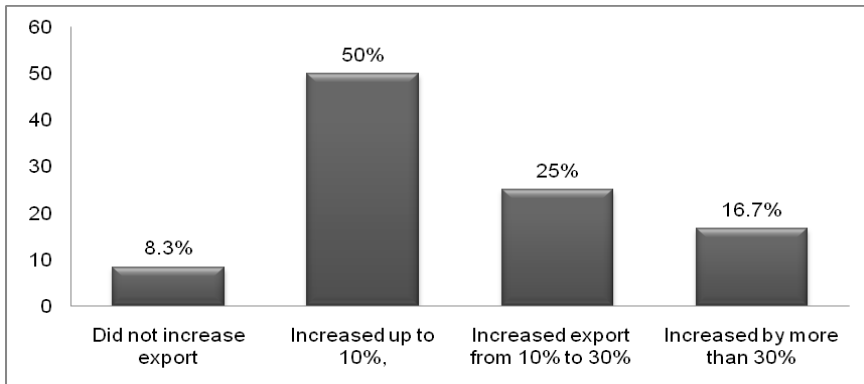

Source: Authors' own survey

How innovative activities are conducted in an enterprise is one of the indicators of innovativeness. Innovative activities can be realized largely independently, in cooperation with other cluster members and in cooperation with research institutes. The analysis of research results shows that half of surveyed enterprises (50%) implements innovative activities in cooperation with other cluster members. Although there is a trend towards implementing those activities in cooperation with other enterprises with the purpose of reducing the research costs, even 41.6% of enterprises carry out their innovative activities largely independently. Data on the cooperation with institutes is not favorable at all so that only 8.4% realize their innovative activities in this way. Strategic networking within clusters enables knowledge transfer and, consequently, the increase of the cluster members' innovative activities.

The development of innovative products enables an enterprise not only to obtain a sustainable competitive position in the domestic market, but also to get into the foreign market through the increase of export. The analysis of the results presented in Fig. 2 shows that 50% of enterprises increased their export by 10% after joining the cluster, 25% of enterprises increased export

by 10%-30%, whereas 16.7% of enterprises increased export by more than 30%.

Figure 2. Indicators of export trend in the surveyed enterprises after joining the cluster

Source: Authors' own survey

On the basis of the results of the survey, it can be stated that more intensive clustering of Serbian enterprises contributes to the growth of innovative activities and strengthening of enterprises' competitive position, which is particularly affected by the growth of the cluster members' export. Previously presented data show that clusters, as one of the forms of networking among strategic partners, enable further development of enterprises through innovative activities on the basis of which it is possible to achieve sustainable competitive advantage. However, with the purpose of statistical verification of the results, statistical model was developed and statistical analysis was applied. The aim of the statistical analysis was to apply statistical methods with the purpose of verifying the starting research hypotheses. The results of the statistical analysis are presented below.

4.2. Statistical analysis and the discussion of the research results

With the purpose of verifying the basic premise, the starting hypothesis H1 was developed: *More intensive clustering of Serbian enterprises brings about the increase of innovative activities and the creation of new products/services resulting from those activities*. Statistical analysis that follows is supposed to confirm or reject this hypothesis. In this regard, data that were obtained on the basis of the survey of the automotive cluster members were used as the starting point.

Namely, data on the number of innovative products that the enterprises launched before joining the cluster, which are presented in Table 1, show that a little more than 40% of the enterprises launched one innovative product into the market. Only about a quarter of the surveyed enterprises launched five or more innovative products before joining the cluster. It can be seen that the number of new and innovative products was very low at the time, which implied the low level of innovative activities.

Table 1. The number of innovative products launched into the market before and after joining the cluster*

Number of innovative products launched on the market	Before entering the cluster		After entering the cluster	
	Number of enterprises	Percentage (%)	Number of enterprises	Percentage (%)
1	5	41.6	2	16.6
2	1	8.3	1	8.3
3	3	25	0	0
4	0	0	4	33.3
5	1	8.3	2	16.6
6	0	0	1	8.3
7	2	16.6	2	16.6
8	0	0	0	0
9 and more	0	0	0	0
* An innovative product includes both the modification and improvement of an existent product or the creation of a new product. The number of innovative products created in the cluster of enterprises covers the period from 2005 (establishment of the cluster) up to the end of 2012, and before entering the cluster covers approximately the same period of time.				

Source: Authors' own survey

The question is whether joining the cluster contributed to the increase in the number of innovative products launched by the surveyed enterprises. Data that are presented in Table 1 show that 33.3% of the enterprises launched four new products after joining the cluster, whereas 16.6% of the observed enterprises launched five or even seven innovative products. Although the result of this research shows evident development of innovations at the cluster level, the number of innovative products is still low, especially because they are largely modifications and improvement of an existent product. After comparing the results from the table, it can be stated that the number of innovative products launched into the market increased after enterprises joined the cluster. Namely, before joining the cluster, the majority of enterprises had launched one product into the market, whereas in one third of

the surveyed enterprises the number of innovative products increased to four after joining the cluster. If this number includes the enterprises that developed five or more innovative products, the percentage of innovative enterprises in the sample almost attains to 75%.

Statistical hypothesis testing method was used for verifying the starting hypothesis H1 and answering the research question whether joining the cluster increased the innovativeness of the cluster members. The process of testing required the creation of dependent samples through the application of the so-called experimental design "before-after". The number of innovative products launched into the market before and after joining the cluster was established for all 12 enterprises from the sample. The analysis, which was conducted with the help of the SPSS software, consisted of several steps. All of them will be presented below.

1: Testing the normality of difference between the paired data. Testing the normality of difference between the paired data provided the results that are presented in Table 2. The results point to the following: since p-value 0.118 (Shapiro-Wilk test) is higher than the risk factor α = 0.05, there is no reason to claim that the difference between paired is not normally distributed.

Table 2. Tests of Normality[9]

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Degrees of freedom (df)	Significance	Statistic	Degrees of freedom (df)	Significance
Difference	.205	12	.176	.890	12	.118
a. Lilliefors Significance Correction						

2: Choosing between parametric and nonparametric tests. Since the difference between the paired data is normally distributed, establishing the difference between the number of innovative products launched into the market before and after joining the cluster requires the use of parametric t-test, which is in this case the most efficient. This test shows whether there is statistically significant difference among mean values of the results.

3: Realization and t-test calculation. Table 3, which presents the basic statistical data on the number of innovative products launched into the market, and Table 4, which presents the result of the t-test of dependent sample, show the test results, corresponding statistical data and the elements needed for formulating valid conclusions. All this is presented in the form of SPSS software output.

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[9] Tables are based on our own calculations.

Table 3. Paired Samples Statistics

		Mean	N	Standard Deviation	Std. Error Mean
Pair 1	Before	2.9167	12	2.27470	.65665
	After	4.1667	12	2.03753	.58818

Table 4. Paired Samples Test

Paired Differences					t-test	df	Sig. (2-tailed)
Mean	Standard Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
			Lower	Upper			
-1.250	1.288	.372	-2.068	-.432	-3.362	11	.006

4: Analysis of the obtained results. Since p-value (the last table column) is lower than the risk of error α = 0.05, it can be stated that there is a statistically significant difference between the average number of innovative products launched into the market before and after joining the cluster. In accordance with the research question, it can be stated that if the result after joining the cluster is higher than the result before joining the cluster, joining the cluster has positive effects on innovativeness. It is obvious from the results presented in the Table 3 that the average number of products launched into the market after joining the cluster (4.1667) is higher than the average number of products launched into the market before joining the cluster (2.9167). Therefore, the stated statistically significant difference implies that joining the cluster has a positive effect on innovativeness measured by the number of launched new and innovative products, which confirms the hypothesis H1.

On the basis of the hypothesis H2, *more intensive innovative activities in the process of cluster networking result in the increase of involved members' revenues, which strengthens the cluster members' competitive position*.

Table 5 shows the total income of the surveyed enterprises in five years (2009-2013). Data presented in this Table and data about the number of full-time employees engaged in innovative activities were used for the statistical correlation analysis that was performed with the purpose of determining the correlation between the two variables: *the number of full-time employees*

engaged in innovative activities and *income*[10]. The reason why the relationship between operating income and the number of staff engaged in innovative activities is observed is that the share of product/services sales income in total operating income is, as a rule, the greatest. In the theoretical part, we pointed to the fact that the share of the sales of new products in total sales income of enterprises appears as one of the most commonly used indicators of performance arising from innovative products developed in the cluster. Therefore, more accurate results would be obtained if only the share of sales income derived from sales of innovative products was observed. However, that statistical data was not available because the companies in the sample do not keep it. In addition, the theoretical part of the paper outlines that the results of innovative activities can be seen through monitoring of indicators of realized profits and profitability of new and modified products. In addition to the fact that the indicators of profitability of new products were not available, so that we could not monitor them, we opted not to monitor profit as well. Specifically, the data of the Serbian Business Registers Agency showed that not all the companies achieved business profit in all years of the observed period. The reason for this is that despite an increase in revenues, an increase in operating costs of some enterprises was higher in some years, due to which they recorded business losses in some years. In addition, it is known in the theory of product life cycle that the costs of introducing new products in the first years are very high, due to which it can happen that enterprises that introduce new products and record sales growth record loss. Specifically, the expression of real effects of introducing innovation takes time, during which the growth in sales revenue could prevail over the negative effects of the increase in costs due to innovative activities and contribute to the realization of profit. To this should be added the increase in other costs that do not necessarily come from innovative activities, but occur for other reasons. Therefore, we decided to monitor the dynamics of operating income (i.e. sales income from products and services) as a performance whose increase may indicate an increase in enterprise's competitiveness.

Table 5 presents the income of enterprises in five analyzed years. It is observed that most of the enterprises during the first three years of the period increased income from year to year. However, this does not apply to the last two observed years, when most enterprises recorded a tendency of decline in operating income. The fall in income in the enterprises in the cluster in the last two years can be explained by prolonged and extended effects of the economic crisis in Serbia, which, with further deterioration of business conditions (rise in VAT, the reduction of foreign direct investment, an increase in the unemployment rate, the weakening of the domestic currency, poor

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[10] The term income refers to the operating income, which includes sales income, income from activating output and goods, the increase in the value of output inventories, and other operating revenue.

receivable collection from customers, etc.) led to the deterioration of business results of many enterprises, including companies in the Automotive Cluster.

Table 5. The surveyed enterprises' income in the period 2009-2013[11]

	Income generated per year				
	2009	2010	2011	2012	2013
In thousands of RSD	3,279,772	4,585,974	5,658,407	4,521,359	4,313,630
In thousands of Euros	34,203.91	43,469.69	54,074.53	39,759.29	37,626.93

Source: The Serbian Business Registers Agency, 2014

The survey of the enterprises in the cluster provided data on the total number of employees, as well as the number of employees engaged in innovative activities. Summing up the data for individual companies has pointed to the fact that in the period of the research the total number of employees in the surveyed enterprises in the cluster was 2269, of which the innovative activities engaged a total of 501 employees, which represents around 22% of the total number of employees.

In order to answer the research question whether joining the cluster increased the income of enterprises due to their more intensive innovative activities and to verify the hypothesis H2, as well as to answer the research question whether the number of full-time employees engaged in innovative activities affected the growth of the cluster members' innovativeness and to verify the hypothesis H3, correlation between the *generated income* presented in table 5 and the *number of full-time employees engaged in innovative activities* for the period of five years was tested. This testing included the following steps:

1) Determining the real value of the generated income by using the value of euro exchange rate[12] (expressed in dinars at the end of the period) for the observed years, which is also presented in table 5.

2) Testing the normality of the data on the real value of the generated income and the number of full-time employees engaged in innovative activities. The results of the conducted normality test are presented in Table 6. They show that for the variable *income* (for all years) with the risk of error α = 0.05 there is enough evidence to support the hypothesis that the observed variables (of the basic set) are not normally distributed. Namely, *p*-value (the last table column) is lower than the risk of error 0.05 for all the years of observing

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[11] Income per year is obtained as the sum of income that individual enterprises generated in observed years.
[12] Euro exchange rate equaled 95.8888 in 2009, 105.4982 in 2010, 104.6409 in 2011, 113.7183 in 2012, and 114.6421 in 2013 (National Bank of Serbia, 2014).

variables income. For the variable *the number of full-time employees engaged in innovative activities*, *p*-value 0.104 (Shapiro-Wilk test) is higher than the risk α = 0.05, so that there is not enough reason to claim that this variable is not normally distributed.

Table 6. Test of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
Income 2009	.247	12	.041	.836	12	.025
Income 2010	.302	12	.003	.678	12	.001
Income 2011	.289	12	.006	.647	12	.000
Income 2012	.270	12	.016	.827	12	.019
Income 2013	.281	12	.010	.818	12	.015
Number of employed in innovative activities	.191	12	.200*	.886	12	.104
a. Lilliefors Significance Correction						
* This is a lower bound of the true significance						

3) C*hoosing the coefficient for testing the correlation between variables.* Testing the correlation between the paired values of the variable *the number of full-time employees engaged in innovative activities* and the variable *income* per each year, respectively, was conducted with the help of Spearman's rank correlation coefficient and the corresponding nonparametric test.

4) C*alculating the coefficient and determining the statistical significance of correlation* by using the SPSS software. The results of the calculation are presented in Table 7.

Table 7. Spearman's rho correlation coefficients and their significance

Variables		Income 2009	Income 2010	Income 2011	Income 2012	Income 2013
Number of employed in innovative activities	Spearman's rho Correlation Coefficient	.902**	.841**	.918**	.904**	.827**
	Sig. (2-tailed)	.000	.000	.000	.000	.001
	N	12	12	12	12	12
** Correlation is significant at the 0.01 level (2-tailed).						

5) Analysis of the obtained results. As the *p*-value is less than the risk of error, in the case of all pairs of data, it can be concluded that the obtained coefficients are statistically significant, meaning that in the basic set there is statistically significant harmonization of ranked data of variable *number of permanently engaged employees in the innovative activities* and variable *income* per years. It is a direct, very strong monotonous correlation. However, chronologically speaking, it is obvious that the value of this coefficient begins to fall, indicating a slight decrease in the level of their correlation, created as a result of falling income in the last two years of the period.

Apart from the aforementioned correlation, correlation between the variable *the number of full-time employees engaged in innovative activities* and the variable *average income (in Euros)* for the observed five years was tested as well. The result of the conducted normality test is presented in the Table 8.

Table 8. Results of normality tests for the variable Average income

Variable	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Average income	.305	12	.003	.746	12	.002
a. Lilliefors Significance Correction						

The results show that for the variable *average income (in Euros)* with the risk of error α = 0.05, there is enough evidence to support the hypothesis that the observed variable (of the basic set) is not normally distributed. Rank

correlation coefficient and its statistical significance are presented in Table 9. Besides, in spite of the risk, it can be stated that the coefficient is statistically significant, that is, that there is a statistically significant, direct and very strong monotonic correlation between *the number of full-time employees engaged in innovative activities* and variable *average income* in the basic set per each year.

Table 9. Spearman's rho Correlation Coefficient and its significance

Variable		Average income
Number of employed in innovative activities	Spearman's rho Correlation Coefficient	.900[**]
	Sig. (2-tailed)	.000
	N	12
** Correlation is significant at the 0.01 level (2-tailed)		

It can be concluded that after joining the cluster, innovative activities of some cluster members increased. Namely, it is evident that there is a statistically significant difference between the average number of innovative products launched into the market before and after joining the cluster. It means that joining the cluster has had a positive effect on innovativeness. Finally, it can be stated that more intensive clustering of Serbian enterprises results in the increase of innovativeness measured by the number of launched innovative products, which confirms the hypothesis H1.

In addition, statistical analysis of the data shows that after joining the cluster, the enterprises increased their income due to the realization of their innovative activities. This confirms the hypothesis H2. When the impact of a number of research staff engaged in innovative projects on the business success of clusters is taken into consideration, statistical analysis has shown that there is a strong correlation between the number of full-time employees engaged in innovative activities and the average income per each year, that is, the enterprises' competitiveness, which proves the hypothesis H3.

4.3. Constraints of the research and implications for the managers

Realization of innovations in an enterprise requires engagement of the most creative human potentials and increases the importance of qualification structure and education of the employees in an enterprise. The data obtained after the survey of the members of the Serbian Automotive Cluster show that the qualifications of employees in the observed enterprises do not favor the

development of innovative activities. Although the percentage of qualified labor amounts to 37.8% and highly qualified labor amounts to 33.3%, with respect to the level of formal education, secondary education (64.8%) is the most dominant. The percentage of employees with higher education is not satisfactory and amounts to approximately 22% of all employees in observed enterprises. Although the number of highly educated people is not satisfactory, research and statistical analyses have proven the correlation and significance of professional staff engaged in innovative projects for the business success and competitiveness of the cluster. This is confirmed by the experience of other countries, presented in other relevant studies (Bošković & Kostadinović, 2011). Specifically, the authors point to an example of the Automotive Cluster of Slovenia. The aim of the cluster was to assist its members in the development of more complex products with higher added value, and to increase the competitiveness of the Slovenian economy. The success of the cluster is confirmed by the placement of nearly 80% of Slovenian production of automotive parts to the EU market, mostly Germany, Austria, and France. Slovenia has also become the largest trading partner of France, thanks to Revoz, which became a subsidiary of Renault in 2004. What the Automotive Clusters of Slovenia and Serbia have in common are certain problems in terms of cost and limited labour mobility, and the most pronounced deficiencies in the area of professional qualifications. Therefore, the Slovenian Automotive Cluster intensely uses benefits arising from clusters, in terms of organising training programmes and scholarship programmes, and invests efforts to harmonise curricula in Slovenian schools and universities with specific needs and requirements of clusters (Bošković & Kostadinović, 2011).

Although research has shown that there is a direct strong correlation between the number of professional staff engaged in innovative projects and growth of the operating income of cluster members, one limitation of the study relates precisely to the expression of business performance as a result of innovative activities. Specifically, due to the lack of appropriate statistical data, it was not possible to distinguish which part of the operating income of the enterprises resulted from the introduction of innovative products. Consideration of the share of new products in the achieved performance of cluster members (sales revenue, exports, profits, market share, etc.) would give a clearer picture of the relationship between the increase of innovative activities after the enterprise's joining the cluster and the growth of business performance and competitiveness of member enterprises. Since the study was limited to statistical data that can be obtained by examining the data in the Serbian Business Registers Agency, which does not provide the above indicators, and given that the enterprises do not carry out such a detailed statistical analysis and that their survey could not provide such data, the conclusions are indirect and can be taken with doubt. In addition, since the Serbian Automotive

Cluster does not have a long history, and since the monitoring of the effects of innovative activities takes longer time, time series of analyzed data were not long enough for certain generalizations and general conclusions.

However, besides the number of employees in enterprises-members of the cluster engaged in innovative activities, it has been necessary to analyze the impact of other factor, i.e. state financial incentives for the development and innovativeness of clusters, on their competitiveness and business success. In the period 2007-2009, there was a program known as the "Program for distribution and use of funds intended for cluster development", while since 2010 the support for clusters has been granted within the "Program for the development of innovative clusters" (NARD RS, 2013)[13].

The necessity of institutional support to cluster development is also confirmed by the results of other studies (Kaličanin & Gavrić, 2014). The support of various government institutions, development agencies, local authorities, and universities, may be direct or indirect. Direct government support may be reflected in the adoption of laws, tax breaks, and other incentives that might encourage companies to engage in clusters. Indirect support can be achieved through the formation of expert teams to assist and monitor clusters, or by forming of special agencies that mediate between the government and clusters. The authors point out that in the EU countries, development agencies play a major role in the cluster development, and are intermediaries between small and medium-sized enterprises involved in the cluster, on the one hand, and the EU institutions, on the other hand. The above-mentioned institutions also provide funds for the development of clusters (Kaličanin & Gavrić, 2014).

Clusters need financial support from the state institutions because the external funds that are available on the market are too expensive (due to high interest rates from banks and other lenders) or unavailable to clusters (due to requirements with respect to financial guarantees, collateral or other security instruments which are required by financial institutions). It is necessary to support the clusters financially until they gain sufficient financial strength and sustainability. Another fact that should be pointed out is that in the past many clusters in Serbia were financed by donor programs and projects of foreign governments and organizations and that the completion of these programs

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[13] "Program for the development of innovative clusters" aims at strengthening the capacity of enterprises for technological development and innovations through partnerships among enterprises and establishing strategic partnerships with scientific-research organizations. The program is based on granting non-returnable funds that should contribute to an increase in sales volume of our enterprises on the home and international market and to establishing cooperation with clusters in the region and preparation for joint projects. Funds are granted on an annual basis based on the announced call for proposals (NARD RS, 2013).

and projects brought the sustainability and survival of the cluster into question.

5. Conclusion

The strategic position of an enterprise could be significantly improved by joining a cluster. Individual business strength is not equivalent to collective strength. Clusters are formed due to several reasons. Some of the most important ones are: the need for specific resources, reducing production and research costs, faster launching of new and modified products into the market, division of risk in the process of realizing new business projects, innovating and knowledge transfer. These processes are stimulated by the external environment as well, which is characterized by stronger global competition, frequent and radical market changes and the necessity of accumulating significant funds with the purpose of innovating and tracking, that is, applying the latest technological achievements. Innovations stand for one of the primary tools with the help of which clusters grow and strengthen their strategic position.

The paper has pointed to the facts that in contemporary business environment clusters represent one of the basic drivers of enterprises' and organizations' innovative activities and, consequently, the driving force of strengthening their competitive advantage. With the help of innovations clusters expand and strengthen their primary activities and modernize their technological basis. Exchange of information, resources, competences, knowledge and technical expertise accelerates the innovation process and helps the cluster to achieve sustainable competitive advantage. It can be concluded that one of the main reason for joining the cluster is to respond to increasing market competition through innovations.

It is evident that clustering of Serbian enterprises contributes to the increase of innovative activities and the development of new products/services resulting from those activities. The presented data show that the enterprises increased their innovative activities when they joined the cluster, which also affected the increase of the enterprises' income after launching new products. Namely, statistical analysis proved statistically significant difference between the average number of innovative products launched into the market before and after joining the cluster. Results of the statistical analysis also showed that more intensive innovative activities in the process of cluster networking resulted in the increase of involved members' income.

What is more, clustering of enterprises enables knowledge transfer and, consequently, the increase of the cluster members' innovative activities. Research has shown that cluster members engage significant number of

employees in research and development activities. For that reason, statistical analysis of the data has shown that there is a strong correlation between the number of full-time employees engaged in innovative activities and the average income per each year.

Adjusting to trends, new technologies, market requirements and the competition also implies the acquisition of knowledge. The process of creating knowledge requires education of all employees as well as dissemination of knowledge among the employees, teams, development groups and partners. In contemporary business environment, that kind of cooperation and communication is realized in networked forms of organizations, such as clusters.

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