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**THE INFLUENCE OF CLUSTERS STRENGTH
AND SPECIALIZATION ON REGIONAL INNOVATIVENESS:
COMPARATIVE ANALYSIS OF HUNGARY, BULGARIA, GREECE,
ROMANIA AND SERBIA***

This paper determines the relationship between clusters and innovativeness and explores the significance of this connection depending on strength and specialization of clusters. Our hypothesis is: Clusters influence the regional innovativeness, depending on their strength and specialization. The research is conducted on the sample of 5 countries: Hungary, Bulgaria, Greece, Romania and Serbia, using the methodology of the European Cluster Observatory (ECO) for clusters and the Global Competitiveness Report, as well as the national statistical reports. To support the research findings, the analysis on the correlation between strength and specialization of clusters and the number of patents in the observed regions as the indicator of innovativeness has been carried out. The outcomes obtained show that stronger portfolio of clusters leads to greater innovative performances, particularly in more economically developed regions. Furthermore, greater geographic specialization influences more patent applications, hence, greater innovativeness in regions. Cluster mapping methodology used in this research is based on the Nomenclature of Territorial Units for Statistics (NUTS) 2 level. Further research on NUTS 3 level and extended comparative analysis for larger number of countries could be performed.

Keywords: innovativeness, cluster, cluster's specialization, region.

JEL Classification: F23, L62, L66, O57, R12.

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**ВПЛИВ ПОТУЖНОСТІ ТА СПЕЦІАЛІЗАЦІЇ КЛАСТЕРІВ
НА ІННОВАЦІЙНІСТЬ РЕГІОНІВ: ПОРІВНЯЛЬНИЙ АНАЛІЗ
УГОРЩИНИ, БОЛГАРІЇ, ГРЕЦІЇ, РУМУНІЇ ТА СЕРБІЇ**

У статті досліджено залежність між кластерами та інноваційністю регіонів, зокрема, залежність інноваційності від потужності та спеціалізації кластера. Досліджено дані по 5 країнах — Угорщині, Болгарії, Румунії, Греції та Сербії. Статистичні дані взято зі Звіту про глобальну конкурентоспроможність, а також з джерел національної статистики. Методологія дослідження належить Європейській спостережній раді за розвитком кластерів. Зокрема, проаналізовано кореляцію між потужністю та спеціалізацією кластера та кількістю патентів як індикатору інноваційності регіону. Результати аналізу даних виявили, що більш потужний портфоліо кластерів у регіоні підвищує його інноваційність, при чому дана кореляція стає ще більш суттєвою для економічно розвинених регіонів. Географічна спеціалізація кластерів регіону підвищує шанси на практичне впровадження патентів, що в подальшому позитивно впливає на інноваційність регіону. Манування кластерів проведено на основі Номенклатури територіальних одиниць для цілей статистики (2-ий рівень). Дослідження може бути продовжене для 3-ого рівня Номенклатури, а також шляхом включення у порівняння інших країн.

Ключові слова: інноваційність, кластер, спеціалізація кластеру, регіон.

Табл. 1. Рис. 4. Літ. 14.

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**ВЛИЯНИЕ МОЩНОСТИ И СПЕЦИАЛИЗАЦИИ КЛАСТЕРОВ
НА ИННОВАЦИОННОСТЬ РЕГИОНОВ: СРАВНИТЕЛЬНЫЙ
АНАЛИЗ ВЕНГРИИ, БОЛГАРИИ, ГРЕЦИИ, РУМЫНИИ И
СЕРБИИ**

В статье исследована зависимость между кластерами и инновационностью регионов, в частности, зависимость инновационности от мощности и специализации кластера. Исследованы данные по 5 странам – Венгрии, Болгарии, Румынии, Греции и Сербии. Статистические данные взяты из Отчёта о глобальной конкурентоспособности и национальных статистических источников. Методология исследования принадлежит Европейскому наблюдательному комитету за развитием кластеров. В частности, проанализирована корреляция между мощностью и специализацией кластера и количеством патентов как индикатора инновационности региона. Результаты анализа данных показали, что более сильное портфолио кластеров региона повышает его инновационность, причём данная корреляция сильнее для экономически развитых регионов. Географическая специализация кластеров повышает шансы на внедрение патентов, таким образом позитивно влияя на инновационность региона. Картирование кластеров проведено на основе Номенклатуры территориальных единиц для целей статистики (2-ой уровень). Исследование может быть продолжено для 3-го уровня Номенклатуры и расширено путём включения в сравнение других стран. Ключевые слова: инновационность, кластер, специализация кластера, регион.

1. Competitiveness, innovativeness and clusters

Determination of the problem in its relation to key scientific and practical issues

Competitiveness has become one of the most important and necessary topics for the economy and the society in general. Clusters have the essential role for the studies on competitiveness, and over the past decades many researchers have suggested that clusters have a crucial influence on economic performances, bearing in mind that clusters are dominantly formed at the level of regional areas, not entire nations. Clusters have the potential to be the key dimension of the regional value plan.

The review of the literature on the topic

Competitiveness in the world economy is not a zero-sum game (Porter, 2008). This enables every country to enhance prosperity if it raises its productiveness and competitiveness, regardless of rises or falls in the competitiveness level of other countries. In a more recent period, this has been especially contributed by the globalization process, which has enabled prosperity for those improving their competitiveness, while at the same time increasing relative costs for those having low productivity (Porter, 2007). Achieving prosperity in the globalized economy is linked to the creation of the best possible conditions in which companies can increase their productivity. Hence, government bears enormous responsibility for the creation of a favourable business environment on its territory. Therefore, the modern theory of competitiveness actually deals with competition among different locations. The primary aims are not to increase the size of the economy, volume of foreign exchange reserves, export volume etc., but to create the high quality business environment, which will enable high standards of living, that is, prosperity.

According to Porter (2007) inbound and outbound FDI can serve as intermediate indicators and enablers of competitiveness. The view that position towards FDI of

any country reflects its competitiveness is shared by many authors (Phillips & Pananond, 2010). In globalized economy, FDI offer significant ways for firms to enlarge and protect their profitability and capital value (UNCTAD, 2006). Sukpanich Nessler and Alan Rugman (2006) claim that to attract FDI a firm needs to possess superior value which is reflected in firm-specific advantages (FSAs) or country-specific advantages (CSAs), also known as location advantage (LAs). Between these two components of microeconomic prosperity, there is a significant interaction: firms influence the business environment and the business environment influences the sophistication of firms operations and strategy (Gugler and Pananond, 2010).

Analyzing the US position in the crisis and the ways out of it, Porter and Rivkin (2012) suggest that the key is in increasing innovations and creating new competitive advantages on that basis. Jason Potts (2011) points out that creative industry is the key driver of contemporary economy and puts a special emphasis on clusters.

Regional clusters are the key source of innovations and can be an important factor in the improvement of competitiveness (Savic Nebojsa et al., 2010). Regions with high concentration of innovative clusters in Europe achieve higher levels of development (Europe Innova, 2006). The presence of strong clusters also influences the volume of innovations and the number of patents (Europe Innova, 2010). In transitive economies the level of cluster development is lower than in developed ones (Ketels, Solvell, 2006).

Definition of the target problem for the analysis

The objective of this paper is to determine the relationship between clusters and innovativeness and explore the significance of this connection depending on strength and specialization of clusters. Our analysis tends to explain that regions with strong portfolio of clusters show greater innovative performances, as well as to determine how specialization of clusters influences the regional innovativeness. In order to support the understanding of clusters performances and explore their industrial and geographical features, cluster mapping methodology has been developed by the European Cluster Observatory (www.clusterobservatory.eu). It offers relevant criteria and the matrix on the strength and specialization of clusters with the Nomenclature of Territorial Units for Statistics (NUTS) level 2, which is adequate for regional analysis and is used in this paper. From the very beginning we need to acknowledge the importance of further research and developments in cluster mapping methodology with NUTS level 3 for economic territory of districts.

2. The comparative analysis of clusters and their influence on regional innovativeness. Presentation of the research material, methodology description and the key results of the research

This part of the paper presents our research conducted on the sample of 5 countries: Hungary, Bulgaria, Greece, Romania and Serbia. The aim of the research is to establish the relationship between the strength and the specialization of cluster portfolio and innovative performances of regions.

First, we study the global indicators relevant as the criteria to determine the state of cluster development in selected countries. The chosen indicators are shown in Table 1.

According to the data presented in Table 1, with the exception of Bulgaria, the observed countries are ranked very low with respect to the state of cluster develop-

ment and hold the ranks that are far below those held on the general competitiveness ranking list. Nevertheless, Hungary has the best conditions for cluster development in terms of local supplier quality, the availability of research and training services, breath of the value chain and particularly industry-university cooperation in R&D. Greece is the country with the highest quantity and quality of local suppliers as well as high availability of latest technologies, however holds very low ranks in company spending in R&D and university-industry collaboration. Serbia is especially lagging behind other countries with respect to the breath of value chain and capacity for innovation.

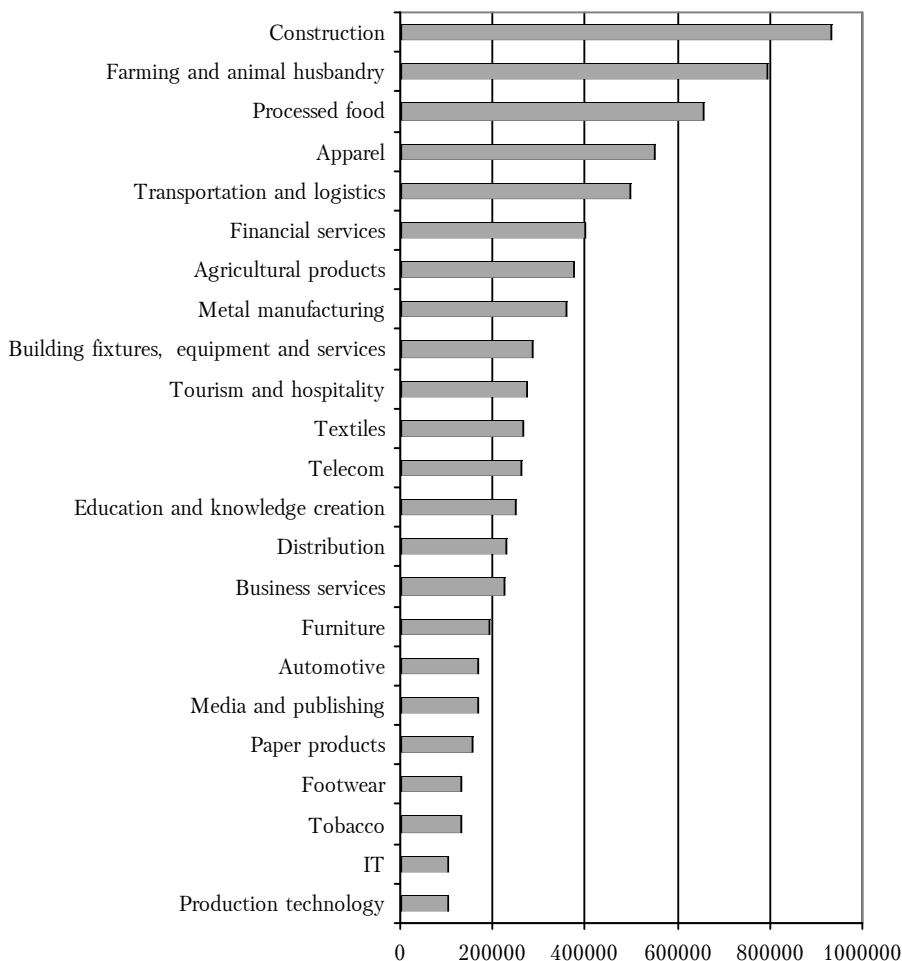
Table 1. The selected indicators of cluster development in the observed countries (competitiveness ranks among 144 countries)

The indices of cluster development	Hungary	Romania	Bulgaria	Greece	Serbia
Country's global competitiveness rank	60	78	62	96	95
The state of cluster development	104	107	87	126	133
Local supplier quantity	97	117	104	83	110
Local supplier quality	63	112	82	67	113
The availability of specialized research and training services	83	112	90	92	125
Companies' spending on R&D	103	87	92	129	132
Industry-university cooperation in R&D	37	113	117	123	99
Breath of the value chain	74	97	86	94	119
Capacity for innovation	45	77	64	104	120
The availability of latest technologies	55	117	98	58	127
Firm-level technology absorption	64	116	125	94	142

Source: The World Economic Forum, 2012. The Global Competitiveness Report 2012-2013. Geneva.

Figure 1 shows that the majority of employees in the 5 observed countries specializes in labor-intensive sectors such as metal manufacturing and food processing, textiles and clothing, or construction working. Clusters are mostly engaged in construction, farming and animal husbandry, food processing and apparel. It can be observed that clusters engaged in labor- and resource-intensive industries are dominant in all the 5 countries observed. Since the modern automotive industry encompasses labor-intensive and, in part, technology-intensive segments of the economy, the existence of a high concentration represents a chance for the region's development and an opportunity for shifting from labor- and resource-intensive to technology- and knowledge-intensive segments of the economy.

In the global knowledge-based economy, companies in affluent countries compete in innovations and the creation of new solutions in order to meet global challenges. In their race for innovations, companies often join global innovation alliances. At the same time, however, they are becoming increasingly dependent on local conditions for knowledge creation and exchange as an important source of innovation. Increased competition in innovations and the significance of knowledge are gradually changing the clusters. Existing clusters are gradually shrinking, while some new, more specialized clusters are emerging through the local cooperation. Monitoring of these transformations and their translation into policy measures are very important for national and local policy makers. It becomes increasingly evident that the access to quality human resources and specialized knowledge gains importance in the knowledge-based economy and that even large companies must cooperate in knowledge creation and exchange (Andreas, Rosted, 2009).



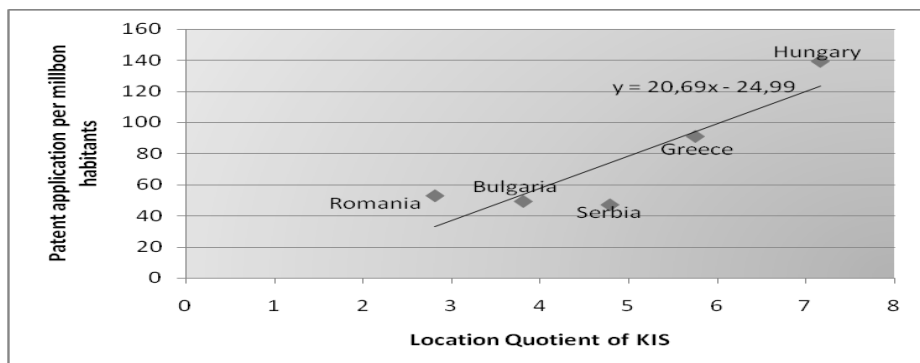
Source: Authors' calculations based on the data from the European Cluster Observatory (www.clusterobservatory.eu).

Figure 1. The total employment by cluster category in the observed countries for year 2012

According to the European Cluster Observatory (www.clusterobservatory.eu), clusters research can be fragmented into 3 large economic segments:

- 1) KIS – knowledge-intensive services (business support services, education and knowledge creation services, financial services and IT);
- 2) CCI – creative and cultural industries (advertising, architecture, arts, crafts, design, fashion, film, music, printing and publishing, R&D, software, video games, TV and radio); and
- 3) LS – life sciences (biopharmacy and medical devices).

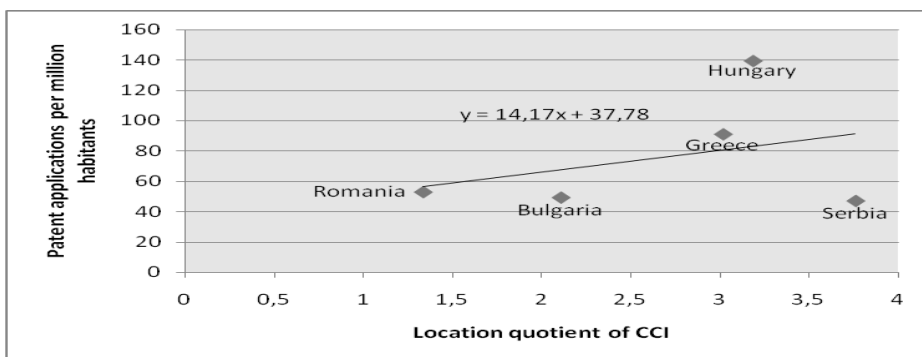
Figures 2–4 illustrate the relationships between patent applications and the location quotient for KIS, CCI and LS clusters in the observed regions. The location quotient represents the % of employees in the clusters to the total number of employees in the region and the measure of a region's specialization.



Source: Authors' calculations based on the data from the European Cluster Observatory (www.clusterobservatory.eu).

Figure 2. Innovative performances and measure of regional specialization – KIS

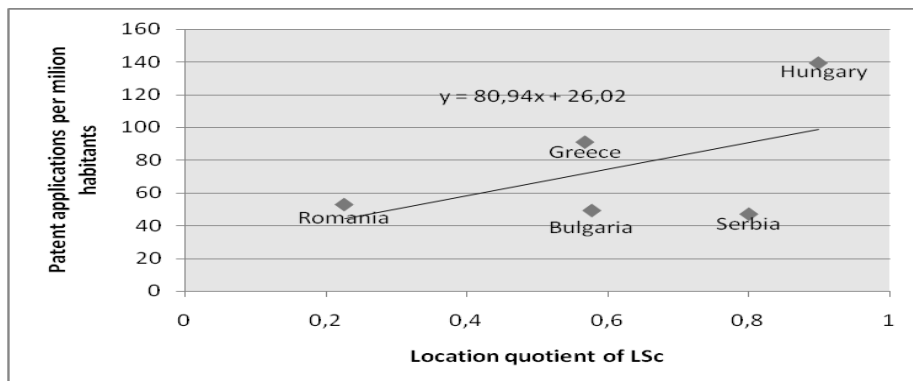
Figure 2 indicates a strong relationship, with the calculated high positive correlation ($r = 0,88183$) between the regional specialization in KIS clusters and the number of patents. There are very small fluctuations in the relation to the found relationship. Despite the greater specialization of KIS in relation to Bulgaria and Rumania, Serbia is lagging behind the number of patent applications. Greece, despite a small number of stars in KIS, has rather strong specialization in these sectors, resulting in a large number of patent applications. Hungary is among the countries which has developed a specialization in most KIS and has so far the greatest number of patent applications per million inhabitants.



Source: Authors' calculations based on the data from the European Cluster Observatory (www.clusterobservatory.eu).

Figure 3. Innovative performances and measure of regional specialization – CCI

Figure 3 represents a weak, however positive, relationship between the regional specialization and the number of patents in CCI clusters. We found a positive correlation ($r = 0,34243023$) which leads us to the conclusion that there is evidence on regional specialization influencing patent applications in the cases of Romania, Greece and Hungary. Serbia is significantly excepted from this: despite large regional specialization in CCI, the number of patents is very low.



Source: Authors' calculations based on the data from the European Cluster Observatory (www.clusterobservatory.eu).

Figure 4. Innovative performances and measure of regional specialization – LS

Figure 4 illustrates the relationship between the level of specialization for LS and the number of patents per million inhabitants. Positive correlation ($r = 0,53007$) was found. If we analyse the data in more detail, we can point to a clear reference to this correlation in the cases of Hungary, Greece and Romania. Bulgaria and Serbia, however, despite the greater specialization of Greece and Romania, are left behind in the number of patent applications.

3. Concluding remarks

Conclusions and further studies perspectives

Competitiveness is now the focus of all countries that seek long-term sustainable development. In search for new modes of strengthening productivity vital support is based on innovation and knowledge. Clusters, as one of the major concepts of competitiveness and economic development, with increased attention paid in the last half-decade, can be considered as a strong platform for knowledge and ideas sharing, hence innovation improvements.

We conducted this research to show that strong specialized clusters affect the innovativeness of the region in which they are located. In the attempt to determine the nature of this relationship, we compare the strength of clusters per region in the observed countries with patent applications per million inhabitants. Furthermore, we calculated the correlation coefficients to support the analysis and indicate the validity of the determined relationships.

We can conclude that the strength of clusters and specialization in certain industries influence the number of innovations in the regions. The regions with strong KIS, CCI and LS clusters as indicated in our analysis have a positive impact on innovation performances. The regions with greater geographic specialization also have more patent applications than the regions with less specialization.

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