

INNOVATION CLUSTERS, TOOLS TO PROMOTE AND SUPPORT REGIONAL SMART SPECIALIZATION

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Abstract:

Smart regional specialization is a concept promoted through the Europe 2020 Strategy that aims to increase the efficiency of the use of European funds for research, development and innovation. Innovation clusters are development tools for businesses in less developed regions of the European Union that can associate and cooperate to create networking opportunities and develop partnerships for investment in research, development, innovation, and technology transfer. The analysis of the potential to develop innovation clusters at the level of the less developed regions in Central and Eastern Europe, using the European Cluster Observatory and the Cluster Stars indicator, helped create a ranking of these regions and identify the economic sectors that play a role in the development of enterprises in the region, in increasing innovation and employment capacities.

Keywords: regional smart specialization, innovation clusters, lagging regions, European Union.

1. Introduction

The Europe 2020 strategy highlights the special role of smart, sustainable and inclusive growth in creating a resource-efficient Europe. In the short term, the Europe 2020 strategy aims to reduce the impact of crisis on the European economy. In the long term, Europe must create conditions for increasing employment, living standards and the level of economic development, by supporting innovation, better use of resources and knowledge capitalization.

In addition, "global competition has evolved from competition between businesses to competition between regions. In this context, clusters play an important role as poles of concentration of competences" (Tanțău, 2011, p. 8). The role of innovation clusters in enhancing the competitiveness and intelligent specialization of regions and the level of development of regional economies is thus evident.

The aim of this paper is to analyze the innovation clusters of the less developed regions of the European Union, based on a centralization of the Cluster Stars indicator created by the European Union and available on the European Cluster Collaboration Platform (European Union, 2018). Section 2 analyzes relevant literature on intelligent specialization and innovation clusters as important development vectors; Section 3 presents the classification of the less developed regions of the European Union, based on the Cluster Stars indicator and the analysis of the results; Section 4 presents the study's findings.

2. Smart specialization and innovation clusters

The concept of smart specialization describes the ability of an economic system or a region to generate new specializations by discovering new areas that offer opportunities as well as to concentrate resources and skills in these areas (Foray, 2015, p. 2). If we relate this concept to that of specialization in a national industry or economy, we find that smart specialization is much more specific. Smart specialization does not describe the importance of a region's industry in the national economy, nor the fields in which a region has specialized in a passive way, but the regional capacity to develop new fields based on the regional concentration of knowledge and skills.

In the context of Europe 2020, five principles explain smart specialization (Foray and Goenaga, 2013; Carayannis and Grigoroudis, 2016): granularity (smart specialization policy should concentrate on activities instead of sectors or firms); entrepreneurial discovery (entrepreneurs are continually searching for, identifying and evaluating new business opportunities); evolving diversification (the priorities emerging today will not be supported forever because 'new activities' are no longer new); experimental nature (innovation policy needs to allow for experiments in order to discover what works and what does not in a particular context); inclusive strategy (smart specialization needs to be inclusive, giving every sector a chance to be present in the strategy through a good project).

Alfred Marshall first mentioned the concept of cluster in 1920 and defined it as an economic space of organizations and companies interconnected by three main factors: workforce, specialized suppliers, and easy access to knowledge and information" (Dan, 2012, p.4).

In Michael Porter's opinion, clusters are "a geographic concentration of interconnected companies and institutions in a particular field" (Porter, 1998), suggesting the existence of a "diamond of competitive advantage" consisting of: factors of production, demand, interdependent and support sectors, strategy, structure and competitors of the organizations (Porter, 1998).

"Clusters are geographic concentrations of enterprises, universities and research institutes as well as local or regional authorities and, as a result, they attract specialized providers, can select from a pool of labor, and have access to information" (Dan, 2012, p.5). Other authors consider that all enterprises can benefit from the local innovation potential, the trend of wages and jobs growth (Muro and Katz, 2010), especially since the role of each partner involved in the cluster is determined by cluster strategy and market requirements (Tanțău, 2011). Clusters are a set of companies that operate in an industry, have interconnected activities, are in geographical proximity and have the potential to increase their competitive advantage and the economic development of the region (Ferreira, Serra et al., 2012, p.72).

Markusen (1996) classified clusters into four categories: "Marshallian clusters" (small and medium-sized enterprises with strong relationships, dependent on cluster synergies); "Hub and spoke" (members are a big company and numerous small business providing support services; the big company sets the conditions for cooperation); "Satellite platforms" (its members are subsidiaries of large and medium-sized enterprises with minimal cooperation between them); "State-anchored" (consisting of state-owned companies that have relationships with specialized suppliers; their development is dependent on the funding of public services).

In the dedicated literature, the term cluster is widely utilized, but the concept of "competitiveness pole" is also in use. According to Matei (2013, p.44), the two terms are nevertheless used differently, thus imposing a conceptual delimitation:

Table 1

Conceptual distinction: cluster/competitive pole

Term	Features	Theoretical foundation
Competitive Pole	Complete structure "triple helix" or "four clover" Strategy generated from objective to act on one or more markets Export orientation Focus on innovative projects National and international impact Focus on production	Porter's diamond
Cluster	Industrial cluster, focusing on the relationship between businesses and structures in various stages of maturity	Marshall's theory

Source: Matei, Ramona-Mihaela (2013), "Creating competitive poles – the sustainable model for obtaining the competitive advantage", *Theoretical and Applied Economics*, 8(585), p.49.

Innovation clusters are equivalent to industrial clusters or cluster initiatives and involve the creation of an interconnected network of enterprises, suppliers, institutions, universities, local and regional authorities that promote innovation and economic growth at regional level. Within innovation clusters, high-tech manufacturing and technology companies, research centers, universities and interested public authorities (Timotin, 2016) occupy an essential place.

The higher the number of innovation clusters, the more the region benefits from the innovation and growth capacity of the key actors involved in clusters, as the very existence of a cluster boosts their efforts. According to Foray and Goenaga (2013, p.8), when initiative is concentrated in a single large company, it may, along with its own employees, suffer from "creative myopia," the inability to look around and learn from others.

In the context of smart regional specialization, the essential aspect of specialization is the specific capabilities of innovation clusters (Todeva, 2014). In regions lagging behind, innovation clusters are important development vectors that

allow the discovery of areas with potential whose influence on the growth of smart regional specialization may be important.

3. Analysis of innovation clusters in less developed regions of the European Union (NUTS2)

Many studies based on clusters use case study approaches to assess regional capability for smart specialization and to determine the extent to which innovation clusters created for regional development respond to the challenges of smart specialization (Maciejczak, 2012; Vanthillo and Verhetsel, 2012; Baler, Kroll and Zenker, 2013). In recent years, the development of data sources on clusters and of the so-called "clusters maps" has allowed for more complex studies.

The aim of this study is to classify the less developed regions in Central and Eastern Europe, based on their potential to develop innovation clusters in different areas.

The current survey identified the less developed regions in Central and Eastern Europe, i.e. in Bulgaria - BG (6 regions), Czech Republic - CZ (7 regions), Estonia - EE (1 region), Croatia - HR (1 region), Latvia - LV (1 region), Lithuania - LT (1 region), Hungary - HU (6 regions), Poland - PL (15 regions), Romania - RO (7 regions) and Slovakia - SK (3 regions), which have a GDP below 50% of the European Union average and low productivity (EC 2014/99/EU, 2014; Muller et al., 2006; OECD, 2011).

The analysis of the number of potential innovation clusters in each region, by sector, was based on the study of the information provided by the European Cluster Observatory, a platform founded by The EU Programme for the Competitiveness of Enterprises and SMEs (COSME) (European Union, 2018). "The European Cluster Observatory is a single access point for statistical information, analysis and mapping of clusters and cluster policy in Europe that is foremost aimed at European, national, regional and local policy-makers as well as cluster managers and representatives of SME intermediaries. It is an initiative of the "SMEs: Clusters and Emerging Industries" unit of the European Commission's Enterprise and Industry Directorate-General that aims at promoting the development of more world-class clusters in Europe, notably with a view to fostering competitiveness and entrepreneurship in emerging industries and facilitating SMEs' access to clusters and internationalisation activities through clusters" (Lammer-Gamp, zu Kocker, et al., 2014).

From the indicators analyzed by the European Cluster Observatory we selected the "Cluster Stars" indicator. According to methodology of the Observatory, the number of "stars" is a composite indicator that takes into account four dimensions: the number of employees, the location quotient, the labor productivity and the annual growth rate. An agglomeration receives one star if it is in the top 20% of the regions of the European Union for the value of the composite indicator. For our study, we recorded the value of the composite indicator for each region, by economic sectors. The composite indicator was calculated based on national data sources for 2013 and it grants each region 0, 1, 2 or 3 stars, depending on the previously mentioned dimensions.

The ranking highlights the presence in the top 11 of regions from the Czech Republic, Poland, Romania and Bulgaria, which scored over 40 stars in total (Table no. 2). Lack of data for some economic sectors or regions in Croatia and Slovenia generated limits for this study.

The Jihovýchod region in the Czech Republic recorded the largest number of Cluster Stars, indicating the existence of large agglomerations and potential for the development of innovation clusters in this region, with an impact on regional smart specialization. The main economic sectors supporting regional development in this region are: Agricultural Inputs and Services; Automotive; Electric Power Generation and Transmission; Forestry; Furniture (Table 2).

Even top-ranking regions exhibit a number of problems caused by lack of investment in certain industrial sectors or the predominance of agricultural activities with low innovation. In fact, these regions are "modest innovators" due to low investment in research and development (Hollanders and Es-Sadki, 2014). However, there is potential for development in these regions, if provided with the creative and intelligent diversification of the regional economy.

Table 2

**"3 cluster-stars" economic sectors in the less developed regions
in Central and Eastern Europe**

Position	Region	Total "Cluster Stars"	Economic sectors with 3 "Cluster Stars"
1.	CZ06 - Jihovýchod	55	Agricultural Inputs and Services; Automotive; Electric Power Generation and Transmission; Forestry; Furniture
2.	PL41 – Wielkopolskie	52	Lighting and Electrical Equipment; Paper and Packaging
3.	CZ02 - Strední Cechy	49	Aerospace Vehicles and Defense, Information Technology and Analytical Instruments; Downstream Metal Products; Environmental Services; Financial Services; Forestry; Information Technology and Analytical Instruments; Oil and Gas Production and Transportation; Tobacco
4.	PL22 - Slaskie	46	Automotive
5.	PL51 - Dolnoslaskie	44	Downstream Chemical Products; Information Technology and Analytical Instruments; Plastics
6.	RO12 - Centru	43	Automotive; Downstream Metal Products; Livestock Processing
7.	BG41 - Yugozapaden	42	Communications Equipment and Services
8.	PL21 - Malopolskie	42	<i>No domain with 3 stars</i>
9.	CZ08 - Moravskoslezsko	41	Automotive; Downstream Metal Products; Electric Power Generation and Transmission; Environmental Services; Forestry; Jewelry and Precious Metals; Production Technology and Heavy Machinery; Recreational and Small Electric Goods
10.	PL63 - Pomorskie	40 stars	Recreational and Small Electric Goods
11.	SK02 -	40 stars	Downstream Metal Products; Furniture;

	Západné Slovensko		Information Technology and Analytical Instruments; Plastics
12.	CZ05 - Severovýchod	39 stars	Forestry; Information Technology and Analytical Instruments; Jewelry and Precious Metals
13.	CZ07 - Strední Morava	38 stars	Forestry; Information Technology and Analytical Instruments; Upstream Chemical Products
14.	HU32 - Észak-Alföld	36 stars	Medical Devices
15.	CZ03 - Jihozápad	35 stars	Automotive; Electric Power Generation and Transmission; Forestry; Nonmetal Mining
16.	RO42 - Vest	35 stars	Automotive
17.	SK03 - Stredné Slovensko	35 stars	Automotive; Footwear; Wood Products
18.	SK04 - Východné Slovensko	35 stars	Leather and Related Products; Upstream Metal Manufacturing
19.	PL32 - Podkarpackie	34 stars	<i>No domain with 3 stars</i>
20.	CZ04 - Severozápad	33 stars	Agricultural Inputs and Services; Automotive; Electric Power Generation and Transmission; Environmental Services; Forestry; Upstream Chemical Products
21.	HU31 - Észak-Magyarország	32 stars	Communications Equipment and Services
22.	PL11 - Łódzkie	32 stars	Appliances; Downstream Metal Products; Plastics
23.	PL61 - Kujawsko-Pomorskie	32 stars	Plastics
24.	RO11 - Nord-Vest	32 stars	Music and Sound Recording
25.	LT00 - Lietuva	31 stars	<i>No domain with 3 stars</i>
26.	HU33 - Dél-Alföld	31 stars	<i>No domain with 3 stars</i>
27.	PL42 - Zachodniopomorskie	31 stars	<i>No domain with 3 stars</i>
28.	BG42 - Yuzhentsentralen	30 stars	Electric Power Generation and Transmission; Recreational and Small Electric Goods
29.	HU21 - Közép-Dunántúl	30 stars	<i>No domain with 3 stars</i>
30.	HU22 - Nyugat-Dunántúl	30 stars	Automotive; Communications Equipment and Services
31.	RO21 - Nord-Est	30 stars	Automotive; Livestock Processing
32.	RO31 - Sud - Muntenia	29 stars	Automotive; Livestock Processing
33.	EE00 - Eesti	26 stars	Agricultural Inputs and Services;

			Nonmetal Mining
34.	HU23 - Dél-Dunántúl	26 stars	No domain with 3 stars
35.	RO41 - Sud-Vest Oltenia	26 stars	No domain with 3 stars
36.	PL33 - Swietokrzyskie	23 stars	No domain with 3 stars
37.	RO22 - Sud-Est	23 stars	No domain with 3 stars
38.	PL31 - Lubelskie	22 stars	No domain with 3 stars
39.	PL43 - Lubuskie	22 stars	No domain with 3 stars
40.	PL52 - Opolskie	21 stars	No domain with 3 stars
41.	PL62 - Warminsko-Mazurskie	21 stars	Furniture; Vulcanized and Fired Materials
42.	BG34 - Yugoiztochen	19 stars	Downstream Metal Products
43.	BG31 - Severozapaden	16 stars	Electric Power Generation and Transmission
44.	BG32 - Severen tsentralen	16 stars	Downstream Metal Products
45.	BG33 - Severoiztochen	16 stars	No domain with 3 stars
46.	LV00 - Latvija	16 stars	No domain with 3 stars
47.	PL34 - Podlaskie	14 stars	No domain with 3 stars

Source: created by authors with data from: European Union (2018), European Cluster Collaboration Platform, Cluster Organisations Mapping Tool. [online] Available at: <<https://www.clustercollaboration.eu/cluster-mapping/>> [Accessed 2 October 2018].

The results allow us to create four performance classes for the less developed regions in Central and Eastern Europe, depending on the potential for the development of innovation clusters:

✓ The "attackers" are the top 11 regions that have achieved between 55 and 40 stars, which are characterized by an environment conducive to the development of innovation clusters, in areas with high potential for regional smart specialization;

✓ The "midfielders" are the regions that have registered between 39 and 30 stars, which are characterized by moderate development conditions geared to supporting smart regional innovation and specialization;

✓ The "defenders" are the regions that have achieved between 29 and 21 stars, with low performance in terms of cluster development and smart regional specialization;

✓ The "reserves" are the regions that have obtained less than 19 stars and for which the available data show a modest potential in developing innovation clusters, to support regional innovation and smart specialization.

Figure 1 gives an overview of cluster performances in the less developed regions in Central and Eastern Europe, so that one can easily observe the degree of concentration of economic activity and the potential to develop innovation clusters.

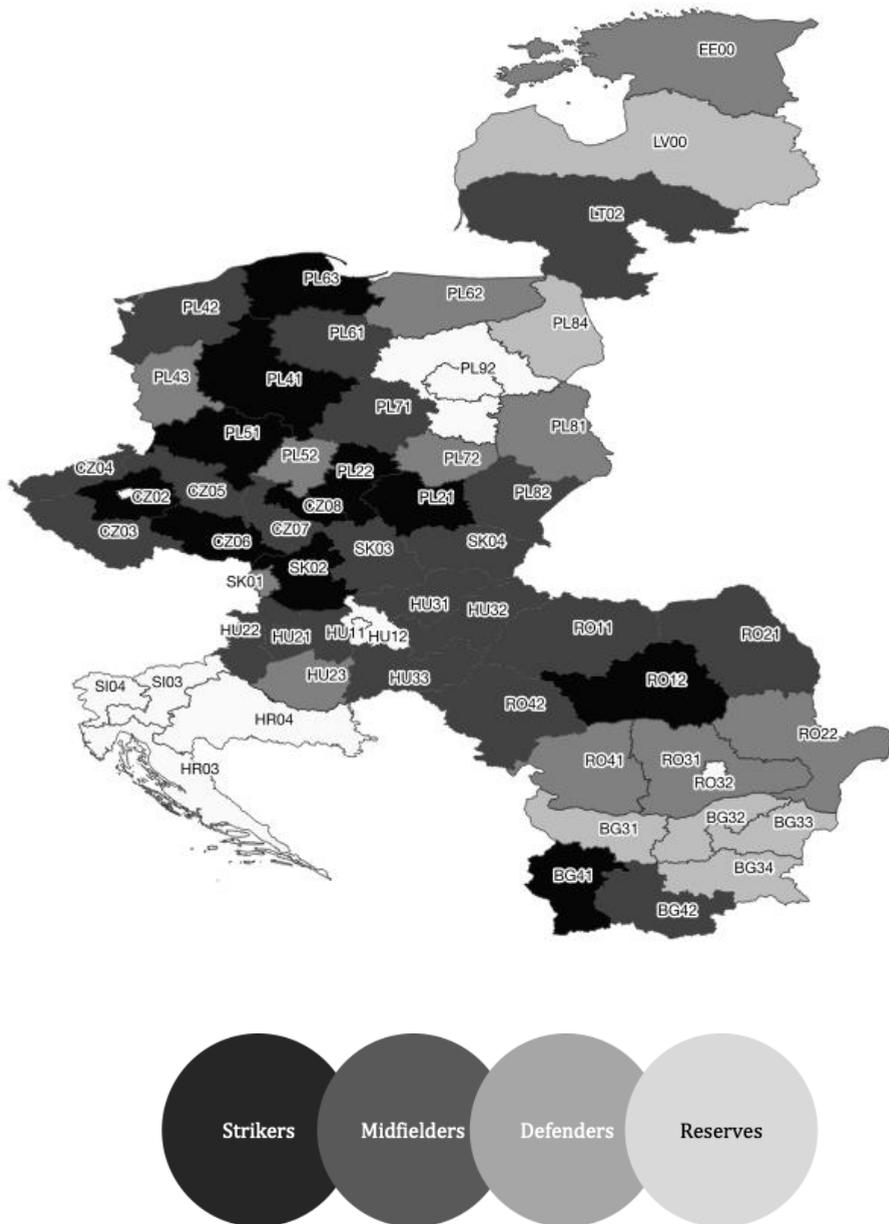


Figure 1. Cluster performance classes in Central and Eastern European regions

Source: realised by authors. No data are recorded for Slovenia and Croatia; the analysis does not consider the case of the most developed regions (CZ01, HU10, PL12, RO32)

The analysis of the 51 economic sectors / domains (Table 3) shows that in the less developed regions of the European Union, the highest development potential for innovative clusters is in the Automotive area (60 stars), Environmental Services (56 stars), Downstream Metal Products (54 stars) and Forestry (54 stars). It should be noted here that the Automotive sector is an important economic domain for half of the regions of Romania and the Czech Republic.

On the last positions of the ranking one can find areas such as Hospitality and Tourism, Aerospace Vehicles and Defense, Information Technology and Analytical Instruments, Tobacco, Financial Services, Metal Mining and Insurance Services. Thus, Insurance Services is representative only for two regions, PL12 - Mazowieckie and BG41 - Yugozapaden. There is also potential for development for Hospitality and Tourism; however, this area is representative only for a Bulgarian region, BG34 – Yugoiztochen.

Table 3
Classification of domains, according to the total "Cluster Stars" indicator

	Domain	Total "Cluster Stars"
1.	Automotive	60
2.	Environmental Services	56
3.	Downstream Metal Products	54
4.	Forestry	54
5.	Apparel	51
6.	Furniture	48
7.	Transportation and Logistics	48
8.	Electric Power Generation and Transmission	47
9.	Wood Products	47
10.	Construction Products and Services	46
11.	Plastics	46
12.	Footwear	45
13.	Recreational and Small Electric Goods	44
14.	Information Technology and Analytical Instruments	43
15.	Communications Equipment and Services	41
16.	Livestock Processing	41
17.	Metalworking Technology	40
18.	Nonmetal Mining	40
19.	Appliances	37
20.	Business services	36
21.	Education and Knowledge Creation	36
22.	Marketing	36
23.	Oil and Gas Production and Transportation	36
24.	Textile Manufacturing	36
25.	Music and Sound Recording	34
26.	Lighting and Electrical Equipment	33
27.	Vulcanized and Fired Materials	33
28.	Agricultural Inputs and Services	30
29.	Food Processing and Manufacturing	29
30.	Performing Arts	29
31.	Upstream Chemical Products	28

32.	Jewelry and Precious Metals	27
33.	Paper and Packaging	26
34.	Production Technology and Heavy Machinery	26
35.	Leather and Related Products	25
36.	Medical Devices	25
37.	Upstream Metal Manufacturing	25
38.	Coal mining	24
39.	Printing Services	23
40.	Water Transportation	23
41.	Video Production and Distribution	21
42.	Biopharmaceuticals	20
43.	Distribution and Electronic Commerce	20
44.	Downstream Chemical Products	20
45.	Fishing and Fishing Products	20
46.	Hospitality and Tourism	18
47.	Aerospace Vehicles and Defense, Information Technology and Analytical Instruments	17
48.	Tobacco	16
49.	Financial Services	14
50.	Metal Mining	7
51.	Insurance Services	6

Source: created by authors after data processing; European Union (2018), *European Cluster Collaboration Platform, Cluster Organisations Mapping Tool*. [online] Available at: <<https://www.clustercollaboration.eu/cluster-mapping>> [Accessed 2 October 2018].

In order for the top-level domains to become vectors for innovative cluster development and smart specialization in the less developed regions in Central and Eastern Europe, there is a need to increase investments in infrastructure, develop R&D capacities and infrastructure, introduce products based on innovative processes, improve public services, improve skills and the performance of human resources.

4. Conclusions

In the current economy, innovation clusters have an important impact on regional growth through flexibility and adaptability to regions' needs and to changes in modern economy. The development of innovation clusters provides access to knowledge, increases interest in introducing modern innovations and technologies, and leads to cost reductions and the implementation of tailored smart specialization strategies.

This study explained the importance of clusters in supporting smart regional specialization. The European Cluster Observatory and the Cluster Stars indicator allowed for a classification of less developed regions in the European Union, identifying the economic sectors with a clear role in regional growth.

The results highlight the fact that some of the less developed regions of the European Union have development potential in areas such as Automotive. Environmental Services, Downstream Metal Products or Forestry. However, the lack of efficient infrastructure, R&D investments and consistent governmental or regional policies determines the modest positioning of a significant number of regions.

The limits of the study derive from the qualitative nature of the data, the lack of data for some regions and areas and the lack of more recent data, the Cluster Stars indicator being calculated at the level of 2013. As the countries and regions improve their innovation cluster reporting, the results of the research will become more relevant to the analyzed regions.

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