IDENTIFICATION OF HIERARCHY OF AGGLOMERATIONS AT REGIONAL LEVEL AND IN INDUSTRIAL SECTOR IN THE REPUBLIC OF MOLDOVA

Alexandra NOVAC[1], PhD, Associate Researcher,
National Institute for Economic Research
Republic of Moldova

Clusters represent one of the most efficient economic incentive mechanisms and become an important tool for developing and increasing the enterprises competitiveness, thus improving also the business climate in the region. At the same time, it is one of the most discussed topics at national level, but still remains a topic of discussion. Currently, the cluster development policy in Moldova is still at the initial stage. Although the mechanisms for clusters creation are not clearly defined, and it has not been yet developed a cluster map, reflecting the regions and industrial sectors with cluster potential, about the need to create clusters was mentioned in several strategic documents.

The paper aims to perform a hierarchy of agglomerations at the regional level, based on those industries with a high degree of specialization, identified via the „three stars" method. The main results achieved following the investigations consist in carrying out the agglomerations hierarchy at regional level, its description and graphic representation. The research methodology is based on: a critical analysis and generalization of literature, analytical materials; „three stars" method for the agglomerations identification; mapping method. The basis of this paper is constituted of final results of a study under the project for the young researchers „Analysis of the potential of clusterization in the Republic of Moldova in the industrial sector" (code 16.80012.08.15A).

Keywords: *economic agglomeration, cluster, enterprise, industrial sector, Republic of Moldova.*

Clusterele reprezintă unul dintre cele mai eficiente mecanisme de stimulare economică, devenind un instrument important de dezvoltare şi majorare a competitivităţii întreprinderilor, implicit de ameliorare a climatului de afaceri din regiune. În acelaşi timp, este unul dintre cele mai dezbătute subiecte la nivel naţional, dar încă rămâne a fi doar un subiect de discuţie. Momentan, politica de creare a clusterelor în Republica Moldova se află încă la etapa incipientă şi cu toate că mecanismele de creare a clusterelor nu sunt clar definite şi nu a fost elaborată o hartă a clusterelor, care să reflecte regiunile şi sectoarele industriale cu potenţial de clusterizare, despre necesitatea instituirii clusterelor se menţionează în mai multe documente strategice.

Scopul acestui studiu este de a efectua o ierarhie a aglomerărilor de tip cluster la nivelul regiunilor de dezvoltare în baza sectoarelor industriale cu un grad ridicat de specializare în raioanele (regiunile) Moldovei, identificate în baza metodei clasificării de tip „3 stele". Principalele rezultate obţinute în urma investigaţiilor constau în efectuarea unei ierarhii a aglomerărilor de tip cluster la nivelul regiunilor de dezvoltare, descrierea şi reprezentarea grafică a acesteia. Metodologia cercetării se bazează pe: analiza critică şi generalizarea literaturii de specialitate şi a materialelor analitice; metoda clasificării de tip „3 stele" pentru identificarea aglomerărilor de tip cluster; metoda cartografică. La baza acestui studiu stau rezultatele finale ale unui studiu realizat în cadrul proiectului pentru tinerii cercetători „Analiza potenţialului de clusterizare în Republica Moldova la nivelul sectorului industrial" (cu cifrul 16.80012.08.15A).

Cuvinte-cheie: *aglomerare economică, cluster, întreprindere, sector industrial, Republica Moldova.*

Кластеры является одним из наиболее эффективным механизмом экономического стимулирования, становясь важным инструментом для развития и повышения конкурентоспособности предприятий, таким образом, способствуя улучшению бизнес-климата в регионе. В то же время это одна из самых обсуждаемых тем на национальном уровне, но по-прежнему остается просто предметом обсуждения. В настоящее время политика создания кластеров в Молдове еще находится на начальном

[1] *© **Alexandra NOVAC, alecsandra_novac@yahoo.com***

этапе, и хотя механизмы для создания кластеров, не определены, и карта кластеров, отражающая регионы и сектора промышленности с потенциалом кластеризации по-прежнему не была разработана, о необходимости создания кластеров, отмечается в нескольких стратегических документах.

Цель исследования – разработать иерархию агломераций на уровне регионов развития на основе промышленных секторов с высокой степенью специализации в районах (регионах) Молдовы, идентифицированных по методу классификации 3 звезды. Основные результаты исследования заключаются в разработке иерархии агломераций на уровне регионов развития, ее описании и графическом представлении. Методология исследования основана на: критическом анализе и обобщении специализированной литературы, аналитических материалов; метод классификации «3 звезды» для определения агломераций; картографический метод. Основой данной статьи являются финальные результаты исследования, проведенного в рамках проекта молодых исследователей "Анализ потенциала кластеризации в Республике Молдова на уровне промышленного сектора" (шифр 16.80012.08.15A).

Ключевые слова: *экономическая агломерация, кластер, предприятия, промышленный сектор, Республика Молдова.*

JEL Classification: C 38, L19, O25, O38.
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Introduction. The economic and technological development at the end of the 20th century and the beginning of the 21st century, which took place internationally, led to an increase role and importance of partnerships between companies, so that they could cope more easily with competition. Companies are forced to look for new solutions to become more competitive. One of these solutions can become the creation of clusters that, according to the experience of other states, have become an effective tool for developing and increasing the competitiveness of enterprises, implicitly improving the business climate in the region. Being part of a cluster makes getting most things done quicker, easier and cheaper because of the joint efforts of the clusters actors. As a result, the companies increase their productivity and operational efficiency (through access to resources, synergies, etc.), accelerate the innovation activity, etc. [10].

Considering the above mentioned the policy of creating and developing clusters is very actual and important for the Republic of Moldova and can have a positive impact on the development of the competitiveness of enterprises and regions, overall.

In order to improve the country's competitiveness, the industrial and entrepreneurial policy mentioned in Chapter 10 of the Association Agreement between the Republic of Moldova and the EU underlines that both the EU and the Government of the Republic of Moldova should encourage the „development of innovation policy, via the exchange of information and good practice regarding the commercialization of research and development…, **cluster development** and access to finance" [1].

Results and discussions. A poor cooperation between entrepreneurs and representatives of local government, the research environment, training, etc. in a region is seen as one of the causes of a low competitiveness of Moldovan enterprises. Their integration into clusters will increase the competitiveness of enterprises through innovative development, cost reduction for joint projects, etc. At the same time, it will also have an impact on the region / country, improving the business climate, creating new businesses, increasing the employment rate of the population, etc.

Internationally, the issue of clusters has been addressed by several authors: Michael Porter (in The Competitive Advantage of Nations, 1990; On Competition, 1998), Lösch and Von Thünen, S. Rosenfeld, W. Roelandt and P.den Hertog , Ö.Sövell, G.Lindqvist, G., Ketels, and others.

The cluster theory was created three decades ago, inseparably been linked to the works of Michael Porter, who introduced this term into economic language in the 1990s. In his works dedicated to industrial clusters (The Competitive Advantage of Nations, 1990) or regional clusters (On Competition, 1998), he describes the cluster as *„a geographical concentration of interconnected companies and associated institutions that operate in a certain field, characterized by synergies of activity and complementarities"* [11, p. 258].

Although the cluster approach is based on the agglomeration theory, there is a diversity of definitions for the cluster concept. The vague nature of the cluster concept makes the identification of industrial clusters a more difficult task. As Dr. Lefebvre said, Ecole des Mines de Paris: „there is no real adequate definition for a cluster. In reality, there are very different types of clusters to be found, involving different types of

partners from industry, research, education, policy (...). The two most famous examples of clusters, Silicon Valley and the Italian districts, are extremely different in their nature and ways of bringing the actors together (Interview)" [3].

In the Republic of Moldova, the problems of identifying and establishing clusters are a relatively new phenomenon for the country's economy. Cluster creation policy in the Republic of Moldova is still at an early stage and although cluster creation mechanisms are not clearly defined, the need to set up clusters is mentioned, inter alia, in several strategic documents: the SMEs Development Strategy for the period 2012-2020, the National Regional Development Strategy 2013-2015, the National Innovation Strategy of the Republic of Moldova „Innovation for Competitiveness", etc.

Numerous studies have shown that clusters have a positive impact on developing and increasing the enterprises competitiveness, in particular the SME sector, through access to new markets, access to new technologies, additional production capacities, cost reduction by distributing it to all cluster members, improving the image of the participants, ameliorating the business climate in the region, etc.

According to the cluster development theory, cluster initiatives appear in those regions characterized by a high cooperation between enterprises in different partnerships and networks but given that the economy of Moldova is currently characterized by insufficient development, it is appropriate that the state should have a direct involvement in the creation and development of clusters.

There are several methods and techniques for identifying clusters. In general, quantitative and qualitative cluster identification methods are distinguished. Among the most commonly used methods in theoretical and empirical literature, we can mention: interviews with experts; the Porter diamond approach; localization coefficient; input-output analysis; the Gini coefficient; shift-share analysis; the "3 star" classification method.

Each of these methods presents advantages and limitations and there is no an unanimously accepted method with respect to the main variables calculated to identify the geographical boundaries of clusters [7].

Statistical methods for identifying agglomerations are based on the identification of inequalities and concentrations in the spatial distribution of a phenomenon [2, 6]. At the EU level, the most-used method of identifying clusters is the "3-star" method. According to this method, the identified/analyzed industrial agglomerations are based on the analysis factors: Size, Concentration, Specialization (localization coefficient) and are classified according to an evaluation scale that takes values from 0 (minimum) to 3 (maximum) stars [5, 8]. There is a threshold for each factor and a sector surpassing the threshold value for any of these indicators (Size, Concentration, Specialization) is given a star.

By applying the methodology proposed by the European Cluster Observatory – *three-star mapping*, several agglomerations[1] of 3, 2 and 1 stars were identified at the regional and rayon level.

The identification of agglomerations was carried out at the level of 5 development regions (NORTH, CENTER, SOUTH, ATU Gagauzia, Chisinau mun.), as well as at the rayon level, based on CAEM rev. 2 (Classification of Activities in the Moldovan Economy), by divisions and groups. For a more detailed analysis of the clustering potential of the industrial branches at the regions and districts level, we will refer to the identified industrial agglomerations, starting from CAEM by groups, which will allow us to specify those industrial activities within an industry, which are concentrated in certain regions or districts of the country.

The 3-star mapping process allowed the identification of 12 industrial agglomerations of 3-star, 5 of 2-star and 1 of one star) at district level, 20 agglomerations of one star in Chisinau mun. (in the manufacturing industry) and 2 agglomerations of 3 stars in the ATU Gagauzia. Table 1 shows the agglomerations identified in the industrial sectors and at the districts level, Chisinau mun. and ATU Gagauzia, based on CAEM by groups [8, 9].

[1] The paper uses the term agglomeration with the meaning of a geographic concentration of companies operating in identical or similar sectors in a given geographic space. It is important to avoid the confusion with the term "cluster", whereby we understand a geographical concentration of interconnected companies operating in a certain area and associated institutions (research institutions, universities, public authorities, financial institutions, etc.) characterized by synergies activity and complementarity.

Table 1

Distribution of 3, 2, 1-star agglomerations on districts level, Chisinau mun. and ATU Gagauzia and industrial sectors, according to CAEM rev.2 by groups[1]

Regions	Industry branches	Number of stars
Chisinau Mun.	C101 - Production, processing and preservation of meat and meat products	1 * (one star)
	C103 - Processing and preservation of fruits and vegetables	1 * (one star)
	C105 - Manufacture of dairy products	1 * (one star)
	C107 - Manufacture of bakery and pastry	1 * (one star)
	C108 - Manufacture of other food products	1 * (one star)
	C110 - Manufacture of beverages	1 * (one star)
	C141 - Manufacture of wearing apparel, except fur	1 * (one star)
	C151 - Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness; preparation and dyeing fur	1 * (one star)
	C152 - Manufacture of footwear	1 * (one star)
	C172 - Manufacture of paper and paperboard	1 * (one star)
	C181 - Printing and service activities related to printing	1 * (one star)
	C203 - Manufacture of paints, varnishes, printing ink and mastics	1 * (one star)
	C222 - Manufacture of plastic products	1 * (one star)
	C231 - Manufacture of glass and glass products	1 * (one star)
	C236 - Manufacture of articles of cement and plaster	1 * (one star)
	C251 - Manufacture of metal constructions	1 * (one star)
	C265 - Manufacture of measuring, testing and navigation; production of watches	1 * (one star)
	C281 - Manufacture of machinery and equipment for general use	1 * (one star)
	C310 - Manufacture of furniture	1 * (one star)
	C331 - Repair of fabricated metal products, machinery and equipment	1 * (one star)
North	C104 – Manufacture of vegetable and animal oil and fats – **Bălți mun.**	1 * (one star)
	C105 - Manufacture of dairy products – **Bălți mun.**	3***(three stars)
	C141 - Manufacture of wearing apparel, except fur – **Soroca district**	2** (two stars)
	C141 - Manufacture of wearing apparel, except fur – **Bălți mun.**	3***(three stars)
	C103 - Processing and preservation of fruits and vegetables – **Soroca district**	3***(three stars)
Center	C110 - Manufacture of beverages – **Ialoveni district**	2** (two stars)
	C107 - Manufacture of bakery and pastry – **Orhei districts**	2* (two stars)
	C101 - Production, processing and preservation of meat and meat products – **Anenii Noi, Criuleni districts**	3***(three stars)
	C139 - Manufacture of other textiles – **Ungheni district**	3***(three stars)
South	C110 - Manufacture of beverages – **Cantemir, Taraclia districts**	2**(two stars)
AT U Gagauzia	C110 - Manufacture of beverages	3***(three stars)
	C141 - Manufacture of wearing apparel, except fur	3***(three stars)

Source: Elaborated by the author [8, 9].

[1] ***Calculations were performed using data from 2014.***

Furthermore, we aimed to achieve a hierarchy of identified agglomerations at the development regions level and in the industrial sector. This exercise was possible by applying an algorithm based on [4] and adapted by the authors to the case of the Republic of Moldova. To achieve the proposed task, the three-stars industrial agglomerations were multiplied by multiplication factor 3, two stars – by multiplication factor 2 and one-star agglomerations – by multiplier factor 1 [4]. Thus, at the regional level, the following algorithm [9] was obtained:

$$\mathbf{3} \times \boldsymbol{Agl}_{\boldsymbol{R}}^{\mathbf{3}*} + \mathbf{2} \times \boldsymbol{Agl}_{\boldsymbol{R}}^{\mathbf{2}*} + \mathbf{1} \times \boldsymbol{Agl}_{\boldsymbol{R}}^{\mathbf{1}*},$$

where,

Agl_R^{3*} – the number of three-stars industrial agglomerations identified at the districts level within each development region[1]

Agl_R^{2*} – the number of two-stars industrial agglomerations identified at the districts level within each development region

Agl_R^{1*} – the number of one-star industrial agglomerations identified at the districts level within each development region.

Applying the above formula to perform a hierarchy at the regions level (based on the agglomerations identified at districts level), we have obtained the following data [9]:

North = 3*×3+2*×1+1*×1=12
Center = 3*×3+2*×2+1*×0=13
South = 3*×0+2*×2+1*×0=4
ATU Gagauzia = 3*×2+2*×0+1*×0 = 6
Chişinău Mun. = 3*×0+2*×0+1*×20 = 20

The scale in the table below can be used to graphically represent the hierarchy. The scale includes conventionally a range from 0 to 20, and is divided in subintervals: [0-3], [4-6], [7-9], [10-12], [13-15], [16-20] (table 2). The obtained values from the lowest to the highest ones are represented by colors.

Table 2

The intervals for the graphic representation of the agglomerations hierarchy at the regional level

The coefficient values for hierarchy	Description of the feature	Color
0-3	Lack of agglomerations in the region or an extremely low distribution	White
4-6	Very low distribution of agglomerations	Red shades from light to dark, the darker the shade is, the region indicates a Higher concentration of agglomerations
7-9	Low distributions of agglomerations	
10-12	Average distribution of agglomerations	
13-15	The distribution of agglomerations above average	
16-20	High concentration of agglomerations	

Source: Elaborated by the author [9].

For example, if the color shade is lighter, the distribution of industrial agglomerations of different stars is smaller, and a darker color shade shows a highest concentration of agglomerations.

Graphically, the industrial agglomerations are represented for each district by the star symbol (the representation size differs from one to three stars) (figure 1).

[1] The calculations were based on the number of the identified agglomerations at the districts level within each development region.

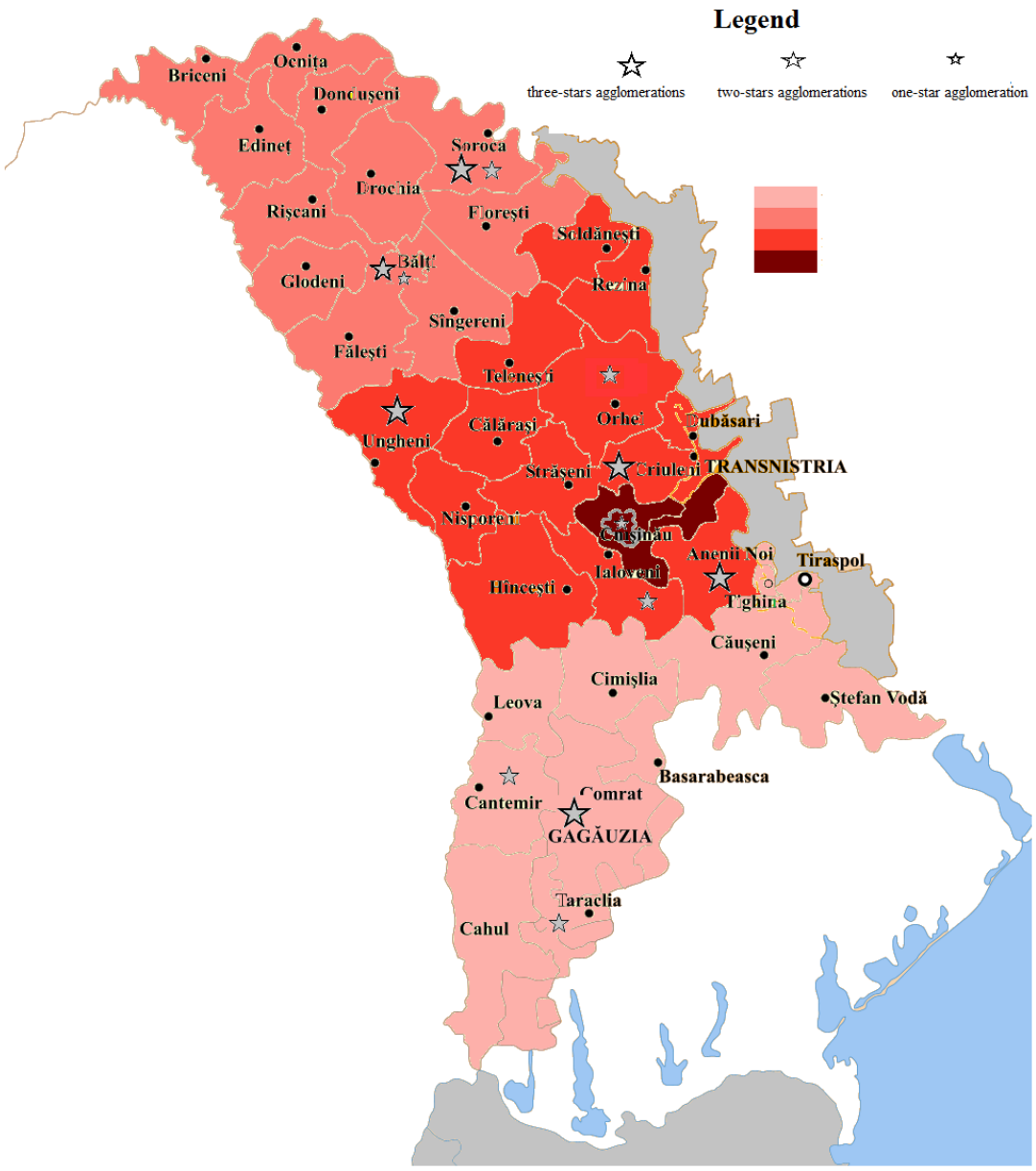

Figure 1. Graphical representation of the hierarchy of agglomerations at the regional level
Source: Elaborated by the author [9].

It is important to note that although there is a large concentration of industrial agglomerations in Chisinau, they have obtained only a star and can be considered as being of interest for potential cluster development. These sectors have earned 1 star because they exceed the 7% threshold (the number of employees in the analyzed industrial branch in the total number of employees in that branch at national level), but they cannot be classified as 3-stars agglomerations since they are no longer more than 2.5% of the number of employees employed in Chisinau municipality.

It is also important to note that although there are regions where an equal number of industrial agglomerations have been identified, due to the fact that some have obtained more agglomerations of 3 or 2 stars, by applying the algorithm, these regions will be represented as having a higher concentration of agglomerations.

Conclusions. Several conclusions emerge from the above analysis:

• Chisinau municipality is the region with the highest concentration of industrial agglomeration. However, it is important to note that all 20 agglomerations identified in Chisinau in the industrial sectors

obtained only one star, indicating that the industrial branches within this region have a high capacity to hire workforce. In Chisinau, the capital of Moldova, no agglomerations of 3 or 2 stars were identified, suggesting that the most economically developed region does not have a single dominant industrial sector, but possesses a diversified economic base. However, the identified agglomerations should not be ignored.

- According to the calculations, the Central region is the second one with a high level of concentration of identified agglomerations, obtaining 3 agglomerations of three-stars in the Anenii Noi and Criuleni districts in the sector of Production, processing and preservation of meat and meat products (C101) and the Ungheni district in the sector Manufacture of other textiles (C139). Also, two districts in the Central region obtained a two-stars agglomeration: Ialoveni district for the Manufacture of beverages sector (C110) and Orhei district for the Manufacture of bakery and pastry (C107) sector.
- In the districts from Northern region as in the Central region 5 industrial agglomerations have been identified, but due to the fact that they have obtained fewer agglomerations of two-stars, by applying the algorithm, the region was represented as having a lower concentration of agglomerations. In the Balti mun. and Soroca district a three-stars and a two-star agglomerations were identified in the Manufacture of wearing apparel, except fur (C141). Another 2 agglomerations of three-stars and one-star were also identified in Balti mun. in the Manufacture of dairy products sector (C105), respectively in the Manufacture of vegetable and animal oil and fats (C104). Another agglomeration of three-stars was identified in the Soroca districtin the Processing and preservation of fruits and vegetables (C103).
- ATU Gagauzia and the Southern region, according to the calculations, indicate a smaller distribution of industrial agglomerations of different stars. These two regions have a greater specialization in the Manufacture of beverages sectors. Thus, in the Southern region 2 agglomerations of two-stars in the Beverage manufacturing sector (C110) were identified in the Cantemir and Taraclia districts, and in the ATU Gagauzia 2 agglomerations of three-stars were identified, one in the Beverage Manufacturing sector and in the Manufacture of wearing apparel, except fur (C141) sector.

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