

# Clusters in Business: A Review of Successful International Models, Factors and Characteristics

Ramzi Alinsaoui\*, Adnan Shehadeh, Evangelos Beris, Panagiotis Kaldis

Department of Wine, Vine and Beverage Sciences, School of Food Sciences, University of West Attica, Egaleo, Greece

Email: \*ralinsawi@uniwa.gr

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## Abstract

Clusters are an important tool and a strategic choice used in the application of a horizontal policy to stimulate local economies and redefine the development model of a region or a country. The aim of the present review is to explore in depth the various models, analyses, characteristics, factors and properties of successful international clusters. Moreover, this article identifies the sources of competitive advantage, as well as factors and characteristics that determine the success of a collaborative innovation formation and provides insight into its evolution and development. The methodology used was literature review, research and criticism from both Greek and foreign literature. A broad sample of sixty (60) publications was selected as part of the survey. Subsequently, the selection of the sample was limited to thirty-six (36) publications that met specific criteria. After reviewing studies and research publications, each individual's data were analyzed, processed and compared with each other. Finally, results and conclusions were drawn.

## Keywords

Innovation Clusters, Clusters, Collaborative Innovation Formations, Competitive Advantage, Regional Strategic Networks

## 1. Introduction

Henry Ford had formulated the theory of Fordism stating that it is a system of great accumulation with mass consumption and monopolistic regulation, which prevailed in the West during the period 1945-1970. The theory of Fordism is based on the organization of labor by combining Taylorism (division and standardization of labor) and industrialization (the use of machines and machinery

in the production process), resulting in rapid increases in the apparent productivity of labor and fixed capital per capita (Lipietz, 1985). However, by the end of the 1960s, Fordism begins to bend, and its production methods begin to experience decreasing productivity growth in relation to increasing capital, resulting in lower capital efficiency (Lipietz, 1985).

Then, in the next industrial era following the Ford period, a new idea is born, it takes shape, and agglomeration economies are created. Thus, the model of large cities dominated by the activity of a single large company during the Ford period (for example FIAT automobile industry in Turin and Ford automobile industry in Detroit) gives way to various forms of agglomeration economies such as Clusters, Industrial Districts, Filières (fabrics), i.e. areas-systems, in which one encounters new forms of flexible production. Agglomeration economies are located in regions that offer the necessary labor force, as well as capital and social equipment infrastructures that are considered necessary and contribute to the reduction of unit costs (Andreosso & Jacobson, 2005).

In the early 90s, Michael Porter (professor in Princeton & Harvard Business School and Advisor to US President Ronald Reagan on industrial competition issues) presented for the first time the concept of Collaborative Innovation Formations—Innovation Clusters. Porter in his book entitled “The Competitive Advantage of Nations” (Porter, 1990b), described clusters as the driving force of the new competitiveness after the Ford economy. As such, it is considered a comprehensive form of cooperation with benefits for all cooperating businesses. Clusters consist of companies operating in the same branch of activity (horizontal clusters) or in different branches of the production process, i.e. in the same supply chain (vertical clusters). These companies are called either “partner companies” or “core companies”, while associations of industries and professional chambers, technological institutes, research institutes and universities, government organizations, financial institutions, etc.—which provide services of a horizontal nature to partners (of the innovation cluster)—are called “supporting companies and agencies”. The clusters exist in many forms, for example at local, hyper local, national but also international level and they may be developed in an urban or rural environment. They can be networks of businesses and cooperatives that cooperate with each other either to reduce the average cost of procurement, production and distribution of specific products or to aim for better promotion of their products to the local markets. Moreover, they can be informal, where the cooperation is not structured through a cooperation protocol with certain tasks and obligations of each partner, or they can be formal (institutionalized), where a protocol and all actions are subject to common goals and mutual benefits. One of the important goals of innovation clusters is bridging the gap between supply and demand of specialized innovation services and technology transfer in one or more value chains (Porter, 1990a).

The research on clusters started from the end of the 19th century and through many researchers, it reaches the current level. Marshall (1890) and Krugman

(1991) described clusters as an agglomeration of firms that constitute spontaneous economic phenomena. Alfred Marshall then uses the term “Industrial Districts” for the first time to describe an economic phenomenon he observes whereby small firms in the same industry achieve economies of external scale to the firm through geographic proximity to other businesses. He also points out that industrial districts provide a skilled workforce, facilitate the development of inputs and services, and help businesses capitalize on the spillover of knowledge and technologies. With this definition, Marshall simply described the geographic coexistence of businesses with a fairly static image.

The clusters have gone through different stages of transformation and now are specializing according to subject area, for example (Information and Communication Technology ICT, the type and size of businesses (SMEs), as well as the area in which they operate (in proximity to urban centers) (Porter, 1990a).

Nowadays, sustainable development is crucial for companies because it not only mitigates environmental and social risks but also fosters long-term resilience, competitiveness, and stakeholder trust in a rapidly evolving global market (Ntanos et al., 2018; Skordoulis et al., 2020; Skordoulis et al., 2022; Lampropoulos et al., 2024). Clusters play a pivotal role in advancing sustainable development by fostering collaboration, innovation, and responsible practices among businesses within a specific geographic area or industry. By bringing together companies, research institutions, and other stakeholders, clusters create opportunities for knowledge exchange, technology transfer, and joint initiatives aimed at addressing environmental and social challenges. Through shared resources, infrastructure, and expertise, clusters enable businesses to improve resource efficiency, adopt sustainable technologies, and reduce their environmental footprint. Furthermore, clusters contribute to economic growth and job creation, particularly in sectors aligned with sustainability goals, while also advocating for supportive policies and engaging with local communities to promote social and environmental well-being. Thus, it can be stated that clusters serve as catalysts for driving holistic and systemic changes towards a more sustainable future.

Another important aspect of clusters is their interrelation with corporate governance. The importance of corporate governance within clusters lies in ensuring transparency, accountability, and ethical conduct among member companies, which are essential for fostering trust and sustainability within the cluster ecosystem (Kalantonis et al., 2019; Kalantonis et al., 2021a; Kalantonis et al., 2021b; Kalantonis et al., 2022). Effective corporate governance mechanisms within clusters facilitate collaboration, mitigate conflicts of interest, and promote responsible business practices, ultimately contributing to the long-term success and resilience of the cluster as a whole.

The aim of this paper is to investigate the various models, analyses, characteristics, factors and properties of successful international clusters. Thus, the paper will contribute to the existing knowledge by providing new evidence and information related to the meaning, identity, specifications and characteristics of

successful clusters. Finally, it sheds light on the stages of formation and transformation that successful clusters can go through, until they can reach specialization according to the thematic field on which they are built.

## 2. The Main Approaches on the Formation of Collaborative Innovation Clusters

According to global experience, there are two main approaches on the formation of collaborative innovation clusters:

1) The classic liberal (Anglo-Saxon) approach proposed in the 80s - 90s by Porter (1990b) that was based on the self-organization of economic factors in the mechanisms of the “free market”. The use of such mechanisms does not imply direct government intervention and/or support.

2) The modern European approach, called “poles of competitiveness”, developed since 2006 in France and based on cooperation between businesses, central and local authorities. The state is interested in the global competitiveness of its economy and in achieving a world-class “pole of competitiveness”, resulting in the provision of various forms of state support.

## 3. The Basic Scientific Approaches of the Cluster Theory

There are three main scientific approaches on the Cluster theory: American, British, and Scandinavian (Bashynska et al., 2022).

The American approach is presented by the theoretical and conceptual studies of American scientists. The theory of industrial clusters, proposed and formulated by M. Porter, reveals the concept of “cluster” introduced into economic turnover by M. Porter himself, and interpreted it as a group of geographically adjacent interconnected companies and related organizations operating in a specific area and characterized by common activities and complementary to each other. Thus, the size of cluster structures may vary from one city to several corresponding countries.

The British approach is about building new forms of spatial organization of the production process. It is based on three main schemes for the inclusion of cooperative formations in the process of increasing the added value of goods and services:

1) The creation of a quasi-hierarchical chain with the inclusion of a cluster, which creates economically viable conditions and benefits for innovation in production, technological process and product production.

2) The inclusion of cooperative formations in the production chain and economic relations in the regional (local) market.

3) The inclusion of cooperative formations in business networks, which leads to the improvement of production and technological processes, resulting in the release of competitive products.

The Scandinavian approach of regional cooperative formations focuses on the development of the theory of economics of learning and the national system of

innovations, based on the creation of innovations and new knowledge, which is considered the most effective means of increasing the level of competitiveness of economic entities-cooperative formations.

#### **4. Definition and Conceptual Approach**

According to Porter (1998), innovation clusters are geographic concentrations of interconnected businesses and organizations in a specific field. They are business formations, usually in the form of public-private partnerships, that promote innovation and competitiveness with the aim of increasing productivity. They are forms of cooperation between businesses and other bodies (chambers, research institutions, universities, professional associations, government bodies, NGOs). Innovation clusters, aim to bridge the gap between supply and demand of specialized innovation and technology transfer services in one or more value chains and to improve availability and promotion of products in local or international markets as well as competitiveness. M. Porter laid the foundations for the Cluster theory in 1990(b) through his book “The Competitive Advantage of Nations”. Then many authors tried to study the subject, giving an economic, social, business and geographical definition and dimension to the clusters. However, each country has identified its own set of successful practices and characteristics for implementing elements of the clustering policy, taking into account national characteristics.

#### **5. Methodology**

The methodology used was literature review, research and criticism from both Greek and foreign literature. A wide sample of sixty (60) publications was selected as part of the research. Subsequently, the selection of the sample was limited to thirty-six (36) publications that met the following criteria: 1) definition 2) characteristics 3) models 4) advantages and disadvantages 5) composition 6) categories 7) sources of funding and 8) consequences of clusters. These publications have targeted methodology in more explanatory terms. Also, they were selected based on year of publication ranging from 2006 to 2022. Thus, we can have a complete picture in terms of developments and transformations of the clusters and their effects on the progress and development of the economies. Therefore, it was considered necessary and particularly important that the research concerning the criteria we chose should be extended as much as possible over a longer period of time. After reviewing the studies and research publications, each individual’s data was analyzed, processed and compared with each other. Then, results and conclusions were drawn.

#### **6. Research Review**

The presentation of the research studies was based on chronological publication, from the oldest to the most recent, in order to present the evolution and upgrade in the transformation process of cluster characteristics over time. Scientific re-

search in the field of clusters was focused on the following directions:

- 1) Clusters in the field of agri-food products (dairy, agri-food, wine).
- 2) Various domains of Clusters.

### 6.1. Clusters in the Field of Agri-Food Products (Dairy, Agri-Food, Wine)

In the field of agri-food products, there have been several studies concerning Clusters. *Aylward & Glynn (2006)* in their research and using empirical data from the Australian wine industry, try to demonstrate that levels of innovation and activity intensify as an industry cluster develops. The research was carried out in the form of individual telephone interviews. A total of one hundred interviews were conducted and a stratified, randomized method was used. The survey included 50 respondents from one innovative cluster (the South Australian wine industry) and another 50 split between two substantially less developed clusters (New South Wales and Victoria). David Aylward and John Glynn conclude that the main sources of competitive advantage are export intensity, product differentiation, branding, marketing innovation and technical innovation. They also argue that growth within a cluster requires the emergence of growth in both markets (export-domestic markets). Finally, they state that development is a key aspect of wine clusters and the more developed a cluster is, the more sustainable the development becomes.

*Beckeman & Skjoldebrand (2006)* tried in their study to describe the most important innovations and changes since 1945 in Sweden in the food sector, to analyze the significance of the innovation, how it was introduced and how it developed to gain acceptance. It is qualitative research based on open-ended interviews with food experts and analysis of society according to Porter's diamond factors. Marit Beckeman and Christina Skjoldebrand conclude that frozen food was the biggest innovation after 1945 in Sweden. No major new food innovations have been introduced, except for chilled products in the 1980s. Additionally, they point out that the Frozen Food Institute had ties to the government and through laws and regulations tried to ensure that quality could be imposed.

*Mueller et al. (2006)* tried in their research to answer three questions:

- What is the conceptual contribution of Porter's cluster perspective and what does the perspective offer that alternative approaches do not have in the study of local economic activity?
- What does the cluster perspective offer to understanding the competitiveness and organization of the California wine industry?
- What are the implications of Porter's Cluster perspective for policy making and collective action?

Researchers answering the questions agree that: first, agglomeration can help some industries and firms prosper in part because they are close to other firms and industries that are prosperous and grow as a result. Second, geographic proximity enhances the flow of information and the success of adaptation. Al-

though the study of [Giuliani & Bell \(2005\)](#) suggests that the cluster approach is of limited use when an industry with severely limited location choices is highly dependent on specialized human capital and innovation. Third, participation in information networks is often critical to competitive success and an example is the California wine industry which notes that in some cases information networks and the adoption and adaptation of innovations have been an important feature of business and industry success and development. Fourth, clusters are entities between settlements and networks.

[Ketels & Memedovic \(2008\)](#) in his study summarizes the cluster concept, focusing on the main theoretical framework but also the empirical findings. It also examines the key pillars of a cluster-based economic policy approach. In conclusion, Christian H. M. Ketels states that: first, the empirical data available in recent years confirm the strong relationship between clusters and economic performance. Second, clusters have the potential to improve the effectiveness of economic policy tools and increase economic benefits from existing ones. Third, one of the characteristics of a cluster-based approach to economic development is its concern for the specific conditions prevailing in a location or country. Fourth, resource-rich economies are an interesting case, where the need to diversify into new clusters is high, but the barriers to success are significant. Fifth, strong clusters benefit from strong external ties and have the ability to exploit them.

[Boja \(2011\)](#) dealt in his research with the importance and advantages of clusters, but also the complexity of the clusters model mainly due to its complex determinants. In conclusion, Catalin Boja argues that: First, economic development based on cluster models, represents a policy that is adopted by many economies and can bring multiple benefits to regional development and competitiveness in an industry. It can also create an economic environment that will more easily adapt to events such as financial crises or other economic and social transformations. Second, the recognition of the advantages of clusters as a form of economic organization, according to [Sölvell et al. \(2003\)](#), has influenced governments to implement policies aimed at taking initiatives to support existing clusters or to form new ones regarding:

- Small and Medium Enterprises (SMEs);
- Regional industrial development;
- Attracting external funds and foreign investors;
- Research and innovation at national or local level.

Third, although existing analysis of clusters emphasizes their advantages, the interconnectedness of factors and their effect on the cluster, economic theory has not yet provided a model that allows both the analysis and the definition of a process for implementing a successful cluster.

Also, [Dries et al. \(2012\)](#) explore in their study the innovation process in the Hungarian agri-food sector using data from a 2011 survey of more than 200 agricultural producers, food processors and food retailers. It should be noted



that only the media have been included. As a result of the study, the researchers argue that access to knowledge transfers through an open network has a positive effect on innovation performance, and innovative performance is increasingly recognized as a key determinant of competitiveness. Absorptive capacity of a firm in turn positively affects its innovation probability, highlighting the substitution evidence between openness and absorptive capacity.

The study conducted by Felzensztein et al. (2012) focuses on the perceived role of clusters in inter-firm Cooperation and social networks, by comparing clustered and non-clustered resource-based industries. The conclusions of the study support that: First, managers belonging to clusters tend to perceive more benefits and opportunities for inter-firm cooperation in marketing activities. Second, there are significant differences in business-to-business collaboration and social networking between clustered and unclustered industries. Third, clustering seems to provide positive and better interaction between firms, since it is followed by cooperation. Fourth, in order to improve the strategic position of enterprises, social networks should be exploited to achieve cooperation between enterprises in the field of marketing. Fifth, the creation of new trade associations representing SMEs allows for greater social and informal interaction between businesses, enhancing the potential for further collaboration between businesses.

Another study is that of Abrhám (2014) in which he tries to identify the clusters that exist in the field of tourism, agriculture and food in the Visegrad group (Czech Republic, Hungary, Poland and Slovakia) and analyze the regional their dispersion, structure and activities. The research uses the methodology of the European Secretariat for Cluster Analysis, which is based on the principle of comparative evaluation. The conclusions of the study support that the economy and price levels of the countries of the Visegrad group are gradually converging to the average in the European Union, which radically changes its competitive position in the international environment. In addition, the economies of the Visegrad countries will not be able to succeed through price alone but will have to develop those aspects of competitiveness that lead to the production of unique goods and services based on a high degree of know-how and innovation. Finally, the development of clusters in the countries that participated in the research is quite diverse.

The empirical research of Mazur et al. (2016) aims to study the main characteristics of the cluster policy in the Russian Federation and to determine the positive and negative effects of this policy on the innovative potential formation of the domestic economy. The research variables are: First, the degree of innovative activity determined on the basis of indicators of the level of R&D expenditure and the number of patents granted. Second, the degree of continuous improvement of competitive advantage due to different types of innovations as follows: technological, organizational and marketing. Third, the degree of participation of the scientific and educational community in the activities of a company that



leads to innovation. In conclusion, Vladimir V. Mazur et al., argue that first, if there are innovative clusters in a region or country, the content of economic policy changes when efforts are not directed towards supporting individual businesses, but towards the development of a successful system of relations between active participants in the economy and state institutions. Second, economic policy must be directed towards competitive advantage through the development of innovation clusters as an effective implementation mechanism. Third, an innovation cluster is a dynamic system that provides self-development based on the performance of the synergistic effect.

Todorova (2017) states in her research that the long-term economic development of any country presupposes the development of competitiveness in both traditional and new knowledge-intensive sectors, a breakthrough in improving the quality of human capital and labor productivity and transforming innovative factors into a main source of economic growth. The relationship between the clustering processes, the strengthening of competitiveness and the acceleration of innovative activity is a new economic phenomenon that allows resistance to the onslaught of global competition and a proper response to the demands of national and regional development. In this study, the methods of statistical analysis are used and the results show this accumulation of potential that have such branches of agriculture as cereal production, fruit growing and various types of nuts, followed by oilseeds, production of vegetable and animal fats. Liudmila Todorova concludes in her research that the interest of the state should be turned to the creation of sustainable and rapid development of the clustering of industries and regions, since it now has a more supervisory position. However, when implementing cluster development policy, it should be considered separately from the regional development process. These procedures should be complementary, not substitutes. It is necessary to develop and adopt for the implementation of the regulatory framework, the effective development of clusters based on good practices in the European Union.

Another research is that of Sozinova et al. (2017) which focuses on the successful development of an industry and innovation cluster. As a theoretical and methodological basis of the research, Russian and foreign monographs, scientific articles, experts in the field of business management, production complexes and clusters of various types were used. During the research as a complex of methods, dialectical, systematic and logical studies were applied in terms of analysis and synthesis. The conclusions of the researchers are summarized in the following points: first, the formation of industrial innovation clusters is carried out in the context of a pyramidal hierarchy of competitive strategies of the region, which shows the examples of relations of the regional economy and the stages of development of competitive potential and methods of ensuring competitiveness. Second, industrial innovative clusters can provide the greatest stability of the regional economy and the realization of its competitive advantages through synergy in product production, operational management, financial investment ac-

tivities and management.

Then, [Paraušić et al. \(2018\)](#) defined in their research paper the linear correlation between cluster development and national innovation potential, which means that countries in which well-developed clusters are located are simultaneously countries that have high national innovation potential and vice versa. The source of the data that the authors analyze in their paper is the World Economic Forum's Competitiveness Report 2017-2018. The World Economic Forum (WEF) is an independent international organization that annually publishes the "Global Competitiveness Report" in which it assesses and ranks countries around the world according to their national competitiveness. The conclusions of the research paper are summarized in: First, innovation and emerging technologies have enormous potential to be a source of growth, but their future development is uncertain. Second, job losses are expected in the coming years as technology transforms manufacturing and services, raising questions about how quickly new jobs will be created and about the future of economic growth models based on the export of labor-intensive manufacturing products. Third, strong and extensive cooperation between universities, scientific institutions and economic entities in research and development activities is very important. The collaboration is directly linked to the application of knowledge in practice, while it leads to the adaptation of basic, applied and experimental research to an appropriate expenditure of budgetary resources intended for innovations.

Subsequently, [Muraru-Ionel et al. \(2019\)](#) reported in their research that clusters play an important role in promoting competitiveness, innovation and job creation in the EU. The Agri-Food sector in Romania had fluctuating developments in the post-accession period, mainly due to the need to comply and align with EU requirements. In addition, in the future clusters must be oriented towards the creation of smart value chains, international collaborations and cross-sectoral partnerships. This research paper proposes a model as a tool to make agro-food clusters smart, as well as provide insights into the most important steps in their creation and development. The methodology used is based on the analysis and synthesis of information on the economic and social aspects of the development of the agri-food sector and clusters in Romania. The analysis of the research results showed that smart agro-food clusters bring significant benefits to economic development and the correct application of the concept of smart specialization. The model proposed to make agri-food clusters smart is designed in the context of the digitization process of agriculture and the agri-food industry.

Later, [Stepanova \(2019\)](#) presented in her study a system for assessing the level of development of the innovation potential of clusters in Russia and the formation of a complex system of interacting elements of an innovation environment that provides the development of innovation of a socio-economic system in the interest of society and the individual. E. V. Stepanova argues in her study (as conclusions), the following: First, the main conditions for the emergence of an

innovation environment are the availability of social connections and networks for the exchange of ideas and information. Second, to ensure the effective operation of a collaborative innovation formation, an information infrastructure is required. Third, to evaluate the level of formation of a cooperative formation, the following key indicators of dynamic innovation are required: 1) Number of employees of the participating organizations. 2) The high-performance jobs created or as a result of the modernization of existing jobs. 3) The average production per employee in organizations participating in the cluster. Fourth, the integration of environmental conditions provides a unique perspective on cluster performance.

Sinyavsky & Tereshchenko (2019) reported in their research that in innovation formations (Innovation clusters), the close relationship between science and production reduces the time of introduction of scientific innovative technologies and contributes to the rapid resolution of not only economic issues, but also in meeting market demand with the aim of satisfying consumer needs. They also state that the cluster model with the organization of innovative activities leads to the creation of an innovative joint activity product and allows the acceleration of its spread, not only domestically but also internationally. In conclusion, the above researchers argue that: first, the creation of innovative clusters, combining science and production, for the first time gave Kazakhstan the opportunity to introduce scientific developments and organize the industrial production of children's and specialized food products, as well as mass products dietary orientation consumption with national content. Second, the management of food industry enterprises based on the cluster approach is a real and necessary process aimed at improving the competitiveness of enterprises in this sector and moving to a new quality level, including international ones, with the simultaneous development of the national economy and profit maximization. Third, the creation and efficient operation of food industry enterprises, based on the cluster approach, presupposes the existence of a modern high-tech industrial zone for placing agricultural and manufacturing production in cluster infrastructures. The goal is to achieve competitive and modern production, not only for the internal but also for the external market.

The research of Turkina et al. (2019) aims to highlight how business innovation is affected by the location in a collaborative innovation formation (Innovation cluster) and how the interaction of the characteristics of the business and the cluster matters. It is an empirical analysis of the innovation performance of firms in regional collaborative innovation formations. In conclusion, Ekaterina Turkina et al. argue that: first, an important issue in regional studies is the strategic objectives of firms regarding their position in regional cooperative formations and the effects of this on their innovation performance. Second, a firm's closeness centrality, which reflects the degree of cooperation, appears to have a positive effect on innovation performance. Third, for the positive effects on innovation to exist, partnerships must be with high-performing industry peers.

The significant positive effects of being connected to research institutes and universities suggest that they are an important external source for business innovation. Fourth, an important element is the relationships between firm innovation performance and cluster size, scope and specialization. Fifth, smaller firms actually exhibit higher innovation performance in new collaborative formations than larger firms, while larger firms benefit more from mature collaborative formations. Sixth, the location of clusters offers benefits and at the same time poses some limitations.

Bashynska et al. (2022) studied the conditions for development of the concept of smart agri-food cooperative formations based on the education-science-production chain for sustainable development and its financial support. The research was based on the theoretical and methodological analysis and emphasis is placed on the following: 1) In the definition of the concept of cluster and grouping, 2) In the analysis of scientific approaches to the theory of clusters, 3) In the analysis of the relevance of the research object in modern Ukrainian reality, 4) In the development of the concept of creating a conceptual basis for the creation of a smart cluster, 5) In the development of clusters for financial regulation with the aim of creating cooperative formations. Iryna Bashynska et al. conclude that: First, the development trends of clustering indicate the relevance and success of this concept in practical experience in many countries. Although a single concept for creating mechanisms (clustering) has not yet been developed, nevertheless each country has identified its own set of successful practices for the implementation of policy elements for cooperative formations considering national characteristics. Second, the approach of cooperative formations (clusters) has evolved into a key tool for the formulation and implementation of economic development policy in several countries, as they have become one of the main driving forces and determining factors of competitiveness, its effectiveness which has been confirmed from global experience. Third, the creation of a cluster increases the efficiency of the work as a whole compared to the efficiency of the individuals involved and the mutual reinforcement of competing positions. Fourth, the main expected results of the development of the intelligent cooperative formation are as follows:

- The increase in the competitiveness of business entities due to the increase in production volume, the share of innovative products and labor productivity in enterprises participating in cooperative formations.
- The increase in exports of resource-free goods and high-tech goods.
- The development of individual entrepreneurship and the increase in the number of small and medium enterprises.
- The increase in the localization rate of the production of competitive products.
- The increase in attracted domestic and foreign direct investments.

The analysis and study of all results and conclusions of previous research and studies leads us to some observations. Firstly, From the study of [Abrhám \(2014\)](#),

the research by [Muraru-Ionel et al. \(2019\)](#) and the research of [Bashynska et al. \(2022\)](#), it is shown that although to date a single concept for the creation of clustering mechanisms has not been developed, nevertheless each country has identified its own set of successful practices for the implementation of policy elements for cooperative formations taking into account national characteristics for the approach of cooperative formations (clusters). Thus, the clusters have evolved into a key tool for the formulation and implementation of the economic development policy of the regions and the economy as a whole in several countries, and this, because they have become one of the main driving forces and determining factors of the competitiveness and efficiency which has been confirmed by world experience. Consequently, smart agri-food clusters bring significant benefits to economic development and the proper application of the concept of smart specialization. The development of clusters in the countries that participated in the research is quite diverse. The economies of the Visegrad countries will not be able to succeed through price alone, but will have to develop those aspects of competitiveness that lead to the production of unique goods and services based on a high degree of know-how and innovation. [Ketels & Memedovic \(2008\)](#) argues that clusters have the potential to improve the effectiveness of economic policy tools and increase economic benefits from existing ones. Also, [Muraru-Ionel et al. \(2019\)](#) report in their research that clusters play an important role in promoting competitiveness, innovation and job creation in the EU. The model proposed to make agri-food clusters smart is designed in the context of the digitization process of agriculture and agri-food industry. Based on the research of [Todorova \(2017\)](#), the role of the clustering process is highlighted, on the one hand, as a tool for strengthening competitiveness and accelerating the development of economic activity, and on the other hand, as a new economic tool that allows resistance to the onslaught of global competition and the correct responding to the demands of national and regional development. [Felzensztein et al. \(2012\)](#) argue that there are significant differences in inter-firm collaboration and social networking between clustered and unclustered industries. Just as clustering seems to provide positive and better interaction between businesses, since it is followed by collaboration.

Secondly, [Aylward & Glynn \(2006\)](#) argue in their research that the main sources of competitive advantage are export intensity, product differentiation, branding and the adoption and adaptation of innovation (marketing innovation—technical innovation). Researchers [Mueller et al. \(2006\)](#) conclude in their research that in some cases information networks and the adoption and adaptation of innovations are an important characteristic of business and industry success and development. Similarly, [Dries et al. \(2012\)](#) argue that access to knowledge transfers through an open network has a positive effect on innovation performance, and innovative performance is increasingly recognized as a key determinant of competitiveness. Additionally, [Abraham \(2014\)](#) points out in his study that the economies of the Visegrad countries will not be able to succeed through price alone

but will have to develop those aspects of competitiveness that lead to the production of unique goods and services based onto a high degree of know-how and innovation. Mazur et al. (2016) argue that first, if there are innovative clusters in a region or country, the content of economic policy changes when efforts are not directed towards supporting individual businesses, but towards the development of a successful system of relations between active participants in the economy and state institutions. Second, economic policy must be directed towards competitive advantage through the development of innovation clusters as an effective implementation mechanism. Third, an innovation cluster is a dynamic system that provides self-development based on the performance of the synergistic effect. Sozinova et al. (2017) argue in their research that industrial innovative clusters can provide the greatest stability of the regional economy and the realization of its competitive advantages through synergy in product production, operational management, financial investment activities and management. Also, the formation of industrial innovation clusters is carried out in the context of a pyramidal hierarchy of competitive strategies of the region, which shows the examples of relations of the regional economy and the stages of development of competitive potential and methods of ensuring competitiveness.

Thirdly, Abrhám (2014) argues as a conclusion of his study that the development of clusters in the countries that participated in the research is quite diverse.

Fourthly, Mueller et al. (2006) point out in their research that: first, agglomeration can help some industries and firms prosper in part because they are close to other firms and industries that are prosperous and as a result grow. Second, geographic proximity enhances the flow of information and the success of adaptation. Third, participation in information networks is often critical to competitive success and an example is the wine industry in California where it is noted that in some cases information networks and the adoption and adaptation of innovations have been an important feature of business success and development and industry. Fourth, clusters are entities between settlements and networks. Turkina et al. (2019) argue in their research that: first, the closeness centrality of a firm which reflects the degree of collaboration seems to have a positive effect on innovation performance. Second, smaller firms actually show higher innovation performance in new cooperative formations than larger firms, while larger firms benefit more from mature cooperative formations. Third, the location of clusters offers benefits and at the same time poses some limitations.

## 6.2. Various Domains of Clusters

There have been several studies that have attempted to shed light on the various types of cluster models. Fundeanua and Badele (2014) who in their study attempt to define the cluster models based on the “triple helix” and the theories of competitive advantage, to identify the institutionalized clusters in the Oltenia region and to highlight their impact on the economic and social development of the area (how businesses can gain a competitive advantage by participating in an

innovative cluster that offers significant benefits to its members). The analysis of the results of the study revealed the following conclusions: First, clusters are geographical concentrations of companies, universities, research institutions, regional or local authorities interconnected in relationships that allow work dynamics, specialization and the exchange of information between the companies that benefit from local innovation capabilities according to the triple helix model. Second, clusters can have an economic and social impact on competitiveness and innovation. Third, the development of innovative clusters will lead to the creation of new jobs in specialization and the increase of income in the area of development. Fourth, an approach to open innovation is based on the interactions between university research on entrepreneurship dynamics, the availability of venture capital provided by the private sector and the policy support framework provided by public administration.

Scutaru (2016), analyzes two models of successful clusters at an international level, namely the French model of competitiveness poles and the American model of innovative clusters. It is empirical research of comparative analysis of the main characteristics of these two cluster models, highlighting the factors that contribute to their success at the international level (aspects that are part of the competitiveness policy supported by the respective states). Liliana Scutaru argues in her research that: first, cluster-based economic development is a new model of development through micro-economic policies that expand widely, because clusters represent the engines of regional development and the economy as a whole. Second, clusters can contribute to the creation of a new vision regarding state economic policy, helping to strengthen the relationships between the state, the private sector, the academic environment and all stakeholders interested in the smooth functioning of the economy. Third, the French poles of competitiveness meet all the characteristics of a world-class innovation cluster, promoting research, development and high technologies par excellence. Whereas the American clusters are distinct identities characterized by a series of factors and characteristics that differ from each other, therefore, one cannot speak of a replicable American cluster model. Fourth, one of the determining factors of a successful cluster consists of massive capital investments made in any legal form. Overall, the main success factors of the two models based on research are:

The success factors of the French cluster are:

- Strong financial support from the state to which is added a wide range of other funds.
- The existence in their composition of certain internationally prestigious universities.
- Great international visibility due to the universities in their structure.
- Specialization in the fields of high technologies.
- Research laboratories that exist both in universities and research institutions and in the private sector.
- Attracting financing in the form of FDI.



- Low labor force mobility.
- Adaptation to market requirements by implementing human capital retraining programs.

The success factors of the American cluster are:

- Great thematic diversification and specialization in high-tech sectors.
- Cooperation with some prestigious international universities.
- Multiple research laboratories, both in universities and in the private sector.
- Great international exposure due to universities and research laboratories.
- International promotion to attract financing in the form of FDI (Foreign Direct Investment).
- Having a skilled and highly skilled workforce.
- Adaptation to market requirements by implementing readjustment programs for human capital.
- A very efficient funding system through strong support from the state and a very wide range of funds to continuously finance innovation.
- High concentration of companies at regional level.
- Continuous innovation, technology transfer and innovation implementation in the market.
- The existence of some business networks and some internal social networks based on the spirit of cooperation and dissemination of information between researchers and between companies in the cluster.
- A strong entrepreneurial spirit that develops on an ongoing basis.
- High labor mobility and permanent attraction of brains.

Moreover, [Napolskikh et al. \(2019\)](#) examine the characteristics and contradictions in the development of clusters and the main types of innovation clusters as the main form of integration of high-tech industries at the regional level and throughout the territory. The analysis of the results of the study revealed that the development of theoretical and methodological approaches for the spatial modeling of the innovation cluster is based on its examination as a complex meso economic system with a specific structure of the organizational hierarchy and horizontal network interactions, as well as their own mechanisms. In addition, companies that are members of an innovation cluster can compete effectively in global technology and innovative markets only if the clustering processes of the economic system are provided with appropriate theoretical and methodological support.

[Borkova et al. \(2019\)](#) attempt in their study to analyze: first, the Russian experience in implementing programs for the development of pilot regional innovation clusters and formulates indications of their sustainability. Second, best practices for the implementation of state cluster policy in individual countries. The researchers report that global experience conventionally identifies six cluster formation models: 1) many small businesses coming together. The model applies to low-end, technological-level products with a high degree of differentiation and fluctuations in demand (High-tech products in Pisa-Tuscany, Italy). 2) The

formation of MMEs around a leading company with large-scale production integrating a set of suppliers at various stages of the chain. The model is applicable for the production of technologically complex products. Product development requires high fixed costs that can only pay off with high sales volume (Toyota Motor Company—telecommunications, residential construction, environmental safety and the production of medical equipment—the Sapporo Scientific Research University in Hokkaido—bioinformatics, robotics, bio-production, nanomaterials, clean energy in Kitakyushu, Japan). 3) A model characterized by a high level of innovation and supported by a strong R&D sector and an advanced education system. The model is applicable to small compact countries relatively scarce in natural resources and export oriented. 4) The model in which there is intense competition between businesses. It applies when the production process does not involve the creation of close relationships (USA Silicon Valley (California)—aerospace engineering, information technology Seattle, Tacoma, Olympia (Wash.)—medical equipment Minneapolis (Minnesota), Jacksonville (Florida)—“clean” energy technologies Pittsburgh, Akron, Cleveland (Ohio and Pennsylvania)—Kansas City (Kansas) Biotechnology and Modern Chemistry 5) The model in which the state plays a key role. The focus is on foreign investment bringing modern technology and providing access to global markets: Innovative clusters (Promoting Innovative Clusters, PIC)—pharmaceutical clusters in Ahmedabad (Vadorara) and Hyderabad—computer software products (Chengdu, Sichuan province)—stamping production (city of Huangyan, Zhejiang Province), India-China. 6) The model where market and competition relations are kept to a minimum. Production is concentrated in large enterprises. The model is applied to the primary sectors of areas with low population density and poor development (Kursk Magnetic Anomaly KMA - South-Yakutsk TPK - West Yakut TPK), Union of Soviet Socialist Republics.

The analysis of the results of the study revealed the following conclusions: first, the formation of a cluster and its prospects depend on many factors, and without state support the cluster will not be able to reach the desired trajectory. Second, effective management of the concept of smart specialization is implemented through strategic planning and forecasting of future opportunities. On the one hand, it is necessary to identify the unique competitive advantages of the region and on the other, to create a clear plan of action within this strategy. The implemented policy instruments should fully comply with the development of defined priorities. Third, it is considered very important to build a system of relations between entrepreneurs and government agencies, as they could coordinate the decisions they make and empower businesses to independently determine their capabilities.

Another research is that of [Khomenko et al. \(2021\)](#). It is an empirical research that studies the concept of regional energy clusters' policy as an effective tool for managing systemic incentives for complex, integrated, social, environmental and economic development of regions. But also, for the formation of the future

energy cluster model in Ukraine with its special characteristics, development prospects, advanced approaches for its creation. The researchers agree in their study that solving the problems requires an overall vision and systematic support of reforms, development capacity for change, integrated actions of government and business, targeted provision of resources, knowledge in energy management and implementation of business planning. Additionally, in the conceptual vision of the future cluster or model of efficient development of an innovative cluster energy area, the realities of change emerge. Finally, the development and implementation of the concept of energy cluster policy should be recognized as a real tool for the further shaping of innovation-oriented regional policy in the form of working groups. That is, feasible and sequential actions involving resources and human capital and potential opportunities.

In the field of technologies, applications and innovation in clusters, several research and studies were carried out that tried to highlight the positives from the implementation (application) of clusters in this area. One such research is that of [Zemtsov et al. \(2015\)](#) whose objective moves in two directions: one is to identify clusters as areas of geographical concentration of small and medium-sized enterprises (SMEs) in the high-tech sector, and the other is to try to check whether existing cluster initiatives comply with the concentration of high-tech SMEs and whether there is a possibility for new initiatives of cooperative formations. The research uses a modified methodology based on the localization index and the data is mainly collected from RUSLANA which is a database, that contains information about Russian companies. The analysis of the research results led to the following conclusions: First, the research and classification of the clusters is done based on their level of development. Second, high-tech industries are mainly concentrated in the regions with the largest settlements, because the largest cities and closed scientific cities are the main sources of new technologies in Russia.

The study by [Babkin et al. \(2020\)](#), aims to define the essence and characteristics of digital platforms of industrial enterprises and clusters and to justify their components and structure. The study uses a generalization method that allows the identification of important characteristics of digital platforms, as well as graphical analysis. In conclusion, the researchers argue that: First, an integral element of the Fourth Industrial Revolution is the development of digital economies, which determine the formation of new requirements for all market participants. Second, the operation of digital platforms can be viewed in three ways:

- When the platform is part of the enterprise itself, which is not part of the cluster.
- The industrial enterprise, which is a member of the cluster, it operates on a digital platform which in turn may not be included in the cluster.
- The industrial cluster operates entirely on a digital platform which allows effective communication with all participants.

According to the researchers, the third option meets the modern requirements

of economic development and the conditions of digitization. Third, a single digital platform of an industrial cluster includes four ecosystems: technological and human resources, decision-making and organizational, cluster members and cluster infrastructures.

In addition, the research of [Bratanova et al. \(2022\)](#), aims to highlight how cluster analysis, based on the analysis of technological advantage, can be used to differentiate geographical areas by activity in artificial intelligence (Artificial Intelligence-AI). The researchers conclude that: First, as a general-purpose technology, artificial intelligence (AI) has the potential to boost economic growth and productivity around the world, change business models, transform science, and change the way where we live and work. Second, a simple and transparent method of analyzing business activities combined with patent and labor market activities in the field of AI technology is provided. Third, the analysis of technological advantage contributes to the differentiation of geographical areas by activity in artificial intelligence (Artificial Intelligence-AI).

Research and studies in the field of competitiveness and competitive advantages of clusters are varied. For example, the research of [Zhao et al. \(2009\)](#) who investigates the role of competitive advantage of Chinese software parks in promoting industrial development. The methodology used in this research is a case study of Dalian Software Park China. Considering the case of DLSP, this analysis is conducted qualitatively since qualitative discussions and not technical issues are the focus of the research. The analysis is based on Porter's diamond model, SWOT (Strength, Weakness, Opportunity and Threat) analysis and interview results. The research conclusions are summarized in: first, the success of DLSP (Dalian Software Park China) as an industrial cluster is based on institutional resources, including strong efforts from government, industry and academia. Second, with the growing awareness of a competitive advantage of the industrial cluster in industrial development and the regional economy, research highlighted the role of local actors in promoting and expanding this competitiveness. Third, a SWOT analysis can highlight areas for further improvement and development by identifying the strengths, weaknesses, opportunities and threats facing industrial clusters. Fourth, while Porter believed that top-down government guidance would not have an impact on development, the Dalian government continues to develop strategic plans to enhance industry development as both a guide and a facilitator, even though the DLSP operated by the private sector.

Another research in the field of competitiveness is that of [Sushchenko & Trunina \(2016\)](#). It is empirical research that investigates the theoretical documentation of the creation of collaborative innovation formations (Innovation clusters) as an approach to improve the competitiveness of companies in external economic activity (export orientation and advanced technologies). The researchers argue (in conclusion) that: First, the main advantage of an innovation cluster in the form of a "knowledge network" consists in the prioritization of its scientific,

research and knowledge elements. Second, Clusters possess a strong scientific, technical and research base that allows them to actively introduce innovations in their activity by developing their intellectual capital. Third, the transfer of activities will help to retain the scientific staff and strengthen the innovation capabilities of the cluster participants, resulting in the creation of new knowledge and its further use within the innovation cluster that would enable enterprises to gain global competitive advantages in foreign economic activities. Fourth, key problems of interdependence of enterprises of a cluster include a low level of cooperation, the absence of joint strategic projects for the development of external economic activity, and the absence of a single database of information regarding the external markets of products, enterprises, suppliers, and potential consumers. Fifth, overcoming the identified “weak” points is possible based on the creation of a single platform that will be the basis for solving problems in the operation of cooperative formations and the coherence of the interests of its members.

Also, the purpose of the research of [Esmailpoorarabi et al. \(2018\)](#) is the identification of place quality indicators and their effects in shaping the attractiveness of innovation formations (clusters). The research additionally aims to answer the question: “how does the quality of place contribute to the attractiveness of innovation clusters?”. In order to address this issue, the research uses the literature review and frames four global best practice innovation clusters, namely One-North (Singapore), Arabianranta (Helsinki), DUMBO (New York), MPID (Sydney). In conclusion, the researchers state that: first, the findings of this research support the existing claims about the important role of place quality in shaping and strengthening the competitive advantages of innovation clusters, as argued by [Kloosterman & Trip \(2011\)](#). Second, it supports the critical position of quality in innovation formations through the five basic elements: context, form, function, image, and atmosphere. Third, the distinguishing characteristics that shape the unique identity of the innovation cluster are described. For example, the research identified the significant difference between the characteristics of city center and suburban clusters, as well as creative and high-tech characteristics. Fourth, creative clusters are more likely to be found in the heart of cities, which is extremely beneficial for both creative industries and cities. Fifth, quality of place is a dynamic and ongoing phenomenon, which requires time and flexible approaches.

Subsequently, the study by [Lysenko et al. \(2020\)](#) focuses on the development of indicators that can overall assess the effectiveness of regional collaborative innovation formations in the higher education system. The main attention of researchers is given to the analysis of business innovations, education development and competitiveness as indicators of the effectiveness of regional cooperative innovation formations in the higher education system. The methods that have been used in the research are: content analysis, statistics, correlation and regression analysis, econometric modeling and graphical method. The analysis of the results of the study revealed the following conclusions: First, the positive

effect of the participation of innovative clusters in the Higher Education System is documented, since they can provide many positive elements to all the members of a cluster such as:

- Closer cooperation between HEIs, businesses and research institutions.
- Attracting targeted investments for the development of new production technologies and innovative infrastructures for all participants in the educational process.
- Intensification of R&D work, research and construction work, cooperation and targeted training of specialists in HEIs and long-term partnership studies in the context of innovative projects.
- Development and introduction of new innovative products and implementation of effective mechanisms to attract investment in education development.
- Creation and development of modern innovative infrastructures in the field of higher education.
- Enhancing the mobility of students and graduates in the global labor market.
- Satisfaction of the interests of all stakeholders in the educational process.

Second, in the context of globalization, the important factors of quality and competitiveness of modern higher education include the development of digital literacy and interpersonal skills, while the ability to think critically and creatively depends not only on technical achievements, inventions and knowledge creation, but also from organizational changes that facilitate the commercialization of R&D results and marketing innovations. Third, there is a close relationship between the level of development of regional innovation formations, business development and innovation indicators, and the level of competition.

In the area of cluster development and approaches we have the empirical research of [Rampersad \(2015\)](#) based on a study involving key participants from government, universities and the industry. It explores approaches to effectively managing innovation clusters using a case study of Tonsley (A\$1.5 billion) innovation cluster in Australia. The findings of the research are summarized as follows: First, Clusters have experienced high failure rates due to insufficient development of underlying relationships between firms and ineffective performance monitoring for outcomes that are of value to the range of stakeholders. Second, as an innovation cluster matures, a longitudinal study can be conducted to investigate its evolution and value chains in different phases, so that management strategies can be applied to each phase of the development of future innovation formations. Third, despite its benefits, the study has limitations and therefore opens the way for future research. Doing so is based on a single case study and therefore future research can compare and contrast it with other innovation groups in other industries, specializations, states and countries to identify patterns and benchmark performance. In addition, a quantitative model should be developed to monitor cluster dynamics and performance to determine if they are on track or if corrective measures should be taken.

Following is the empirical and quantitative research of [Kostygova et al. \(2019\)](#),

who investigate the improvement areas of the clusters, in order to increase their innovation, as well as form a system of indicators for the quantitative characteristics of the proposed activities. The conclusions of the research showed that: first, clusters are an integral part of the modern economic development of most countries, because a modern cluster has significant potential. Second, measures to improve a cluster are systematized in order to increase innovation, and for this, the system of indicators for quantitative analysis proposes an assessment of the individual directions of innovation development of the cluster in the following directions: 1) Development of the innovation infrastructure of the cluster. 2) Increase of cluster members. 3) Development of the educational infrastructure. 4) Improvement of management. Third, for each recommended directive that exists, a set of measures necessary for their implementation is proposed. Fourth, to evaluate the results obtained in the research, a cluster development index system is proposed that includes the following:

- Period from the development of innovations to their implementation in production, years, months. Number of innovative organizations at regional, inter-regional and national level cooperating with a cluster.
- Percentage of the share of cluster members engaged in innovation activities in the total number of cluster members.
- Availability of personnel training and retraining systems for cluster members.
- Existence of a cluster management company, cluster development centers and other similar innovative structures.
- Percentage of the share of innovative products in the total production of the cluster.
- Percentage of the share of products with higher added value in the total production of the cluster.
- Percentage of the share of products that substitute exports and imports in the total production of the cluster.

Fifth, the importance of the obtained results lies in the development and concretization of methodological guidelines for the study and evaluation of measures to increase the innovation of clusters.

In addition, the study of [Turgel et al. \(2020\)](#), with the aim of analyzing the legal framework of innovation cluster policies in Russia and Kazakhstan and describing the classification and comparison criteria of city-based clusters. The study uses methods of systemic and comparative analysis and formalized methods of analysis of normative acts. Consequently, the researchers argue that: first, in both countries the number of clusters in large cities increases annually. Second, in both countries there are clusters with different specialization usually with a number of participants of 11 - 50. Third, in the two countries there are clusters of different specialization. Fourth, cluster policies are an important integral part of regional and urban development. Fifth, the global criteria for classifying clusters include: 1) The year of creation; 2) The number of partici-



pants in the cluster; 3) Specialization; 4) Role of the cluster policy indicated in the socio-economic development strategy of the territory.

Another area of cluster research is the Socio-Cultural dimension and the state support of the clusters. [Gomes & Laukkanen \(2013\)](#) aim in their study to investigate the dimensions (i.e. individual and social) that sustain and nurture the existence of Clusters. Specifically, the study examines the mechanisms of convergence and divergence within a cluster. Also, it is emphasized that the study is based on a strategic case study, so that a complex social phenomenon can be better understood in its natural context, for this a cluster was chosen in the Portuguese textile sector. Data were collected from three companies of the same cluster using various tools, more specifically: questionnaire, interviews, observation and document analysis. The conclusions of the study are: First, although the three companies operate in the same cluster, they differ significantly in terms of commercial orientations and cultural and strategic profiles, which are combined with a low presence of isomorphic mechanisms, Conclusion that contrasts with that of the Poudet and St. John. Second, informal relationships at the heart of the cluster are common and differences of managers play a role, but in so doing, they reinforce and motivate the aspects of the business that unite the cluster. Third, although clusters share certain characteristics and functions, as suggested by authors such as Porter, they are nonetheless composed of firms operating with different dispositions, behaviors, and even strategic and cultural orientations. Clusters may share the same results and reveal similar performance but differ in how the entities in them are combined. Fourth, a longitudinal observation of clusters would offer a unique opportunity to confirm how cultural and strategic profiles react and interact with the cluster environment and how they change over time.

Next study is that of [Varga et al. \(2013\)](#) who examine the conditions and the initial results of the granting of state aid for Innovation clusters in the Republic of Serbia. In conclusion, the researchers argue that under the conditions of globalization, the government must play an active role in helping SMEs to survive in the tough international competition, using the tool of state aid for cooperative formations of innovation (innovation clusters), within a legal and institutional framework. Also, Serbia strictly regulates the laws defining who can apply for state aid, what costs are covered and for what purposes, etc. In addition, state aid for innovation cooperative formations and as an economic policy measure is an appropriate tool in creating innovative capabilities that are necessary to ensure economic survival.

The study by [Muraru-Ionel et al. \(2017\)](#) focuses on the following objectives:

- Increasing the innovation capacity of clusters and links that include social relations.
- Increasing the competitiveness of clusters and the possibility of creating new jobs.
- Encouraging interdisciplinary research by encouraging interdisciplinary cluster

collaboration as well as social awareness within clusters.

- Intensification of cluster networking and cross-fertilization by establishing links between EU and Romanian clusters, partnerships, including staff exchanges and mobility programs between clusters are also crucial for the identification and development of emerging industries.
- To offer important tools and measures to increase social innovation within clusters and to become models of good practices for other clusters.

The conclusions of the study are summarized in: first, a comprehensive strategy or a public experimental program to support social innovation should be developed by the state and experts from all sectors. Second, further research and study on social innovation needs within clusters should be encouraged by the government and other parties, since data sources and research infrastructure should be established. Third, in the short-term specific areas of social innovation to consider include: cross-sectoral strategies and relationships, social funding (funding models) and mechanisms.

Finally, we have the empirical research of [Lozhachevska et al. \(2021\)](#) aims to highlight the importance of improving and developing logistics management and marketing behavior of innovative clusters in territorial communities as a basic condition in the digitization process of society and the electronic (online) market. In conclusion, [Lozhachevska et al. \(2021\)](#) claim that: First, the clusters in each country develop on their own in an evolutionary way, but all of them with effective government support. Second, in order to improve the logistics management and marketing behavior of innovation clusters in local communities they should be a favorable space of communication, which represents the relations between state and business formed in a certain region. In shaping such a space, one should understand the multidimensionality and ramification of the theoretical approaches underlying cluster development. Third, cluster initiatives are planned and organized strategically. Moreover, state efforts are successfully delegated to create a cluster policy, which consists of operational actions related to the formation of cluster development and resource support.

The analysis and study of all the results and conclusions of previous research and studies leads us to some observations. Firstly, [Napolskikh et al. \(2019\)](#) state in their study that the development of theoretical and methodological approaches for the spatial modeling of the innovation cluster is based on considering it as a complex meso economic system with a specific structure of organizational hierarchy and horizontal network interactions, as well as their own mechanisms. Also, companies that are members of an innovation cluster can compete effectively in global technology and innovative markets only if the clustering processes of the economic system are provided with appropriate theoretical and methodological support. [Khomenko et al. \(2021\)](#) agree in their study that the conceptual vision of the future cluster or model of efficient energy development of innovative cluster area emerges the realities of change. Also, the development and implementation of the concept of energy clusters policy should be recognized as a

real tool for the further formation of innovation-oriented regional policy in the form of working groups, feasible and sequential actions involving resources and human capital and possible chances.

Scutaru (2016) argues in her research that: First, cluster-based economic development is a new model of development through microeconomic policies that are widely expanded, because clusters represent the engines of regional development and the economy as a whole. Second, clusters can contribute to the creation of a new vision for state economic policy, helping to strengthen the relationships between the states, the private sector, the academic environment and all stakeholders interested in the smooth functioning of the economy. Third, one of the determining factors of a successful cluster consists of massive capital investments made in any legal form. Fourth, the French poles of competitiveness meet all the characteristics of a world-class innovation cluster by promoting research, development and high technologies par excellence. In contrast, American clusters are distinct identities characterized by a series of factors and characteristics that differentiate each other. Therefore, one cannot speak of a replicable American cluster model. Fifth, there are different success factors of the two models (French clusters, American clusters).

Subsequently, researchers Fundeanua and Badele (2014) conclude that: first, clusters are geographical concentrations of companies, universities, research institutions, regional or local authorities interconnected in relationships that allow work dynamics, specialization and information exchange between companies that benefit from local capabilities innovation according to the triple helix model. Second, clusters can have an economic and social impact on competitiveness and innovation. Third, the development of innovative clusters will lead to the creation of new jobs in specialization and the increase of income in the area of development. Fourth, an approach to open innovation is based on the interactions between university research on entrepreneurship dynamics, the availability of venture capital provided by the private sector and the policy support framework provided by public administration.

Borkova et al. (2019) state in their study that: first, global experience conventionally identifies six cluster formation models. Second, the formation of a cluster and its prospects depend on many factors and without state support the cluster will not be able to reach the desired trajectory. Third, the effective management of the concept of smart specialization is realized through strategic planning and anticipation of future opportunities. Fourth, it is important to build a system of relationships between entrepreneurs and government agencies, as they could coordinate the decisions they make and empower businesses to independently determine their capabilities.

Secondly, Zemtsov et al. (2015), argue in their study that clusters are researched and classified based on their level of development. In addition, high-tech industries are mainly concentrated in the regions with the largest settlements, because the largest cities and closed scientific cities are the main sources of new technol-

ogies in Russia. Babkin et al. (2020) argue in their study that: first, an integral element of the Fourth Industrial Revolution is the development of digital economies, which determine the formation of new requirements for all market participants. Second, the operation of digital platforms can be viewed in three ways:

- When the platform is part of the enterprise itself, which is not part of the cluster.
- When the industrial enterprise is a member of the cluster, it operates on a digital platform which in turn may not be included in the cluster.
- When the industrial cluster operates entirely on a digital platform that allows effective communication with all participants. According to the researchers, the third option meets the modern requirements of economic development and the conditions of digitization.

Thirdly, a single digital platform of an industrial cluster includes four ecosystems: technological and human resources, decision-making and organizational, cluster members, and cluster infrastructure.

Another research is that of Bratanova et al. (2022) who conclude that: first, artificial intelligence (AI), as a general-purpose technology, has the potential to boost economic growth and productivity around the world, change business models, transforms science and changes the way we live and work. Second, a simple and transparent method of analyzing business activities combined with patent and labor market activities in the field of AI technology is provided. Third, the analysis of technological advantage contributes to the differentiation of geographical areas by activity in artificial intelligence (Artificial Intelligence-AI).

The research of Zhao et al. (2009) points out that a SWOT analysis can highlight areas for further improvement and development by identifying the strengths, weaknesses, opportunities and threats facing industrial clusters. Also, while Porter believed that top-down government guidance would not have an impact on growth, the Dalian government continues to develop strategic plans to enhance industry development as both a guide and a facilitator, even though the DLSP operated by the private sector.

Sushchenko & Trunina (2016) argue in their research that the main problems of interdependence of a cluster's enterprises include a low level of cooperation, the absence of joint strategic projects for the development of external economic activity, and the absence of a single database of information regarding external product, business, supplier and potential consumer markets. They also emphasize in the defined "weak" points based on the creation of a single platform that will be the basis for solving problems in the operation of cooperative formations, the coherence of the interests of its members and the synergistic effects from overlapping them.

Also, the research of Esmaeilpoorarabi et al. (2018) describes the distinguishing characteristics that form the unique identity of the innovation cluster. For example, the research identified the significant difference between the characte-

ristics of city center and suburban clusters, as well as creative and high-tech characteristics. In addition, it states that creative clusters are more likely to be found in the heart of cities, which is extremely beneficial for both creative industries and cities. [Lysenko et al. \(2020\)](#) after developing the indicators that can evaluate overall the effectiveness of regional collaborative innovation formations in the higher education system, they showed the close relationship that exists between the level of development of regional innovation formations, business development and innovation indicators and the level of competition.

Next, [Rampersad's \(2015\)](#) empirical research based on a case study involving key stakeholders from government, universities and industry argues that: first, Clusters have experienced high failure rates due to insufficient development of the underlying relationships between firms and the ineffective monitoring of performance for outcomes that are of value to the range of stakeholders. Second, as an innovation cluster matures, a longitudinal study can be conducted to investigate its evolution and value chains in different phases, so that management strategies can be applied to each phase of the development of future innovation formations.

[Gomes & Laukkanen \(2013\)](#) conclude in their study the following: First, although the three companies operate in the same cluster, they differ significantly in terms of commercial orientations and cultural and strategic profiles, which are combined with a low presence of isomorphic mechanisms, conclusion that contrasts with that of the Poudier and St. John. Second, informal relationships at the heart of the cluster are common and differences of managers play a role, but in so doing, they reinforce and motivate the aspects of the business that unite the cluster. Third, although clusters share certain characteristics and functions (as suggested by authors such as Porter), they are nonetheless composed of firms operating with different dispositions, behaviors, and even strategic and cultural orientations. That is, clusters may share the same results and reveal similar performance but differ in the way the entities in them are combined.

The study conducted by [Muraru-Ionel et al. \(2017\)](#) states that in the short-term specific areas of social innovation to consider include: cross-sectoral strategies and relationships, social finance (funding models) and mechanisms.

[Varga et al. \(2013\)](#) argue in their study that under the conditions of globalization, the government must play an active role in helping SMEs to survive in the tough international competition, using the tool of state aid for cooperative formations of innovation (innovation clusters), within a legal and institutional framework.

The empirical research of [Lozhachevska et al. \(2021\)](#) concludes that: First, the clusters in each country develop on their own in an evolutionary way, but all of them with effective government support. Second, in order to improve the logistics management and marketing behavior of innovation clusters in local communities they should be a favorable space of communication, which represents the relations between state and business formed in a certain region.

## 7. Conclusion

At present, the question is related to “what is ultimately appropriate to learn about clusters”, and it has not yet been fully investigated, since until now no unified concept for the creation of mechanisms (clustering) has been developed by economic science. However, each country has identified its own set of successful practices for implementing elements of cluster policy, considering national characteristics. Nevertheless, the following conclusions emerge from the analysis and comparison of all scientific research directions:

- One of the main objectives of clusters is the transfer of technology and the exchange of ideas and information in one or more value chains. The cooperative formation (cluster) is considered an important tool and a strategic choice used in the exercise of a horizontal policy to stimulate local economies and redefine the development model of a region or a country.
- The main sources of competitive advantage that lead to economic growth are export intensity, product differentiation, branding, and the adoption and adaptation of innovation (marketing innovation-technical innovation, etc.), with innovation playing the decisive role.
- The configuration of the development mode of each cluster will depend on its country of operation.
- The geographical proximity and location of businesses offers a variety of benefits and privileges to clusters but at the same time poses certain limitations.
- Various models of cluster formation around the world are identified.
- Artificial intelligence (AI) as a general-purpose technology and the conditions of digitalization have the potential to boost economic growth and productivity around the world, change business models, transform science, and alter the way we live and work.

Under the conditions of globalization, the government must play an active role in helping SMEs to survive in the tough international competition, using the tool of state aid for cooperative innovation formations (clusters) within a legal and institutional framework. Also, the formation of a cluster and its prospects depend on many factors and without government support, the clusters will not be able to reach the desired trajectory.

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## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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