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How do Clusters Foster Sustainable Development? An Analysis of EU Policies

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Abstract: Sustainable development is one of the fundamental and most important objectives of the worldwide policy. The conducted research shows that sustainable development (SD) is increasingly important in the consciousness of the EU countries, which can be viewed through a prism of the undertaken projects. This paper raises the issue of clusters and their significance in the development of a sustainable economy. The article explores trends in the European Union policy related to sustainable development and clusters. The purpose of this study is to find an answer to the following questions: How can clusters contribute to sustainable development and what are the key factors that ensure this process? To achieve the goal of the article a systematic study of the literature and reports was carried out. Moreover, the analysis of the activity of European clusters in the context of sustainable development was performed. Next, the examples of cluster projects focused on sustainable development were presented. It was shown that the clusters contribute a smarter and sustainable development by succeeding in technological and scientific results, developing new technologies for emerging industries, creating new business activities, enticing major technology companies, and connecting local firms into world-class value systems. Furthermore, the clusters participate actively in sustainable development as they promote knowledge creation, joint learning, technology transfer, as well as collaboration, and sustainable innovations. Finally, clusters facilitate the sustainable upgrading of small and medium enterprises and encourage the participation of stakeholders in the process of sustainable development.

Keywords: cluster; sustainable development; sustainable economy; SDG implementation

1. Introduction

Recently, the possibility of spreading the idea of sustainable development (SD) through the development of cluster initiatives was recognized [1]. Connections between clusters and sustainable development are not so precise and the increased interest in SD vs. clusters by academics has been observed in the last decade [2–5].

The basic factors that determine the potential of clusters to implement SD include [6,7]: the ability to influence the strategic goals of enterprises collected in clusters by local governments, building social trust, creating favorable conditions of social acceptance for external effects of enterprise development,

increasing interest in innovative activities, including eco-innovation, knowledge transfer between cluster members and business environment institutions.

One of the mentioned priorities is a global partnership, which should result in cooperative and strong partnerships at all levels and between different governments, the private sector, civil society and other parties [8]. To achieve cooperation at the international level and to increase innovation, resulting in new products and technologies aiming at achieving sustainable development groups (SDGs) (e.g., reducing water waste, decrease of environment pollution, poverty reduction, new jobs creation, activation of local community, improving economic indicators) the paper refers to clusters and their relation with sustainable development.

As the clusters are the most common places where one can find education, research, innovation, environmental solutions, and sustainable technologies, the paper raises the issue of clusters and their significance in the development of a sustainable economy as well as explores trends in the European Union (EU) policy related to SD and clusters. As a result, this paper aims to determine the potential of clusters in promoting sustainable development. To achieve the main goal of the paper the following specific objectives will be realized: (i) analysis of the effects of clusters on sustainable development according to the state of the art, (ii) analysis of the directions of EU cluster policy undertaken in last two decades relating to sustainability—EU projects directly or indirectly related to sustainable development, and (iii) an indication of examples of the activities performed by clusters to support sustainable development.

2. Theoretical Framework

2.1. Cluster Concept

Since the 1990s, researchers have emphasized the importance of clusters in economic development in different aspects [9–16]. Such structures became an important part of almost every national and regional economy in countries all over the world [17,18]. The concept of clusters is built on traditional theories of localization and integrates other concepts such as industrial districts, growth poles, systems of production, regional innovation systems, or learning and creative regions. The original concept of the territorially concentrated enterprises was established by Marshall [19] (industrial district) [20]. The concept was developed by researchers who emphasized the results of the interaction between participants who enhance innovation capacity, increase the level of competitiveness and help to achieve a beneficial coefficient of socio-economic development [21–25]. Historically, clusters have been found in traditional industries such as textiles in northern Italy, steel in Pittsburgh or car manufacture in Detroit [26]. Porter [27] merely popularized the theoretical achievements of Marshall; nevertheless, Porter is seen as the precursor of the economic aspect of clusters. According to his definition a cluster is a geographically concentrated, competitive, cooperative group of interrelated companies, specialized suppliers, service providers, and finally, companies operating in related sectors and associated institutions [27,28]. The popularity of cluster structures was also increased by organizations such as UNIDO and OECD after their attempts to use the concept of clusters as a tool for development [29,30] Creating networks and enterprise cooperation contributes to positive effects for entities belonging to this network [31]. The academics highlight that clusters as networks generate benefits for enterprises located in this structure, e.g., easier and affordable access to means of production, distribution channels, human resources, or knowledge and innovation [32]. Benefits for companies and institutions within a cluster comprise profit increase due to lower costs incurred by companies operating within the network, export increase, higher innovativeness, better expansion of knowledge and technological progress, enhanced competitive advantage, faster productivity growth related to the concentration of the resources of innovation absorption capacity [33]. The existence of networks also ensures risk sharing, joint analysis of ideas and initiatives, sharing costs of introducing innovations, availability and possibility to exchange experienced and specialized employees. This confidence of partners contributes to frequent formal and informal contacts between them and the exchange of experience.

The role of the government in creating a cluster is very important. It is worth noting that clusters are more willingly created when there is financial and institutional support from the government. The most popular kinds of support include such incentives as:

(1) Creation of the offices or the employment of the specialists–advisers financed by the authorities in establishing and running clusters,
(2) Subsidies for establishing the cluster and the costs of its management (especially in the initial period of operation),
(3) Facilitating the application for public funds for research and development (in the form of additional points for the mere fact of being a cluster), which gives an advantage compared to non-cluster enterprises,
(4) Promotion and information activities financed by public authorities to increase the intensity of cluster creation.

2.2. Sustainable Development Concept

The concept of sustainable development (SD) is a concept of development directed towards achieving a balance between social aspects, economic activities, and the environment. The term SD is widely discussed in present political and environmental discourses [34]. Currently, most countries in the world face many sustainability challenges from youth unemployment to the aging population, climate change, pollution, sustainable energy, international migration, and rural area depopulation. The concept of sustainability [35] is not new and has both enthusiasts and opponents, and it is deliberated in various aspects [36,37]. SD is one of the most critical challenges and priorities of the modern world. It is also observed as a strategic trend in global environment protection policy and socio-economic development [38]. Challenges of the present day and willingness to strive for sustainable development result in the creation of programs and projects supporting research and implementation of solutions that take into account economic, environmental and social aspects, and which may be motivators for other market participants (the examples are RUBIZMO [39] and EuroSea [40] projects implemented under the Horizon 2020 program).

SD is more and more often identified in the pro-ecological context [41]. However, it should be remembered that the area of the environment is not the only pillar of this concept. The other two pillars—society and economy—are equally important. The three pillars of SD are fundamental and occur across all sectors of the economy [42]. It should be highlighted that SD recommends that the needs of the future can be met depending on how well social (equity, participation, empowerment, social mobility, and cultural preservation), economic (services, household needs, industrial growth, agriculture growth, and efficient use of labor), and environmental (biodiversity, natural resources, carrying capacity, ecosystem integrity, and clean air and water) objectives or needs are balanced. Very often needs are incompatible; for instance, industrial growth may conflict with the protection of natural resources [43]. Besides, sustainable development can be seen as equalizing opportunities between regions with high development potential (usually large urban agglomerations) and areas with lower development potential (e.g., rural areas, less industrialized regions, etc.) [44]. Moreover, SD is understood as growth based on education, research, and innovation, digital society as well as growth based on a more competitive low-carbon economy. SD makes/involves efficient and sustainable use of resources, protection of the environment (by reducing emissions and preventing biodiversity loss), capitalization on Europe's leadership in developing new green technologies and production methods, as well as the introduction of efficient smart electricity grids [45,46]. From the EU point of view, sustainability should be considered by companies as attractive business opportunities which result in profits [47]. Increased resource efficiency, circular economy solutions, and participation in green markets represent essential opportunities for European small and medium enterprises (SMEs) and their improvement in productivity and boosting their competitiveness.

SD is characterized by various dimensions and results in complex interactions. To follow the changes referring to sustainability in particular areas SD indicators were developed and applied.

They refer to the main areas of SD—social, economic, and environmental [48]—and are based on selected indicators from the global indicator framework and reflect the SD goals (SDGs) [49]. SDGs are presented in the United Nations *2030 Agenda for Sustainable Development*: no poverty; zero hunger; good health and well-being; quality education; gender equality; clean water and sanitation; affordable and clean energy; decent work and economic growth; industry, innovation, and infrastructure; reduced inequalities; sustainable cities and communities; responsible consumption and production; climate action; life underwater, life on land; peace, justice, and strong institutions; and finally, partnership for the goals [8].

3. Material and Methods

To elaborate on the necessary information about clusters in the context of SD, the authors conducted desk research. The identification of the papers concerning SD and the cluster concept was performed. This part of desk research was devoted to establishing the theoretical framework of the EU cluster policy directions and to broadening the knowledge related to the dependence between clusters and SD. The desk research was supported by Google Scholar, Emerald, EBSCO databases and websites dedicated to clusters and SD concepts. The analysis allowed the authors to systematize the knowledge and definitions related to the examined phenomenon. To research SD in the cluster's context it was decided to perform Boolean keyword and subject term searches in EBSCO, Emerald, and Google Scholar databases using search phrases reflecting the phenomena and Boolean search operators such as AND and NEAR, with the phrases: sustainable development, environmental development. The searching was realized on 10–12 July 2019.

Moreover, the research was also conducted based on the authors' expert knowledge resulting from research and analyses of reports, case studies, and the following interactive maps of the EU e-platforms dedicated to clusters: European Cluster Collaboration Platform, Excellence Cluster for Regional Improvement Website, Green and Cluster Excellence Programme Website. The platforms were analyzed to check the directions of the EU's activities in the context of SD, to provide knowledge on actions and types of activities resulting in the improvement of sustainable development and to enable the assessment of activities carried out in the context of clusters vs. SD.

To complete the research and to achieve the goal of the paper, examples of the activities performed by clusters to support sustainable development were selected. Moreover, all cluster partnerships were analyzed that were realized under the European Strategic Cluster Partnerships for Smart Specialization Investments (ESCP-S3) and European Strategic Cluster Partnerships for Going International (ESCP-4i). Then, using the method of deduction and inference, a list of cluster activities that contribute to sustainable development was indicated. Finally, the analysis of the Cluster Partnership recently created in the EU and an assessment of the activity of chosen clusters and its contribution to sustainable development was performed.

4. Results

The desk research proved that clusters are an essential part of the contemporary economic development of most countries and regions. Clusters are considered as engines of growth and have become a popular policy tool for boosting economic growth and innovation.

The coexistence of clusters with sustainable development/sustainable economy and sustainability in scholarly publications in the years 1990–2019 was checked (Table 1).

As seen from conducted research, in the last two decades a growing number of the papers referring to the issue of clusters concerning SD was observed. Therefore, a more detailed analysis was conducted for the years 2000–2019, as confirmed in the research included in the EBSCO, EMERALD, and Google Scholar databases. The used operator AND allowed us to distinguish the papers related to clusters and SD in the content. In the EBSCO database the number of results of "cluster AND sustainable development" was significantly lower (one in 2002, 47 in 2017, and 13 in 2018–2019) than in EMERALD

and Google Scholar. The results of the search in EMERALD and Google Scholar databases are presented in Figures 1 and 2, respectively.

Table 1. Cluster and sustainable development—literature analysis.

Keyword Boolean Operators	EBSCO	Emerald	Google Scholar
Cluster AND sustainable development	159	9511	847,000
Cluster NEAR sustainable development	2695	309	19,700
Cluster AND sustainable economy	9	6852	334,000
Cluster NEAR sustainable economy	1031	254	239,000
Cluster AND sustainability	182	6519	739,000
Cluster NEAR sustainability	195	241	334,000

Source: own research.

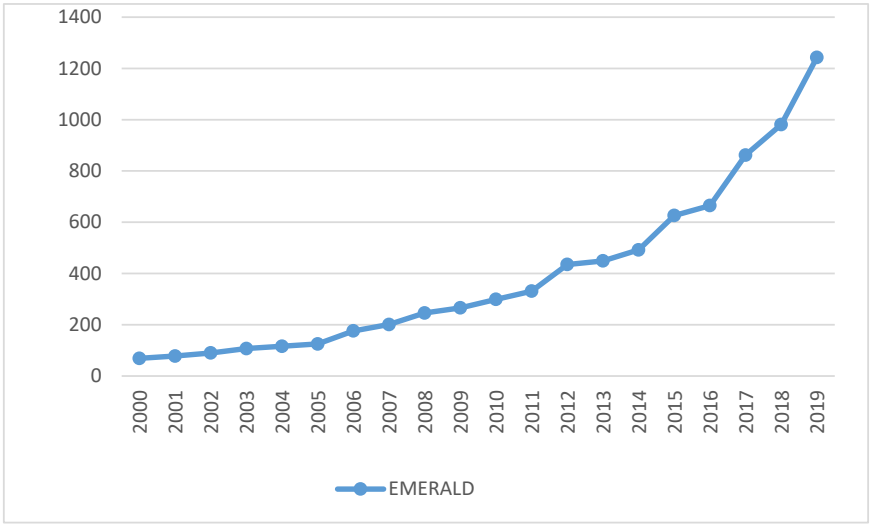

Figure 1. Number of articles containing the search "cluster" and "SD" (2000–2019). Source: Own elaboration based on EMERALD (between 1 January 2000 and 31 December 2019).

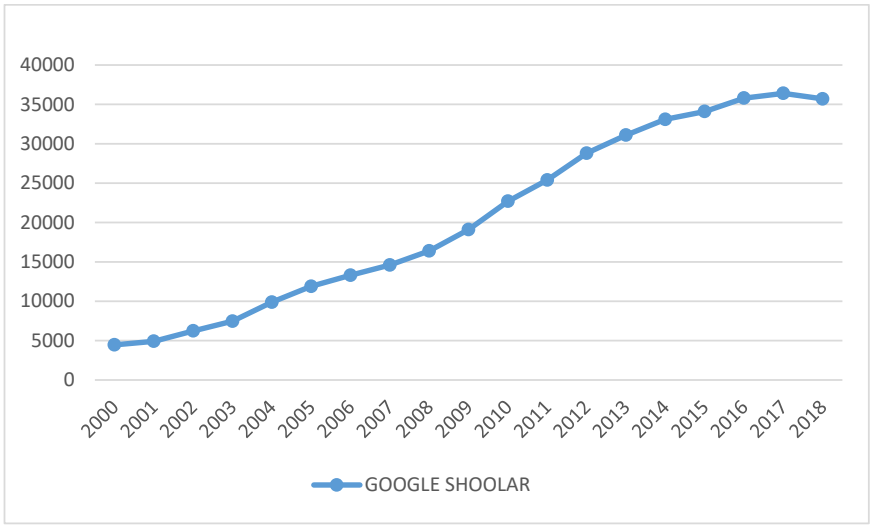

Figure 2. Number of articles containing the search "cluster" and "SD" (2000–2019). Source: Own elaboration based on Google Scholar database (between 1 January 2000 and 1 December 2019).

In the Emerald database, a constant increase in the number of analyzed papers was observed: from 69 in 2000 to 1243 in 2019, while in the Google Scholar database, the number of papers increased from 4460 in 2000 to 36,400 in 2017. In 2018 the upward trend stopped, and in 2019 there were 35,700 papers.

The issue of clusters and their significance in SD is the subject of theoretical and empirical studies [50–52]. The research also concerns the role of clusters in regional and economic development [53, 54]. It is also recognized as an extensive solution to the existing urban planning issues, the aim of which is providing a better quality of life. The cluster approach is also used in connection with the concept of smart specialization to increase the efficiency and effectiveness of economic systems contributing to sustainable development simultaneously [55]. In smart specialization, strategies of countries and regions clusters are a fundamental component and they bring together universities, local authorities, and businesses. For business, clusters are a platform through which they can have many benefits, i.e., easier access to the appropriate information, participation in research projects, better access to financing sources, knowledge exchange, cooperation with R&D and public sector institutions [56]. Universities and research centers take advantage of being a part of clusters as they have great opportunities to realize projects in cooperation with the business sector. Finally, the public sector uses clusters to communicate more efficiently with private actors/players and design cluster policies more competently [57]. Thus, there are many benefits of being in a cluster for all entities in general.

However, also some disadvantages of clusters are indicated. For example, in a situation of economic downturn in a given industry, with excessive concentration and scale of cluster activity, there is a risk that a given region will be overly dependent on one industry/sector, i.e., there will be an imbalance in the structure of the region's economy (too high a share of one industry and too small a share of other industries). Usually, the cluster helps in the development of the region, but the collapse in the market, where it operates, may lead to a regional crisis. A good example is the city of Detroit in the U.S.A. When the car industry in the U.S.A. collapsed, the city was depopulated and the industries dependent on the automotive industry collapsed. As a result, the population's wealth declined and the unemployment index increased significantly, and a problem with the entire city's budget for its development appeared.

Nonetheless, the awareness of the European Commission of the importance of the cluster in sustainable economic development forced them to undertake different projects indirectly related to the improvement of the environment. As the effect of the EU activities, the European Cluster Alliance was established, constituting a network of institutions representing central and regional authorities and development agencies that support transnational cooperation between regions in the field of cluster policy development. The main aim of EU actions is to intensify cluster and business network collaboration across borders and sectoral boundaries [58]. The EU actions enable European cluster cooperation, exchange of knowledge and experience by participation in international projects. As the result of undertaking activities in 2014, the European Strategic Cluster Partnerships (ESCPs) under the COSME program was established and two projects were undertaken to boost industrial competitiveness and investment within the EU: the European Strategic Cluster Partnerships for Smart Specialization Investments (ESCP-S3) and European Strategic Cluster Partnerships for Going International (ESCP-4i). Moreover, the EU promoted projects for cluster excellence and new industrial value chains (13 INNOSUP-1 projects) [59].

In 2018 the nine European Strategic Cluster Partnerships for Smart Specialization Investments was launched and they enabled cluster cooperation in thematic areas related to regional smart specialization strategies and increased the participation of the industry. All cluster partnerships are presented in Table 2.

Most cluster partnerships activities (Table 2) stress the importance of the environment and concentrate on increasing knowledge and cooperation, technology transfer, new business collaborations, and what is the most important industrial modernization. It is expected that all planned activities will contribute not only to increased international cooperation between companies but also to more sustainable development in the EU.

Table 2. European Strategic Cluster Partnerships for Smart Specialization Investments (ESCP-S3) and its contribution to sustainable development.

Acronym	Sector	S3 EU Priority Areas	Expected Results on Sustainable Development
TRACK	Agricultural Inputs and Services	Sustainable innovation, Sustainable agriculture	Adoption of new technologies for improving efficiency and traceability in various vegetal-based agri-food chains, modernization of the vegetal-based agri-food chain.
TEX4IM	Textile Manufacturing	Manufacturing and Industry, Textiles, wearing apparel and leather and related products	Generation of a long-term partnership for boosting industrial competitiveness and investment in European textile and clothing sector, set up a sustainable incubator and accelerator system for the generation of joint investment projects in the textile and clothing sector. Joint strategy for industrial modernization of the telecommunication (TC) sector of Europe.
S3martMed	Biopharmaceuticals	Human health and social work activities, Human health activities (medical services)	Foster cooperation between European clusters and their small and medium enterprise (SME) members in the field of medical technologies.
EACP-EUROSME	Aerospace Vehicles and Defence	Aeronautics and Space, Aeronautics	Reconsideration of the present sector conditions, stressing the importance of the environment with new cluster strategies that support the circular economy across the entire aerospace value chain and life cycle.
EACN	Automotive	Advanced manufacturing systems	Industrial modernization in the automotive industry, investing in a smart, innovative and sustainable industry.
DIGICLUSTERS	Food Processing and Manufacturing	Information and Communication Technologies (ICT), Computer programming, consultancy and related activities	Prototyping new value chains and emerging industries based on combined competencies of consortium partners, focusing on developing competitive next generation and added-value products and services through the innovative approach of intra-regional and interregional hackathons.
CYBER SECURE LIGHT	Lighting and Electrical Equipment	Digital Agenda, ICT trust, cybersecurity and network security	Knowledge and cooperation assets concerning the cybersecurity implementation, strengthen with insights on cybersecurity in smart building and related innovation investments, investment for pilot business initiatives/technology transfer projects.
CONNSENSYS	Food Processing and Manufacturing	Manufacturing and Industry, Food, beverage and tobacco products	More interconnected, resilient and smart agri-food system in Europe, validation and implementation of IoT solutions based on smart electronic systems and embedded technology in the food industry on a wide scale (from multinationals to locally operating SMEs).
AI4Diag	Biopharmaceuticals	Manufacturing and Industry, Biotechnology	Industrial modernization of diagnostics companies to reinforce their international leadership.

Source: own elaboration based on [59].

As the first example, the European Automotive Cluster Network for Joint Industrial Modernisation (EACN) is presented [60]. Six partnerships clusters are represented: Poland, Spain, Bulgaria, France,

and Serbia. The partnerships resulted in the engagement of 560 enterprises and were aimed at initiating joint R&D projects concerning the virtualization of processes, robotics and artificial intelligence, the elasticity of production, and skills and competencies. EACN's contributions are directed towards areas such as efficient and sustainable manufacturing or entrepreneurs' integration in Industry 4.0.

The next partnership [61] refers to Cyber Secure IoT Lighting and Home Automation systems for Smart Building (CYBER SECURE LIGHT) and refers to ICT/Digitalization—Lighting and Electrical Equipment sector. The partnership enables seven clusters from Italy, Poland, France, Spain, Hungary, and Slovenia to engage their 1115 representatives. The most important CYBER SECURE LIGHT partnership's aims, from the SD point of view, are: fostering interregional business-to-business collaboration deals for innovation and smart investments, cooperation ensuring company growth in the smart building/IT/cyber, technology transfer projects and cooperative agreements, co-learning and knowledge sharing, supporting the development of cluster bridges with other complementary ecosystem actors to enlarge the CYBER SECURE LIGHT consortium and investigate new development and cooperation opportunities [61].

To strengthen clusters, to internationalize them, to enable their transfer of knowledge, and to make SDGs achievable for them the Cluster Excellence Programme [62] was introduced. The project aimed also at strengthening cluster management excellence in the EU. The program was organized as two editions and focused among other things on providing top quality services to cluster enterprises, facilitating internationalization, developing strategic plans and action plans for the sustainable development of clusters. As the result of the Cluster Excellence Programme 11 projects were composed by partnerships of clusters representing various countries (the proposal has been continued). Thanks to this project, companies gain an opportunity for knowledge and experience exchange, spreading innovation, participation in workshops, study visits and training, etc. Moreover, partners improve and test new management skills, and SMEs strengthen their competitiveness [62].

The next initiative of the EU contributing to knowledge transfer and skills improvement is the Smarter Cluster Policies for southeast Europe (ClusterPoliSEE) [63]. The project aims at developing and implementing effective smart specialization strategies for cluster development and concentrates on eco-innovation. This project gives opportunities for sustainable business through collaborative R&D projects leading to greater sustainability and economic diversification [64].

Moreover, to present the activity of European clusters in the context of SD, an analysis of European clusters referring to their activities in sustainable development was conducted. As results from the conducted research show, clusters are conscious of SD importance and pay attention to the development in accordance with sustainability. To specify the cluster activities resulting in SD, it is worth presenting particular examples of clusters and their undertaken initiatives to strengthen, promote and ensure sustainable socio-economic development. Clusters are networking engines which facilitate the interactions among their members at regional, national, trans-national, international or sectoral level. Participation in clusters facilitates the exchange of new knowledge, liaising and offers various opportunities for the members. But what is most important is that more and more often clusters contribute to the development of a sustainable economy. In the EU there are clusters that directly and indirectly foster SD. Clusters that directly influence SD operate in sectoral industries such as sustainable energy, automotive and environmental services. Many clusters operate in the EU but only some of them are presented in this paper. For example, TWEED cluster [65] is a sustainable energy cluster located in Belgium. The cluster aims to set up high-quality projects in the fields of production and exploitation of sustainable energy: renewable energy sources and the implementation of new processes to achieve energy savings, energy efficiency or the reduction of greenhouse gas emissions, including CO_2. This cluster consists of companies and R&D institutions cooperating in the following sectors: solar energy, wind energy, biomass, energy efficiency, smart grid, and green products and services. The activities of TWEED include [65]:

- Networking between industrial or commercial companies and other actors of sustainable energy sectors,

- Developing synergies with other actors of sustainable energy sectors (including other clusters),
- Promoting cluster members locally and internationally,
- Carrying out industrial, technical, market and economic studies on the sustainable energy sector.

The Electric Vehicles Industrial Cluster [66] of Bulgaria is the next example. The cluster constitutes a good practice example of a cluster initiative directly promoting sustainability aimed at achieving SD, improved competitiveness of the cluster members and a sustainable and clean environment. The cluster aims among other things at industrial investment projects for technological renewal and introduction of innovations to reduce the energy intensity of transport schemes, implementation of models of mass urban transport by electric buses, building sustainable educational models, etc. [66].

There are also clusters in which activity indirectly contributes to SD. For example, the Upper Rhine Cluster for Sustainability Research (URCforSR) [67] is a cluster located in Germany that engages various universities of applied sciences and research institutes. It aims to establish a research association with European significance in such fields of study as [67] governance, energy, infrastructure, societal change, transformation processes and technology, resource management, and multiculturalism and multilingualism. Cooperation in the clusters allows the exchange and transfer of knowledge as well as leads to interdisciplinary research on the governance of sustainable growth. Moreover, the cluster conducts different projects for protection against pollution or to increase renewable energies [67]:

- NAVEBGO—Sustainable reduction of biocide input into the groundwater of the Upper Rhine,
- SMI: Inclusive Smart Meter—artificial intelligence to support proactive control of energy consumption by end-users,
- SuMo-Rhine—promotion of Sustainable Mobility in the Upper Rhine Region,
- The cluster also promotes SD in its book *Sustainability Governance and Hierarchy* [68]. The book analyzes the concept of sustainability governance through sustainability and environmental studies.

Another example of a cluster that can contribute indirectly to SD is the Green and Sustainable Finance Cluster in Germany (GSFCG) [69]. It aims at developing user-oriented concepts for the implementation of sustainable criteria in the business models of the various stakeholders operating in the financial center. This cluster also promotes investing in private capital in accordance with sustainability [69].

Studies have shown the increasing trend in the EU of activities referring to the importance of clusters in the context of sustainability. The directions undertaken by the EU have a positive effect on the awareness of companies operating in clusters by broadening their knowledge concerning sustainable development, as well as encouraging them to sustainable activities. However, the main idea is wider and, next to the international projects, worldwide actions are promoted concerning third world countries.

5. Discussion

Among numerous benefits that clusters bring [70] this study focused on their influence on the development of a sustainable economy [51]. Clusters can lead to smarter and sustainable development by succeeding in technological and scientific results, developing new technologies for emerging industries, enticing major technology companies, and connecting local firms with world-class value systems [46]. The literature also provides cluster activity in the field of environment protection [71]: technological activities (e.g., energy, biomass, water treatment, innovative solutions in reducing storage, recovery, and recycling of rain), educational activities (e.g., training in the use of renewable energy issues, energy efficiency, biomass, photovoltaic, wind and water turbines, geothermal energy and biogas plants) and research activities (e.g., environmental studies). Dyrda-Muskus [71] underlines the environmental advantages of clusters activities. However, there are more factors by which clusters can support achievements in the area of sustainable development. Interesting research is presented by

Borkowska-Niszczota [72], i.e., classification and analysis of factors stimulating the impact of a tourist cluster on SD. Some research referring to SD concerns SMEs belonging to clusters and their further development, as well as their corporate social responsibility (CSR) [31,52].

Moreover, the research related to the investigated issue is presented by Bankova and Slavova-Georgieva [73] on a Bulgarian example. The research was based on the indicators (ecological sustainability index, social progress index, and state of cluster development). The possibilities of clusters in contributing to sustainable development were checked in the context of cluster development and CSR of enterprises belonging to clusters [73].

The EU policymakers, aware of the role of clusters in sustainable development, decided to make an effort to assist the growth of clusters. Cluster policies are widely encouraged by international authorities, such as the European Union and OECD, and have grown worldwide both at regional and national levels [74,75]. The policy actions used by policymakers comprise direct and indirect financial support, start-up support, aid for administration, networks, and cooperation, and general assistance for cluster activities [74]. The models of cluster policy in particular countries vary significantly. Generally, this policy is based on activities focused on the creation of an environment favorable for cluster development, such as ensuring appropriate financial instruments and improvement of coordination channels, as well as supporting science-business cooperation [76].

However, these activity costs are financed from public funds, i.e., taxes from the whole society and other state or regional revenues, which means that there may be a shortage of funds or the reduction of other social or development-oriented activities. Moreover, supporting clusters from public funds gives them an advantage over other enterprises also wanting/expecting to develop, but not being a part of cluster networks. So, there is a doubt about the equal treatment of all entities operating in a given sector/region. Another question is connected with the cost-benefit analysis, i.e., whether society has measurably more benefits from creating clusters than publicly funded expenditures.

Nevertheless, the EU underlines the trend of internationalization of clusters in accordance with Agenda 2030 development goals and global partnerships. As a result of changes taking place in the modern world and economy, a new stage in the development of clusters is promoted—the stage of foreign expansion and international cooperation. Several activities aimed at accelerating the process of increasing innovation and competitiveness of the European economy are realized in particular countries and regions in the EU.

Connections between clusters and sustainable development are not so precise and the increased interest in SD vs. clusters by academics is observed in the last decade. The links between business and SD refer to different types of innovations (sustainable innovation or eco-innovation) that have a reduced negative impact on the environment [77].

6. Conclusions

As a result of the undertaken actions in 2016–2017, about 150 cluster organizations across 23 European countries were involved. They developed and implemented joint strategies to support the internationalization of enterprises. Moreover, collaboration projects were implemented among EU clusters, as well as clusters and international organizations from outside the EU. Thanks to international cooperation and exchange of knowledge and experience, more and more clusters are aware of how they can influence the SD.

The selected examples of the clusters' contributions to sustainable development were presented. It is worth noting that clusters are the places where sustainability can be achieved. As evidenced from the research, clusters create synergies between businesses and universities, and research and reinforce links between them using existing strengths and opportunities. Clusters ensure the continuous development of new technologies resulting, first of all, from the possibility of cooperation among different entities and involvement in research of scientific units [78]. Clusters constitute an integral part of the innovative environment and play a significant function by providing a fast flow of information and effective acquisition of knowledge in the process of absorption of innovation. Functioning in a

network allows the use of highly specialized knowledge that is not available directly on the market. The development of high-tech sectors is one of the possible methods of strengthening the competitive position. Clusters are characterized by highly innovative entities and institutions, mainly due to the specific conditions of the high technology sector and the created environment. By participating in EU projects clusters meet SDGs [79,80], increasing their influence on the internal and external market.

Thus, the clusters can foster SD in various direct or indirect manners (promoting activities and education). The analysis carried out allowed the authors to formulate the following conclusions and recommendations:

- Clusters can play an important role in supporting the SD process,
- The last decade provided a lot of research on clusters and some of it refers to SD,
- The cluster policy in the EU contributes to strengthening the position of clusters in achieving SD,
- There are many initiatives in the EU aimed at cluster activity enhancement, and consequently at SD.

However, there are some challenges associated with clusters. For example, cluster companies gain a competitive advantage over other companies outside of clusters, which weakens the other companies and may lead to their collapse or industry change. This may contribute to an increase in the concentration of production, income, and resources in a particular place (cluster). Excessive concentration of capital and resources in an ever-smaller group of people and entities may lead to negative stratification of income and social inequalities due to the wealth, and this is contrary to the assumptions of sustainable development. There is also a risk that some clusters are created only to collect grants, and then their activity ends (the question that arises here is how many clusters are formed due to the desire to network activities, and how many to collect grants). Besides, not all clusters contribute to sustainable development (i.e., heavy industrial clusters) and it is a challenge for governments and management of clusters to encourage them to undertake sustainable activities.

It seems that future cluster policy should support particularly the development of those clusters that contribute to SD and energy efficiency through pro-ecological solutions, ensuring the effects on SD. It is important to elaborate on a cluster development strategy focused on SD by including a document/agreement for the entire structure, involving all members and referring to the principles of SD. Only in this way will SD become an objective of every particular company or organization in the cluster. The performed analysis indicated that there is a research gap in the field of the constant measurement of clusters in the context of SD.

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Abbreviations

SD	sustainable development
SDG	sustainable development group
CSR	corporate social responsibility
SMEs	small and medium enterprises
EU	European Union
TC	Telecommunication

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