한국경제지리학회지 제26권 제4호 2023(391~407)

Regional Innovation Clusters Policy in Germany: Focusing on the State Baden-Württemberg*

Young-Jin Ahn** · Ji-Yeung Gu***

독일의 지역 혁신클러스터 정책: 바덴-뷔르템베르크주를 중심으로*

안영진** · 구지영***

Abstract: The state of Baden-Württemberg has one of the strongest regional economies in Germany and is known as one of the most innovative regions in both Germany and Europe. Clusters have played a central role in innovation strategies. The article analyzes the current cluster policy in Baden-Württemberg. The Baden-Württemberg cluster policy has systematically supported the development of clusters, cluster initiatives, and state-wide networks. It has also provided increasing support to regions in developing and implementing innovation and networking activities. The cluster policy has specifically focused on promoting collaborations across different industries and technologies, as well as implementing measures for internationalization. The goal of the Baden-Württemberg state cluster policy was to professionalize cluster management and improve its quality. The cluster policy in Baden-Württemberg has adopted a bottom-up approach and utilized various measures and instruments to promote dialogue. The cluster policy in Baden-Württemberg has established a dedicated cluster agency responsible for developing strategies and implementing individual measures.

Key Words : cluster, cluster policy, cluster agency, Baden-Württemberg, Germany

요약: 바덴-뷔르템베르크주는 독일에서 가장 강력한 지역경제를 보유하고 있으며, 독일과 유럽에서 가장 혁신적인 지역 중 하나로 알려져 있다. 클러스터는 바덴-뷔르템베르크주의 혁신 전략에서 중추적 역할을 해 왔다. 이 논문은 바덴-뷔르템베르크주의 현대 클러스터 정책을 분석하는 것을 목표로 한다. 바덴-뷔르템베르크주의 클러스터 정책은 클러스터의 형성뿐만 아니라, 혁신 네트워크 활동을 체계적으로 지원해 왔다. 클러스터 정책은 특히 다양한 산업 및 기술 간의 협력 장려와 국제화를 위한 조치를 추진하는 데 초점을 맞추었다. 바덴-뷔르템베르크주의 클러스터 정책의 주요 목표는 클러스터 관리를 전문화하고, 클러스터의 품질을 제고하는 것이었다. 바덴-뷔르템베르크주의 클러스터 정책은 상향식 접근방법을 채택하여 대화를 촉진하기 위해 다양한 조치와 수단을 활용해 왔다. 또한 바덴-뷔르템베르크주의 클러스터 정책은 산업 클러스터 육성 전략을 개발하고 다양한 조치를 시행하는데 책임을 맡은 전담 클러스터 관리기관을 설치하여 운영해 오고 있다.

주요어: 클러스터, 클러스터 정책, 클러스터 에이전시, 바덴-뷔르템베르크, 독일

* This study was financially supported by Chonnam National University (Grant number: 2023-1137-01) (이 논문은 전남대학교 학술연구비 (과제번호: 2023-1137-01) 지원에 의하여 연구되었음).

** First Author: Professor, Department of Geography, Chonnam National University (전남대학교, jahn@chonnam.ac.kr)

*** Corresponding Author: Researcher, Korea Research Institute for Human Settlements (국토연구원, jiyeonggu@krihs.re.kr)

https://doi.org/10.23841/egsk.2023.26.4.391

1. Introduction

The importance of regional ecosystems has been highlighted in the dynamic global economy, where businesses form strategic alliances and position themselves strategically within value chains (Auerswald and Dani, 2017; Rodrik, 2018). These ecosystems extend beyond corporations and include business service providers, research and development institutes, innovation service providers, universities, and advanced training institutions. A key factor in achieving success is the concept of regional agglomeration, which is essential for the prosperous development of industry clusters (Kosfeld and Titze, 2014; Audretsch and Belitski, 2021).

Recognizing the importance of regional agglomeration, it is clear that understanding and utilizing clusters are essential for long-term economic growth and competitiveness. The cluster approach, as explained by Michael Porter in the early 1990s, has become a crucial tool in regional competitiveness policies globally (Porter and Enright, 1990; Ganske and Carbon, 2022). This approach suggests that companies and regions can greatly benefit from cluster formations, which are geographical concentrations of companies and innovation activities.

European policymakers adopted the cluster approach in the late 1990s, resulting in the proliferation of approximately 3,600 cluster initiatives across the continent. Beyond Europe, regions in North Africa, Asia, and Sub-Saharan Africa have also acknowledged the effectiveness of cluster strategies in enhancing regional competitiveness. As the global adoption of cluster policies continues to grow, it becomes increasingly important to reevaluate and clearly articulate the fundamental assumptions of cluster theory (Wilson *et al.*, 2022).

This study aims to address the multi-dimensionality of the cluster concept, recognizing the various ways in which cluster policies are conceptualized and implemented. The following sections critically analyze the development and current status of cluster policies in Germany, with a specific emphasis on the state of Baden-Württemberg as an interesting case study. This paper explores cluster theory and policy to enhance our understanding of the dynamics that drive regional economic development and competitiveness.

2. Theoretical Background: Clusters and Cluster Policy

The cluster concept has remained popular among academics, politicians, and economic development practitioners since the mid-1990s. According to Porter (1998: 197), clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (such as universities, standards agencies, and trade associations) in specific fields. These clusters compete with each other but also cooperate. This understanding of clusters emphasizes the significance of physical proximity and local networks of collaboration, competition, and knowledge sharing in the creation of innovation. Industrial

clusters are collaborative networks of economic and scientific actors in research and development (R&D) and production (cf. Martin and Sunley, 2003; Koschatzky, 2012). These clusters are typically located in close proximity to each other and specialize in related fields.

A cluster is a group of interconnected companies and associated institutions in a specific field that are located close to each other geographically. These companies and institutions are linked by commonalities and complementarities. Cluster constituents benefit from various types of positive location-specific externalities due to their close proximity in terms of geography and activities (Choo, 2013; Kiese, 2023). These externalities encompass access to specialized human resources and suppliers, knowledge spillovers, increased competition, and learning from close interaction with specialized customers and suppliers.

Cluster policy refers to government actions aimed at influencing the development of clusters, which are characterized by specific structural features. In recent decades, a variety of policy approaches have been referred to as cluster policies (Nam, 2004; Ketels, 2013; Rothgang *et al.*, 2021).

Cluster policy can be viewed as a type of industrial policy that focuses on specific regional characteristics and aims to develop existing building blocks, such as specialized agglomerations and networks, into clusters. It also aims to transform potential and latent clusters into functioning ones (Benner, 2012; Kiese, 2012). Cluster policies have two main objectives: to promote the concentration of firms and organizations within a specific sector or technological field, and to facilitate collaboration among geographically or technologically proximate firms in order to create positive network effects.

Cluster policy has become a preferred method for policy-makers in numerous countries. Today, clusters in Europe, North America, and other regions are widely recognized as effective tools for promoting regional economic development (Sedlmayr *et al.*, 2021). In the European Union, policy instruments were introduced in the early 1980s to develop innovative regional strategies. Explicit cluster policy programs have been in place since the late 1990s. The EU policy has aimed to establish common principles and improve framework conditions for clusters in all Member States, while also supporting internationalization (OECD, 1999; OECD, 2006; Borrás and Tsagdis, 2008).

In the USA, there are currently few well-funded long-term clustering initiatives in comparison to Europe. Additionally, there are very few efforts to connect related clusters within the US. Public interventions often prioritize enhancing framework conditions. Notable initiatives include the Massachusetts Medical Cluster, the Cumberland Emerging Technology Cluster, the New England Water Innovation Network, and the Research Triangle Clean Tech Cluster. Canada's significant experience with clustering initiatives began in Quebec, taking inspiration from France. Canada has recently launched a national cluster competition to select five Superclusters. The winners, including the Digital Technology Cluster, the Protein Industries Cluster, the Next Generation Manufacturing Cluster, the Scale AI Cluster, and the Ocean Cluster, will receive $950 million in

co-funding over five years (cf. Spencer, 2014).

There are various cluster development approaches in Asia. Some countries, such as China and Korea, have prioritized the development of Special Economic Zones (SEZs) and Industry Parks. Japan has a strong emphasis on research and development (R&D) clusters that tend to be isolated from businesses. In several countries, there is a shift from investing in physical infrastructure and providing financial incentives to individual businesses towards promoting the competitiveness of industry clusters (Choe and Roberts, 2011). This includes incentivizing specialized industries, fostering high-level skills development, and encouraging innovation (Sedlmayr *et al.*, 2021: 41).

3. Overview of Cluster Policies in Germany

Germany is a leading proponent of cluster policy and initiatives in Europe. Germany has a rich history of cluster funding and a strong emphasis on regional development. Cluster policy in Germany began in the mid-1990s, leading to the implementation of several support programs at both the national and federal state levels (Hantsch *et al.*, 2013). Numerous cluster initiatives have been launched in Germany at both the national and state levels over the past 30 years. Figure 1 provides an overview of recent cluster policies and initiatives in Germany.

At the national level, support has been provided by the Federal Ministry of Economics and Energy (BMWi) through its program "go-cluster: Exzellent vernetzt!" The "Leading-Edge Cluster Competition" is organized by the Federal Ministry of Education and Research (BMBF) as part of the Federal Government's Hightech Strategy (Stahlecker and Kroll, 2012; Sedlmayr *et al.*, 2019). According to a recent survey conducted by the Commission of Experts, over 430 clusters in Germany have received funding.

The Federal Ministry for Education and Research (BMBF) launched the "Leading-Edge Cluster Competition" in 2007 as part of the High-Tech Strategy to support innovation clusters

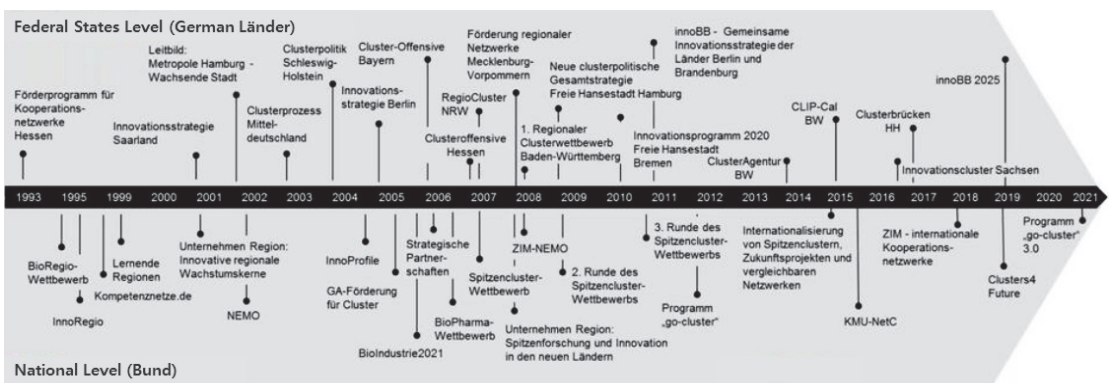

Figure 1. Overview of German Cluster Support Programmes

Source: Gerdes and Nögel (2021)

in cutting-edge technologies. In three rounds, 15 cluster initiatives were selected and subsidized with up to 40 million Euros to help them become leaders in their respective technology fields or to solidify their existing top positions (Ahn, 2014).

Another prominent example of cluster policy in Germany is the "go-cluster" program. The Federal Ministry for Economic Affairs and Energy (BMWi) has been implementing a cluster-policy measure since 2012. A total of 3.3 million Euros was spent during the first funding period until mid-2015. The BMWi reports that a similar amount of funding has been allocated for the current program period (mid-2015 to mid-2018). The aim is to promote cluster management and develop new cluster services. The "go-cluster" program has stimulated improvements in cluster management and has helped transform German clusters into highly effective international clusters.

The Federal Ministry for Education and Research (BMBF) has implemented the "Innovation Initiative for the New German Länder — Entrepreneurial Regions" since 1999. This initiative combines various funding initiatives and instruments that focus on different phases of the innovation process, while also considering the unique characteristics of innovation structures in East Germany (Burkhardt and Hillmann, 2009). Since 2016, the program has been expanded into a nationwide innovation funding concept in Germany to assist regions dealing with unique challenges of structural change. The exact total volume of cluster measures is challenging to determine, but it is estimated to exceed 40 million Euros annually (Ahn, 2018).

The Federal Ministry for Education and Research (BMBF) launched "Clusters4Future" (Zukunftscluster-Initiative) in 2019 as the latest development in German cluster promotion at the national level. The Federal Ministry for Education and Research is supporting research-intensive regions in Germany with innovative approaches to knowledge and technology transfer. Their goal is to establish the next generation of regional innovation networks (Künzel and Meier zu Köcker, 2015; Götz and Jankowska, 2017; Götz, 2021).

Furthermore, all 16 German federal states (Länder) have implemented the cluster concept in their economic, regional, and innovation policies, although to varying degrees (Kiese, 2013; Kiese, 2019). They have also initiated cluster initiatives across various technology sectors. The individual strengths of each region, including specific technology, economic and innovation competencies, as well as existing structures and unique characteristics, were considered. The individual programs at the federal and state levels include financial support for cluster management organizations, funding for innovation projects, training activities, and joint public relations.

One example of a highly specific cluster strategy implemented by regional policymakers is the "Cluster-Offensive Bavaria" in Bayern. This initiative, which will run from 2006 to 2023, aims to promote 19 clusters with an average funding of 2 million Euros (Ahn and Gu, 2022). Similarly, the state of North Rhine-Westphalia (Nordrhein-Westfalen) has identified 16 clusters, each with its own unique setup (Programm Exzellenz.NRW). Each office funded by the North

Rhine-Westphalian cluster policy received approximately 2 million Euros of public funding, similar to the situation in Bavaria (Kiese, 2012).

4. Cluster Policy in Baden-Württemberg

The state of Baden-Württemberg is renowned as one of the most innovative regions in Germany and Europe, particularly in the areas of energy and environment, automotive, ICT, and creative industries. Clusters naturally play a central role in the innovation strategy. The Ministry of Economy has implemented a robust Cluster program to enhance these competencies and create a tool for mapping these Clusters (Figure 2).

The state of Baden-Württemberg has approximately 110 clusters and cluster initiatives spanning 30 different sectors, including aluminum processing and packaging design. The diversity of sectors in Baden-Württemberg's economy reflects its multiplicity. Additionally, when examining the regional cluster map, it is evident that the clusters are dispersed throughout the entire state, showcasing the economic vitality of both urban and rural areas.

The state of Baden-Württemberg has implemented a cluster policy to promote the creation of sustainable and self-sustaining structures. This policy provides targeted support to the players within each cluster, assisting them in their ongoing development and professionalization. The cluster policy supports the development of clusters, cluster initiatives, and state-wide networks. It also assists regions in implementing innovation and networking activities.

Support for cluster initiatives and networks in Baden-Württemberg is divided into three action areas. There are tools available to support and promote the development of clusters and

Figure 2. Regional Cluster Map of the Baden-Württemberg
Source: The Ministry of Finances and Economics Baden-Württemberg (2012)

networks. These activities include promoting cluster excellence through information and networking. Grant programs provide financial support for projects and initiatives focused on innovation, networking, and regional development. The third action area aims to enhance the integration of cluster initiatives as key players in regional innovation policies (Ministry of Economic Affairs, Labour and Housing Baden-Württemberg, 2019).

1) Instruments for Promoting Clusters

The cluster policy in the state of Baden-Württemberg aims to establish sustainable and self-supporting structures. Additionally, it provides services to cluster actors that meet their needs for development and professionalization processes. All cluster policy actions are systematically aligned with each other. The cluster strategy of Baden-Württemberg is characterized by a strong focus on dialogue, a bottom-up approach, and the active involvement of all cluster actors.

Figure 3 illustrates the chronological order of measures and instruments used in Baden-Württemberg since 2006 to support cluster initiatives and state-wide networks under the targeted cluster policy. The image clearly demonstrates that the focus of the measures has shifted over time. Although the initial focus was on making the term "cluster" understandable and transparent in the cluster landscape of Baden-Württemberg, including its cluster initiatives and networks, the current emphasis is on implementing measures to enhance the professionalism of existing cluster and network management. These measures aim to support clusters in addressing the challenges posed by globalization and demographic change. This also involves preparing cluster management to handle tasks such as internationalization and implementing cross-sector innovation processes for the benefit of cluster actors.

The cluster policy in Baden-Württemberg is founded on engaging in dialogue with regional stakeholders and fostering cluster initiatives and statewide networks (Prognos AG, 2009). The approach used in security management is bottom-up, starting from the beginning. In the context of cluster funding, the term "bottom-up" refers to support service goals and measures that are not dictated solely by policy or the public sector ("top-down"), but instead are tailored to the specific needs and challenges of the regions and their companies. This principle applies to

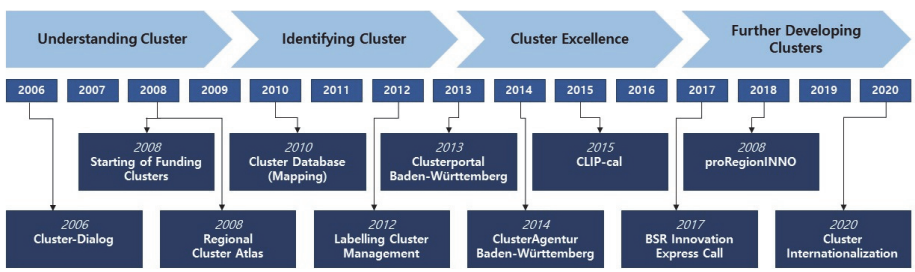

Figure 3. Baden-Württemberg Cluster Policy Instruments and Changing Requirements

Source: The Ministry of Economic Affairs, Labour and Housing Baden-Württemberg (2019)

both cluster initiatives, which tailor their thematic focuses and range of services to specific local circumstances, and to the cluster policy itself. Cluster policy instruments are developed through dialogue with cluster actors from different regions. This principle is also reflected in the concept of the "cluster dialogue" as a guiding idea for the state's cluster policy measures.

Cluster policy activities are divided into different formats to cater to specific target audiences within the cluster dialogue framework. These formats include Cluster Dialogue, Cluster Manager Meetings, and Cluster Forum (Ministerium für Wirtschaft, Arbeit und Wohnungsbau, 2013). The Baden-Württemberg cluster policy is discussed and developed through the cluster dialogue, addressing current questions and measures. In addition to the twelve regional cluster contacts, representatives from state agencies, chambers, and other organizations, such as "Steinbeis 2i GmbH" and "Baden-Württemberg International GmbH", participate in the cluster dialogue. The outcomes of the cluster dialogue and its working groups are incorporated into cluster policy objectives and government initiatives (Baden-Württemberg International, 2017).

The cluster manager meeting is held once a year. Representatives from all cluster initiatives listed in the Cluster Database, as well as state agencies and state-wide networks, are invited to the meetings. The state-wide cluster manager meeting served as a platform for exchanging cluster-specific information and experiences, as well as networking. The conference provides cluster managers with the chance to engage in discussions with each other and with cluster policy actors in the state, allowing them to address their challenges and problems and find shared solutions. The Ministry utilizes the conference to communicate important cluster policy messages and share outcomes from cluster dialogue working groups. The state-wide Cluster Forum was first held in 2007 and has been held biennially since then. The objective of the professional conference is to make a range of cluster-related topics accessible to a wider audience, especially representatives from the fields of economics, politics, and science. The participants have engaged in presentations and discussions on current topics, trends, and developments.

Baden-Württemberg remains one of the few regions in Germany and Europe that has meticulously documented all its clusters, cluster initiatives, and state-wide networks, providing transparency through detailed structural data. The initial Baden-Württemberg Cluster Atlas was published in 2008 to provide an overview of the cluster landscape in the region. The BW Cluster Portal serves as a modern web platform for cluster initiatives, state-wide networks, and regional organizations. The "RegioClusterAgentur" service provider offers information on clusters for cluster actors, companies, and the public. The heart of the Clusterportal BW is the web-based Cluster Database, which was introduced in 2010. It provides a comprehensive list of all cluster initiatives and state-wide networks in Baden-Württemberg, along with detailed descriptions (European Secretariat for Cluster Analysis, 2013; Ministerium für Wirtschaft, Arbeit und Wohnungsbau Baden-Württemberg, 2018).

The Cluster Database is a professional platform for showcasing cluster initiatives and serves as a comprehensive database for potential customers and stakeholders. The cluster database consists of around 110 state-wide networks and regional cluster initiatives in Baden-Württemberg. These networks connect the main actors in the state and its regions, and sometimes even consolidate funding measures in specific sectors. Current cluster-related developments are also available on the Clusterportal BW. Specific issues, such as the internationalization of cluster initiatives and their evaluation and performance assessment, are addressed using practical examples.

In order to ensure the long-term development of cluster initiatives in Baden-Württemberg, it is not sufficient to only establish cluster management structures. Instead, these areas require consistent improvement and professionalization. In July 2012, Baden-Württemberg became the first EU region to introduce the "Cluster Excellence Quality Label" at the regional level (Cluster-Exzellenz Baden-Württemberg). The Cluster label program has been launched based on the criteria and assessment process developed within the European Cluster Excellence Initiative (ECEI). The "Cluster Excellence Baden-Württemberg" label aims to professionalize management structures of cluster initiatives and promote quality in the region, with the goal of reducing the number of clusters.[1)]

The state of Baden-Württemberg has developed numerous cluster initiatives in recent years. The cluster policy aims to support and promote the development of cluster initiatives and state networks. This is particularly important in helping key actors in these innovations establish themselves at the intersection of economics, research, and policy. The "ClusterAgentur Baden-Württemberg (CA BW)" was established in 2014 to support and promote the development of cluster initiatives. It was funded by the European Fund for Regional Development (EFRE) and state

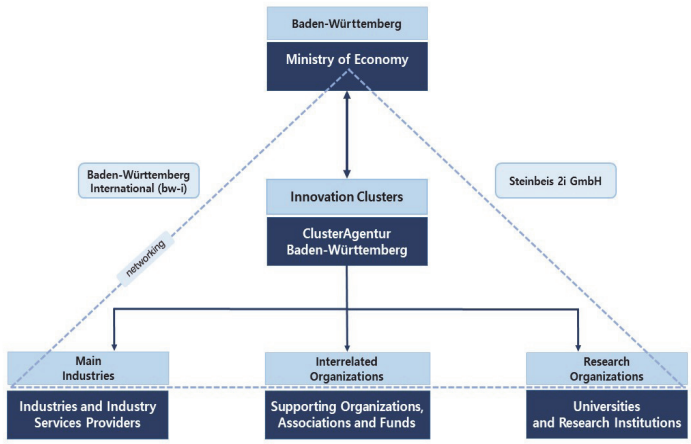

Figure 4. Cluster Structure of the Baden-Württemberg

Source: The Authors

funds. The "ClusterAgentur Baden-Württemberg" is a service provider for regional cluster initiatives, networks, and cluster policy in the state of Baden-Württemberg. The "ClusterAgentur BW" is an established tool that supports networking, cooperation, innovation, and the professionalization of cluster managements and initiatives (Figure 4).

2) State Funding Programmes to Support Clusters

The state government of Baden-Württemberg has systematically supported the development of clusters, cluster initiatives, and networks at regional, national, and international levels to enhance visibility. The Ministry of Economic Affairs, Labour, and Housing of the state of Baden-Württemberg offers programs that provide financial support for cluster and network management, as well as other innovation intermediaries. During the early years, financial support primarily focused on establishing and developing cluster management structures in regional cluster initiatives and state-wide networks.

During the previous EFRE grant period (2007~2013), approximately 7 million Euros from EFRE and state funds were allocated for this purpose. The discussion between cluster policy partners in the cluster dialogue resulted in a paradigm shift in funding, considering the comprehensive existing cluster structures that also cover technological target areas of state policy. Financial support in recent years has primarily focused on promoting innovative projects and measures by cluster organizations, as well as regional networking activities. The Ministry of Economy launched a competition in 2008 to strengthen regional clusters in Baden-Württemberg and activate additional regional innovation potential. The 36 submissions from various regions of the state encompassed a diverse range of industries and technology fields. These included microsystem technology, medical engineering, aerospace, packaging technology, biotechnology, automotive, surface technology, energy/environmental, and nanotechnology (Ministerium für Wirtschaft, Arbeit und Wohnungsbau Baden-Württemberg, 2018).

The Ministry of Economic Affairs, Labour, and Housing of the state of Baden-Württemberg primarily funds the development and testing of innovative projects and services through regional cluster initiatives and innovation platforms. This targeted support aims to assist cluster management. The funding was based on the 2014 "Verwaltungsvorschrift (administrative regulation: VwV) ERFE Cluster and Innovation Platforms — CLIP." The specific call is scheduled for 2020. A total of 2 million Euros were available for the EFRE funding period. The objective of this funding was to enhance collaboration among companies, universities, research institutions, and other stakeholders in clusters and networks within Baden-Württemberg's specialized industries. Collaboration within and between initiatives should be intensified, and new actors, especially small and mid-sized companies, should be engaged and incorporated into cluster initiatives. The goals include developing and disseminating new technologies while enhancing innovative capacity. The ultimate aim of CLIP funding was to enhance the professionalism of cluster initiatives and

state-wide networks, as well as their services, in order to establish and advance sustainable and resilient structures.

The Ministry of Economic Affairs, Labour, and Housing of the state of Baden-Württemberg has collaborated with Baden-Württemberg International GmbH to provide a grant program since 2009. This program supports the internationalization of clusters and networks in Baden-Württemberg. The grant program remains highly sought after and is constantly adjusted to meet the needs of cluster initiatives. Currently, there are several areas of support available for cluster internationalization, including developing internationalization strategies, participating in international programs for cluster and network managers, attending international trade fairs, and arranging for cluster experts to travel abroad.

The Baden-Württemberg cluster policy has become increasingly interconnected with the regional economy and innovation policy. Well-established cluster initiatives have been proven to be effective in implementing a proactive regional innovation policy. The concept of regional competitiveness through innovation and sustainability is also applied in the competition "RegioWIN" (Regionale Wettbewerbsfähigkeit durch Innovation und Nachhaltigkeit), which was initiated in 2013. The funding supported the development of regional strategy concepts in its initial phase. The second phase of the competition focuses on transforming these strategic concepts into regional development concepts, which include projects that are ready for implementation (Meier zu Köcker *et al.*, 2017).

Cluster initiatives can play a role as actors in the regional innovation policy. A total of 85 million Euros in funding (ERDF and state funds) is available for the RegioWIN competition (Häberle, 2016).[2] The competition's overall objective is continued in the new program "ProRegioINNO," which aims to activate regional innovation potential. The regional innovation capacity is strengthened through four core elements: promotion of regional innovation management, development of regional innovation infrastructure in densely populated areas, regional business forums, and new consulting services provided by the ClusterAgentur BW.

3) Structural Characteristics of Clusters

In Baden-Württemberg, a diverse and intricate cluster landscape has emerged in recent years. In recent years, over 110 cluster initiatives have been established in the state of Baden-Württemberg alone, with many of them spanning different sectors and regions. Cluster initiatives and state-wide networks in Baden-Württemberg have several differences. The sector and industry structures in which cluster actors operate, as well as regional economic structures, have a significant impact (Ministry of Economic Affairs, Labour and Housing Baden-Württemberg, 2019).

In order to organize the various clusters and cluster initiatives in the state of Baden-Württemberg, we analyze the cluster initiatives and statewide networks listed in the Cluster Atlas. The following indicators are considered when evaluating cluster initiatives and state-wide networks: the age of the initiatives, the size and composition of the cluster and network actors,

personnel capacities for cluster and network management, and financing. Because Baden-Württemberg has consistently updated the Cluster Atlas in recent years, the 2018 edition enables us to track developments from 2014 to 2018 and incorporate them into our analysis (Figure 5).

The effectiveness of a cluster initiative or state-wide network often correlates with its age, serving as an indicative factor of its performance capabilities. Generally, older and more established cluster and network management programs are presumed to outperform their younger counterparts. This is attributed to their proven track record in securing financing over an extended period and establishing sustainable structures. An illustration of this trend can be observed in the Baden-Württemberg Cluster Atlas, where the oldest cluster initiative dates back to 1974, contrasting with the most recent establishment in 2018. Notably, the average age of cluster initiatives and state-wide networks in Baden-Württemberg stands at ten years. Moreover, a significant percentage of these cluster initiatives have surpassed the four-year mark, further emphasizing the maturity and stability of the regional network landscape (Ministerium für Wirtschaft, Arbeit und Wohnungsbau Baden-Württemberg, 2018).

The Baden-Württemberg Cluster Database contains approximately 110 cluster initiatives, state-wide networks, and state agencies. The median value is used to provide an average number of members in cluster initiatives and state-wide networks, taking into account the wide deviations in their

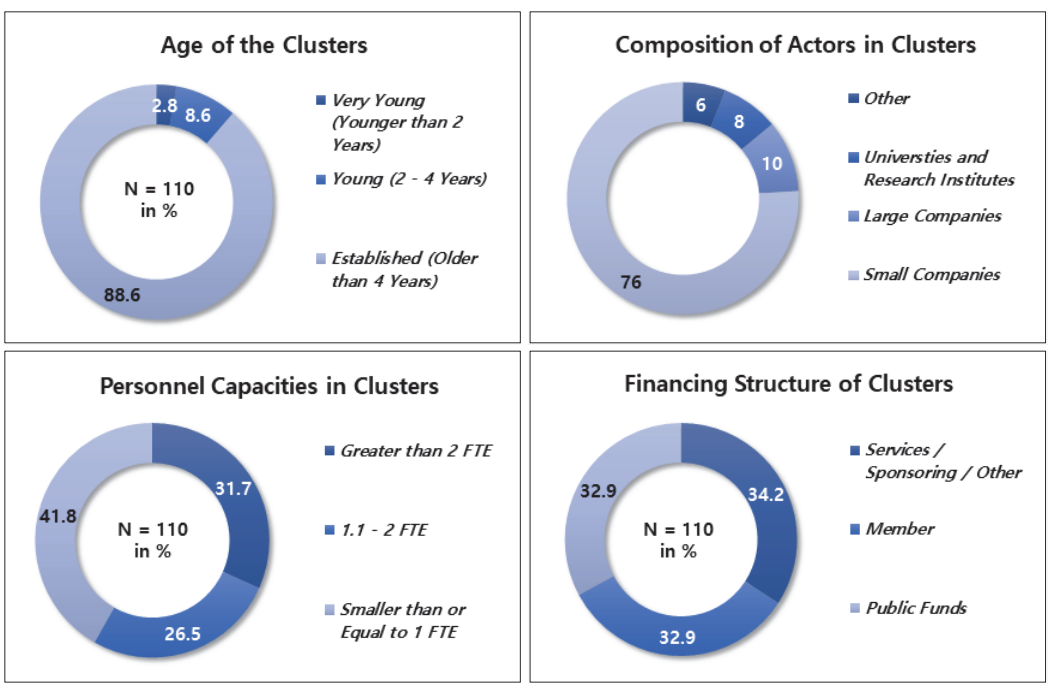

Figure 5. Structural Characteristics of Clusters in Baden-Württemberg

Source: The Ministry of Economic Affairs, Labour and Housing Baden-Württemberg (2019)

numbers. In Baden-Württemberg, there are 68 members per cluster initiative or state-wide network. The criteria for the GOLD Label of the European Cluster Excellence Initiative (ECEI) and the "Baden-Württemberg Cluster Excellence" quality label require a minimum of 40 actors to ensure the vitality of a cluster initiative. According to a 2018 survey, 73% of regional cluster initiatives have met the criteria for the "Baden-Württemberg Cluster Excellence" quality label by having over 40 members. In state-wide networks, the percentage of initiatives with over 40 members is relatively high at 77.3%. 18.2% of organizations have over 25 members, while only 4.5% have fewer than 25.

The effectiveness of cluster initiatives and state-wide networks relies heavily on the personnel capacities for managing clusters and networks. If management has enough personnel capacity, they can provide tailored and professional services that add value for cluster actors. Roughly one-third (31.7%) of cluster initiatives and state-wide networks have more than two full-time equivalent (FTE) personnel. The percentage of cluster initiatives is approximately. The full-time equivalent (FTE) percentage is relatively high at 41.8%.

Another interesting aspect pertains to the distribution of public and private financing in cluster and network management, with the average value in Baden-Württemberg standing at approximately 33%. Notably, cluster initiatives in this region rely heavily on member contributions, constituting around 33.0% of their financial support. Additionally, they leverage revenue from paid services, contributing approximately 34.2% to their overall financing structure. This dual approach reflects the diverse sources that sustain cluster initiatives in Baden-Württemberg, highlighting a balanced reliance on both member engagement and revenue-generating activities.

5. Conclusion

The state of Baden-Württemberg has become one of the most competitive and economically robust regions in Germany and Europe. Baden-Württemberg is a leading region in industrial high-technology and research and development. In recent years, Baden-Wuerttemberg has seen the development of a diverse and thriving cluster landscape. Many companies, research institutes, and universities are part of regional cluster initiatives and networks at the state level.

The Baden-Württemberg cluster policy has been a central element of the state's innovation policy (Ministerium für Wirtschaft, Arbeit und Wohnungsbau Baden-Württemberg, 2020). It aims to strengthen the innovative capacity of companies within the state, increase the competitiveness of the Baden-Württemberg economy, and position the state as an international economic hub. The cluster policy in Baden- Württemberg, like in other states, is situated at the intersection of established policy areas such as industrial policy, technology, research, and innovation policy.

Cluster initiatives and state-wide networks in Baden-Württemberg can be understood as cooperation alliances between competent partners from the industry, science, research, and politics which are characterized by close coordinated interaction and communication among each

other. Through this intensive and particularly early cooperation between companies and research institutions, the knowledge transfer is accelerated which lets companies benefit from the research findings so that they can market innovative products and services each more expediently and competitively. It also helps research institutions to effectively find partners in the industry to realize their research products. Cluster initiatives and networks are thus able to significantly increase the innovation capability of enterprises and to contribute to the profiling and positioning of the regions in global competition. In this aspect, cluster initiatives and networks that benefit from the spatial agglomeration of the stakeholders are more than a loose web of relations.

The cluster policy in Baden-Württemberg has adopted a bottom-up approach and utilized various measures and instruments to promote dialogue. The instruments or measures used in cluster policy aim to enhance networking, communication, and linkages among the various actors within the cluster. These include workshops, conferences, online platforms, newsletters, and regular meetings.

The cluster policy in Baden-Württemberg is implemented by a dedicated cluster agency, which is responsible for developing strategies and implementing individual measures. The professional management of this agency has played a central role in handling the thematic and organizational complexity of most supported clusters. Baden-Württemberg's cluster agency is a concrete instrument for achieving these goals. It serves as a service provider for cluster initiatives, statewide networks, and cluster policy within the state. The agency acts as a partner to cluster management and initiatives, assisting them in their continuous improvement efforts.

The cluster policy of Baden-Württemberg has achieved success beyond the state's borders. Cluster Initiatives from the state of Baden-Württemberg have consistently outperformed other competitors in national competitions organized by the German Federal Ministry of Education and Research (BMBF), including the Clusters of Excellence ("Spitzencluster") Competition and the Health Regions of the Future ("Gesundheitsregionen der Zukunft") Competition. Four out of the ten winners of the BMBF Clusters of Excellence Competition are either from Baden-Württemberg or have a connection to the state.[3] This is undeniable evidence of the success and effectiveness of the cluster policy measures implemented so far. They are also experiencing growing success in European grant programs.

Notes

1) These especially include the following networks and clusters, which currently hold the quality label "Cluster-Exzellenz Baden-Württemberg": Allianz Faserbasierte Werkstoffe Baden-Württemberg e.V.; automotive-bw; BioLAGO e.V. — the health network; Cluster Elektromobilität Süd-West; Medical Technology Cluster Mannheim; microTEC Südwest e.V.; Photonics BW e.V.; TechnologyMountains e.V.; Virtual Dimension Center Fellbach w.V..
2) Smart specialization is a concept that has been introduced in regional development policy by the European Commission by its communication "Regional Policy contributing to smart growth in Europe 2020". The European Commission has encouraged the design of national/regional research and innovation strategies for smart specialization as a means to deliver a more

targeted structural fund support focused on regional knowledge strengths and a strategic and integrated approach to harness the potential for smart growth and the knowledge economy in all regions. So, Research and Innovation Smart Specialization Strategy has turned into a policy concept thanks to the strong demand for more effectiveness in European Union cohesion policy in order to transform productive structures towards higher value-added activities. With smart specialization strategies, all german regions have been trying to identify their innovation niches, based on regional industrial clusters (Directorate-General for Research and Innovation of European Commission, 2013; Foray, 2014).

3) In the leading-edge cluster competition, four of Baden-Württemberg clusters were rewarded: biotechnology cluster Cell-based and Molecular Medicine Rhein-Neckar — BioRN; Forum Organic Electronics in the Metropolitan Region Rhein-Neckar; microTEC Southwest — The Cluster of Innovations in Freiburg; Elektromobilität Südwest in Stuttgart, as well as the CyberForum e.V. in Karlsruhe with the cross-state excellence cluster Software Innovations for the Digital Enterprise — Darmstadt, Kaiserslautern, Karlsruhe, Saarbrücken, Walldorf.

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Correspondence: Ji-Yeung Gu, Urban Research Division, Korea Research Institute for Human Settlements, 5 Gukchaegyeonguwon-ro, Sejong-si, 30147, Korea, Tel: 82-44-960-0675, E-mail: jiyeonggu@krihs.re.kr

교신: 구지영, 30147, 세종특별자치시 국책연구원로 5, 도시연구본부, 전화: 044-960-0675, 이메일: jiyeonggu@krihs.re.kr

최초투고일 2023년 12월 06일
수 정 일 2023년 12월 15일
최종접수일 2023년 12월 18일