

International cooperation as a success factor for the industrial transformation process in the automotive sector

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Executive Summary

Baden-Württemberg's automotive industry cluster is one of the leading European hubs for automotive engineering and manufacturing of vehicles and components. Similar to many automotive industry clusters worldwide, Baden-Württemberg's automotive manufacturers and suppliers have been confronted with significant economic, geopolitical and technical changes throughout the last years. Electrification and digitalization in the transport and mobility sectors are advancing with increasing speed while recent geopolitical developments, interruptions in supply chains and rising energy prices represent major challenges for the sector. To maintain economic strength and employment, it is of central importance for an automotive industry cluster such as Baden-Württemberg to manage the industrial transformation process in the automotive sector strategically and to provide suitable support measures. Next to strategies in the fields of decarbonization, digitalization and the design of resilient supply chains, a suitable approach to international cooperation and business development is considered to be one of the key factors to successfully manage the transformation process.

Keywords: global, government, market development, province, supply chain

1 The industrial transformation process in Baden-Württemberg's automotive sector

For the State of Baden-Württemberg, located in the south-west of Germany, automotive engineering and manufacturing is one of the key industry branches and central determinant for economic success and employment in this region. Out of 11.1 million inhabitants, about 470,000 people, are directly or indirectly employed in the automotive industry cluster and the service branches associated [1]. The automotive industry cluster comprises three OEM manufacturing vehicles in Baden-Württemberg as well as more than 1,000 automotive suppliers – from international system suppliers to specialized and highly innovative SME. In 2020, Baden-Württemberg's automotive ecosystem generated an annual turnover of more than 115 billion Euro [2] and represents about 25% of Germany's entire automotive production. Baden-Württemberg's automotive sector is highly connected to international markets with more than 75% of vehicles and components being exported, mainly to the U.S., China, the United Kingdom, South Korea and France [2].

Similar to many automotive industry clusters worldwide, Baden-Württemberg’s automotive manufacturers and suppliers have been confronted with significant economic, geopolitical and technical challenges throughout the last years. Electrification and digitalization in the transport and mobility sectors are advancing with increasing speed. Emission standards set by the European Union as well as timelines to phase out internal combustions engines in many European countries are triggering the shift towards alternative drive train technologies and accelerate the industrial transformation process. Digitalization, automation and the increasing relevance of data and software in the entire mobility sector at the same time require new expertise within automotive companies as well as new forms of cooperation across sectors.

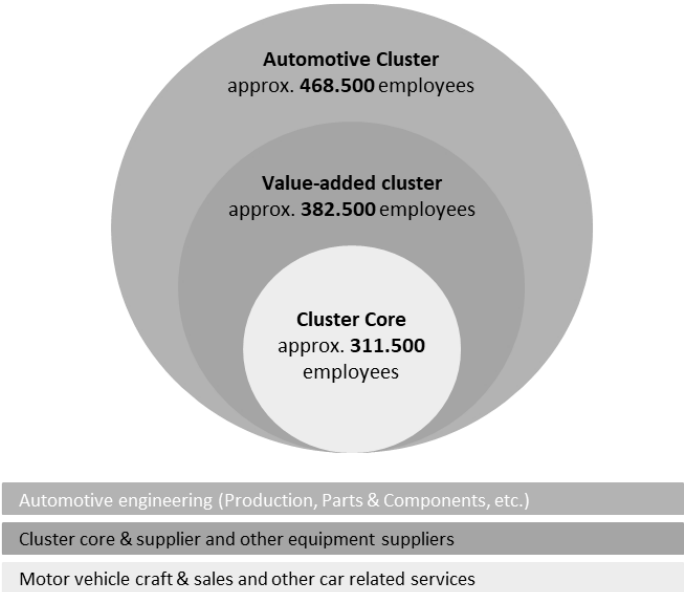


Figure 1: Structure of Baden-Württemberg automotive Cluster (source: e-mobil BW, based on Strukturstudie BWe mobil 2019)

This generates enormous economic potentials for OEM and automotive suppliers located in Baden-Württemberg as new drivetrain technologies and battery systems will have an increasing importance in the market. At the same time, the technological transformation in the automotive sector also bears significant risks for Baden-Württemberg as an industrial location. Phasing out traditional internal combustion engine technologies and shifting the focus to electrified drivetrains and interconnected vehicles will have important impacts on employment and workforce. While new jobs can be generated in the fields of electric components and digital solutions, powertrain-dependent production plants may be highly affected by the fade-out of internal combustion engine technology [1].

2 The industrial transformation process in Baden-Württemberg’s automotive sector

In order to support its regional automotive industry cluster in the transformation process, Baden-Württemberg’s State Government has initiated a Strategic Dialogue for the Automotive Sector in Baden-Württemberg (SDA), a systemic cooperation format between the political level and automotive experts from industry and academia [3]. Established in 2017, the initiative has enabled systematic networking and cooperation across ministries, industries and sectors as well as the civil society to lead one of the state’s key industries into a positive future that provides jobs and secures the living of many people. During the last five years, more than 300 experts in different focus areas have developed strategies for the future of the automotive sector and more than 50 projects have been initiated to illustrate innovative solutions for future transportation. Since its strategy realignment in 2022, the SDA has been working along the focus topics

“Vehicles”, “Data” and “Energy” in structures that are even more agile and powerful to scale the results of the preceding, practice-oriented research [4].

This systemic cooperation format of the SDA is complemented by targeted cluster networks that support knowledge transfer, initiate joint research projects and offer a targeted support for small and medium enterprises in the transformation process to electrification and digitalization. With more than 200 partners from industry, universities and research institutes, Cluster Electric Mobility South-West, founded in 2007 by major industry players from Baden-Württemberg, is one of the most significant innovation networks on future transport solutions in Europe. It brings together the unique expertise on electrification and digitalization as well as automotive manufacturing technologies in Baden-Württemberg. The strategy-based integration of competences from the fields of automotive engineering, energy technology, information and communication systems as well as manufacturing technologies creates unique synergies and enables an important cross-sector knowledge transfer. The cooperation between international industry players, innovative small and medium-sized enterprises and renowned research institutes is a key factor for the technological transformation to future transport solutions in Baden-Württemberg [5].

Hydrogen and fuel cell technology represent a second important field of action in designing the future of Baden-Württemberg’s automotive industry cluster. In December 2020, the State Government of Baden-Württemberg passed an own hydrogen roadmap to enable the market ramp-up of hydrogen and fuel cell technology and develop the state into an internationally leading location in this technology field. It focusses on three key areas: supply of hydrogen, consumers and manufacturing capacities for key components. With its focus areas, Baden-Württemberg’s hydrogen roadmap aligns with similar strategies on the federal and European level and supports their targets for hydrogen as future source of energy in the transport sector and other fields of application [6]. The implementation of Baden-Württemberg’s hydrogen roadmap is supported by the newly-created Platform H2BW which connects all relevant players from industry, academia and the public sector along the value chain and supports networking, knowledge transfer and coordinating of funding programs in cooperation with the state administration [7].

In close collaboration with Platform H2BW, Cluster Fuel Cell BW represents the central innovation network for hydrogen and fuel cell technology in Baden-Württemberg and connects major corporations as well as highly innovative small and medium-sized companies from the automotive, energy and machinery sectors with renowned research institutions. Established in 2013, Cluster Fuel Cell BW today comprises more than 200 stakeholders from industry, academia and the public sector that bundle their activities in five strategic fields: (1) hydrogen production and infrastructure, (2) transport, (3) energy, (4) production and (5) education. Similar to Cluster Electric Mobility South-West, a major goal of all members in Cluster Fuel Cell BW is to implement joint R&D projects in the field of hydrogen close to the market in order to advance the industrialization process towards mass production of mobile and stationary fuel cell technologies [8].

3 Baden-Württemberg’s automotive industry in the international context – the need for reliable and resilient supply and value chains

Baden-Württemberg’s automotive sector is highly connected to international markets with more than 75% of vehicles and components currently being exported, mainly to the U.S., China, the United Kingdom, South Korea and France. This strength in export business is based on the specialization of Baden-Württemberg’s automotive manufacturers in the premium vehicle segment where manufacturers can generate a relatively high profit margin in comparison to other market sectors [2]. In 2021, automotive manufacturers and component suppliers exported goods with a volume of 48.8 billion Euro to international markets which corresponds to 22% of all exports from Baden-Württemberg [9]. At the same time, vehicles as well as vehicle components with a value of 22.7 billion Euro (11.5% of total imports) were imported into Baden-Württemberg [10]. The significant trade surplus underlines the competitiveness of Baden-Württemberg’s automotive products in the world market. A more detailed analysis of trade values furthermore reveals that the OEM in Baden-Württemberg are generally more export-oriented than the mostly small and medium-sized automotive suppliers [2].

During the last three years, however, the Covid-19 pandemic, the war in Ukraine and other geopolitical developments, have impressively illustrated the vulnerability and dependency of Germany’s automotive

sector on international supply and value chains. The highly efficient and cost-optimized production in the automotive industry with its strong implementation of just-in-time and just-in-sequence production as well as minimized warehouses turned out to be particularly prone to such interference. As a result of the pandemic and shortages chip supply, domestic production decreased by 25 % in 2020 and another 12 % to 3.1 million cars in 2021 –the lowest level of production since 1975 [11]. At the same time, automotive manufacturers are extending their production capacities globally, especially in Asia, while Germany is becoming less relevant as manufacturing location. In 2020, only 26% of those vehicles sold by German OEM were still produced in Germany [2]. This development also strongly affects small and medium-sized automotive suppliers which are a major building block of Baden-Württemberg’s automotive ecosystem.

While the automotive sector in Germany and Baden-Württemberg was able to recover relatively fast after former economic crises, the current situation seems to be more persistent due to a number of profound structural changes in the economic and technological context [2]:

- focus on production of premium vehicles at German facilities, relocations in the volume segment to international production facilities, including corresponding production losses at German supplier locations;
- continuing internationalization with the establishment of regional production networks in Europe, North America and Asia (local-for-local), including the need to internationalize for suppliers (follow- your-customer) with employment losses at German locations;
- increasing international competition for critical materials, increasing dependency on China;
- digitalization towards connected vehicles and automated driving;
- decarbonization of the vehicle and the entire supply chain.

A study carried out in 2022 by DLR Deutsches Zentrum für Luft- und Raumfahrt and IMU Institut in close cooperation with e-mobil BW underlines the need for automotive clusters to define strategies to ensure reliable and resilient supply and value chains in the context of these economic, geopolitical and technological trends. It underlines that a suitable strategy for internationalization will be one of the key factors, next to strategies in the fields of decarbonization, digitalization and support for SME, to successfully manage the transformation process and maintain international competitiveness [2].

Successful internationalization will increasingly require a broad presence of OEM and small and medium-sized automotive suppliers in global markets. It will not only ensure the participation of Baden-Württemberg companies in future growth sectors, such as electrification, battery technology or hydrogen fuel cell systems, but also contribute significantly to coordinate reliable and resilient supply chains. Next to a strong presence in international markets, the analysis recommends to establish a continuous flow of information about economic, political and technological developments in global markets as an essential tool for the automotive ecosystem to prevent future disruption of automotive production and component supply [2]. Especially for small and medium sized companies, which represent a major core of Baden-Württemberg’s automotive cluster, building resilient supply and value chains is key for a successful role in the transformation process but also a significant challenge in the context of recent developments.

4 Strategic approach to internationalization in Baden-Württemberg’s automotive industry cluster

Due to its strong involvement in international markets and significant rates of import and export for automotive components and products, the regular consideration of strategic aspects of internationalization and continuous information about economic, political and technological developments worldwide is vital for Baden-Württemberg’s automotive industry cluster. In order to ensure a successful transformation process towards future mobility solutions, automotive clusters and innovation networks do not only have to define implement technology roadmaps for electrification and digitalization as well as ensuring robust supply chains but also need to define comprehensive internationalization strategies that analyze their individual role in the global technology network and identify major competitors from a technology-driven perspective.

Already in 2011, Cluster Electric Mobility South-West, in close dialogue with its partners from industry, academia and the public sector, defined a dedicated internationalization strategy that continuously monitors

the development and deployment of future transport technologies worldwide, identifying relevant market competitors and technology hubs and recommending specific activities and measures. This strategy is based on a scientific analysis of the international development of electric mobility in Asia, Europe and North America by the Fraunhofer Institute for Systems and Innovation Research ISI (published in 2015) [12] as well as a continuous monitoring of international trends through delegation visits, conference and trade fair participations and expert meetings by cluster management and cluster members from industry and academia. To ensure this continuous flow of information and strategic coordination of internationalization activities, a working group with members from industry, academia and public institutions has been established to advise the cluster management on suitable measures to foster international trade relations and cross-border technology cooperation. Regularly monitoring relevant changes in the international political, economic and technological landscape, the working group carries out a continuous strategic process that examines the international priorities and target regions of the cluster and, if necessary, reformulates its internationalization strategy.

The internationalization strategy of Cluster Electric Mobility South-West currently comprises the following regions in Europe, North America and Asia:

- Asia: China (with special focus on Shanghai Beijing, Shenzhen, Nanjing), Japan, Korea
- Europe: Belgium (with special focus on Flanders), Finland (with special focus on Oulu), France (with special focus on Auvergne-Rhône-Alpes, Grand Est, Paris/Ile-de-France), Italy (with special focus on Lombardy), Netherlands (with special focus on Noord-Brabant), Norway (with special focus on greater Oslo region), Spain (with special focus on Catalonia), Sweden (with special focus Gothenburg, Lund), United Kingdom (with special focus on Midlands, Wales)
- North America: Canada (with special focus on Ontario, Québec), U.S. (with special focus on California, Michigan, Oregon)

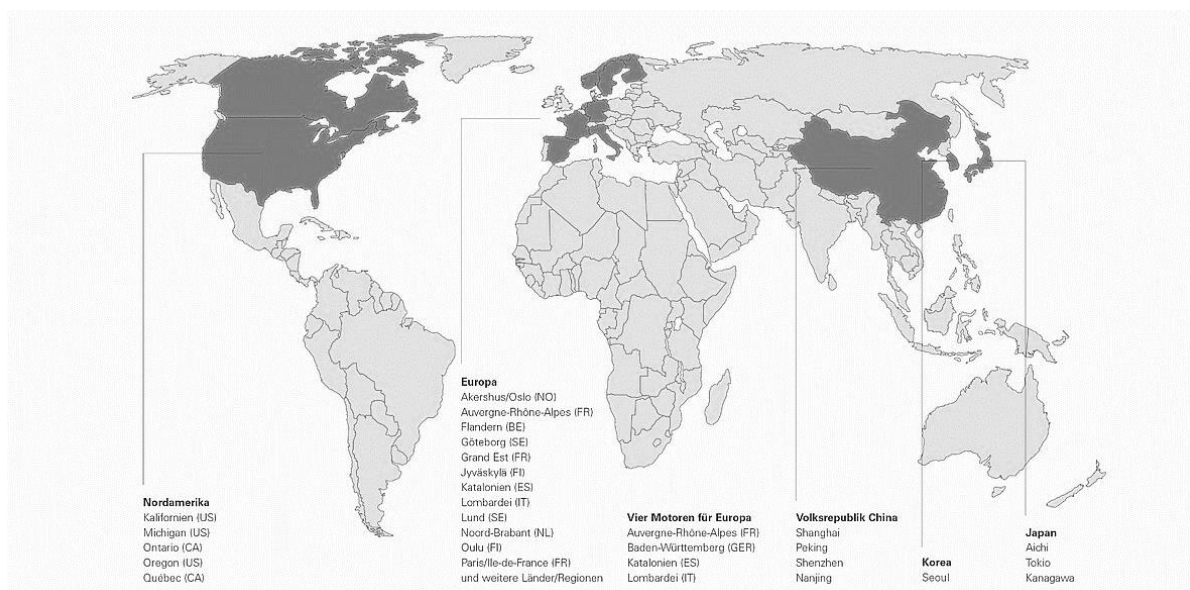


Figure 2: International focus regions (source: e-mobil BW)

Due to the rising economic and technological significance that hydrogen and fuel cell technologies have gained during the last years, the network partner in 2020 decided to include this field of technology into the internationalization strategy. In a first step towards strategically targeted activities, an analysis of perspectives and opportunities for hydrogen and fuel cell technology in international markets has been carried out in cooperation with Prognos AG (document not publicly available) [13]. The following international locations have been identified as primary focus regions for activities on hydrogen and fuel cell technology:

- China
- France

- Japan
- United States (with a special focus on California)

In a mid- to long-term perspective, however, additional focus regions will have to be considered as partners for cross-border technology cooperation, export markets for products from Baden-Württemberg or providers of green hydrogen. Therefore, the following focus regions in Asia, Europe and South America will be continuously monitored and evaluated on future potential for cooperation in the internationalization strategy:

- Asia: India, South Korea
- Europe: United Kingdom (with special focus on Scotland), Spain
- South America: Brasil

Together with partners from industry, academia and public sector, a more detailed internationalization strategy for the sectors of hydrogen and fuel cell technology that considers knowledge management on international developments as well as cross-border cooperation will be worked out in the context of Cluster Fuel Cell BW and Platform H2BW.

5 Results and learnings

On the basis of these strategic guidelines for international cooperation and initiation of business contacts, the State Agency for New Mobility Solutions and Automotive in Baden-Württemberg, e-mobil BW and together partner organisations have developed a broad portfolio of activities that support network partners from industry and academia in initiating and deepening their international business and cooperation relationships. This includes:

- delegation visits for companies, universities and research institutions
- initiation of international cooperation projects
- participation in international trade fairs and congress events
- matchmaking events and cooperation platforms
- information events on international business and cooperation opportunities

The business and technology monitoring with partners from industry, universities and research organisations as part of international delegation trips represents one of the most central components of the internationalization activities within Baden-Württemberg's automotive cluster. Since 2011, all technology and research locations identified in the internationalization strategy and a number of additional locations have been visited for business and cooperation initiation as well as more in-depth discussions on specific cooperation activities. A continuous documentation of the outcomes has resulted in a comprehensive knowledge on the international developments in the automotive as well as hydrogen and fuel cell technologies sectors. The assumptions for relevant technology and research locations identified in the development of the internationalization strategies for Cluster Electric Mobility South-West and Cluster Fuel Cell BW have been confirmed.

At the same time, it became clear that it is important to regularly monitor international economic, political, technological developments and to evaluate cooperation and business opportunities in additional countries and regions. During the last years, Cluster Electric Mobility South-West has established new cooperations with clusters and networks in Scandinavia, especially in Finland and Sweden, with a strong focus on IT and data solutions for future transport. After an interruption following Brexit, also UK is again becoming more relevant for stakeholders in Baden-Württemberg with a number of renowned activities in the fields of future propulsion technologies as well as connected and automated mobility.

At the same time, the international development in the hydrogen and fuel cell sectors is currently very dynamic and will lead to the inclusion of new target regions into the internationalization strategy. As the internal analysis with Prognos AG [13] already shows, it will be important to consider a close cooperation and exchange with further regions in Europe, South America and Africa with a high potential for the use of renewable energies for electrolysis as well as technology cooperation. Specific business and factfinding missions to Andalusia, Scotland as well as Brasil and Chile have already established initial cooperation contacts regarding future supply of green hydrogen as well as technology cooperation with component and system suppliers for electrolyzers and fuel cell systems from Baden-Württemberg.

During the past years, the internationalization activities established by Baden-Württemberg's automotive cluster organisations have created a broad international network. In this context, exchange with European technology and research locations has proven to be particularly viable. Especially, SME which are in the focus of the internationalization strategy and need most support in building up international business and cooperation contacts, have so far shown most interest in exchange with companies, research institutions and networks in neighboring European countries, since there is geographic proximity and formal as well as legal barriers are perceived to be lower. During the last years, there has also been a shift from a focus on international factfinding towards more business oriented internationalization activities among the SME in the cluster network.

In order to support small and medium-sized cluster members in creating international cooperation activities and provide a learning space on cross-border project engagement, Cluster Electric Mobility South-West in 2017 has initiated the cross-border project "German-French alliance for innovative mobility solutions (AllFraTech)" with its French partner cluster CARA to enhance the research and innovation partnership among the mobility-related innovation networks in Baden-Württemberg and Auvergne-Rhône-Alpes. Based on the long-term exchange and cooperation relationship between both clusters, a common strategy for long-term technological cooperation with a focus on the targeted support of SME in cross-border cooperation was initially developed. Based on the jointly developed cooperation strategy, two cross-border research and development projects with the participation of companies, universities and research in-house directions from both regions have been carried out between 2019 and 2021. These technology-oriented projects were supplemented by joint workshops and mutual delegation visits. The activities of the cooperation project were funded by the Federal Ministry of Education and Research (Germany) and the regional funding scheme "RDI Booster" (France).

The State Agency for New Mobility Solutions and Automotive in Baden-Württemberg, furthermore supports these internationalization activities with its engagement in initiatives such as the Four Motors for Europe. This network of strong European economic regions has been initiated in 1988 by the governments of Auvergne-Rhône-Alpes (France), Baden-Württemberg (Germany), Catalonia (Spain) and Lombardy (Italy) as a basis to enhance cross-regional European exchange. In 2010, the Four Motors for Europe established a regular dialogue of innovation clusters and networks in the field of future transport technologies. The working group "Electric and Hydrogen Mobility" brings together experts from cluster networks, public institutions and research institutes from Auvergne-Rhône-Alpes, Baden-Württemberg, Catalonia and Lombardy as well as associated partners from Flanders (Belgium) and Wales (United Kingdom). Furthermore, representatives from Baden-Württemberg are involved in the recently created Automotive Regions Alliance (hosted by European Committee of Regions) and initiatives for hydrogen and fuel cell technology such as the European Hydrogen Valleys Partnership.

The internationalization strategies and activities for Baden-Württemberg's automotive cluster are regularly evaluated and updated based on a continuous monitoring in the following focus areas:

- structural and thematic changes within the cluster and its innovation networks
- changes and developments in the relevant technology fields (automotive business, electrification, digitalization, hydrogen, fuel cell technology, etc.)
- economic, political and social developments in the international context (international trade relations, trade barriers, etc.)
- new international contacts and cooperation interests with relevance for the automotive and mobility cluster in Baden-Württemberg (including cooperation interests of Baden-Württemberg's State Government)

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Presenter Biography



Stefan Büchele studied Political Sciences and English Language at the University of Stuttgart. At e-mobil BW, he is responsible for the field of international cooperation. His focus is on the exchange with international cluster networks and the initiation of cross-border projects with partners from industry and academia.