FORSCHUNG AKTUELL
2/2015

Research-driven Clusters & Green Mobility – A Cross-Regional Comparison

Alexandra David, Judith Terstriep & Jessica Welschhoff

Institut Arbeit und Technik

To the Point

- The improvement and sustainability of urban transport systems is a necessity for quality of life, wellbeing and safety of citizens.
- Germany, France, Norway, the UK, the Netherlands and Sweden are anticipated to be the top six European countries for Battery Electric Vehicles (BEVs) on the road in 2020.
- In total 4 regional and 24 national electromobility-related RTDI policy measures have been identified for Austria, Czech Republic, France, Hungary, Germany and Switzerland, comprising top-down and bottom-up initiatives.
- Research-driven clusters (RDCs) entail a high potential to stimulate electromobility-related RTDI activities at the regional level and increase the competitiveness of regional economies.
- Electromobility is expected to become a central topic in several regions. Hence, it is even more important for regions engaging in this field to specialise. «Smart Specialisation Strategies» (S3) can be viewed as promising approach for «specialised diversification» that exploits the economies derived from related variety.

Zentrale Einrichtung der Westfälischen Hochschule Gelsenkirchen Bocholt Recklinghausen in Kooperation mit der Ruhr-Universität Bochum

Westfälische Hochschule

RUHR UNIVERSITÄT BOCHUM RUB

WHY DO WE NEED ELECTROMOBILILTY?

12% of total EU emissions of carbon dioxide (CO_2) stems from car.

Contrary to many other sectors, greenhouse gas emissions of the transport sector are still increasing, and are predicted to grow further. At the same time a high and increasing volume of traffic, large numbers of commuters, together with congestions is a growing problem for many cities and regions. Forasmuch, the improvement and sustainability of urban transport systems is a necessity for the quality of life, wellbeing and safety of citizens.

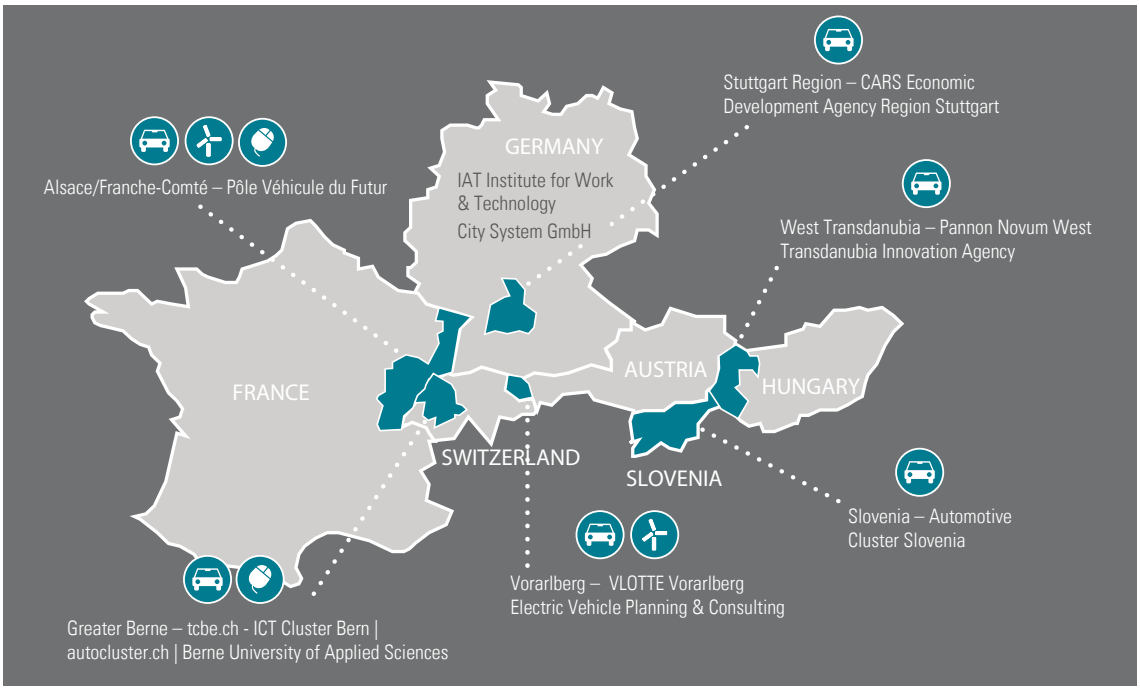
«Electrification of transport, i.e. electromobility, means the embedding of electric vehicles in a wider urban mobility concept.»

In the coming years, electric vehicles (EVs) could play a significant role in the paradigm shift towards sustainable mobility. If this vehicles run on renewable energies, they could substantially contribute to reduce CO_2 as well as noise emissions. They offer promising opportunities for the future development of «green mobility» solutions for cities and regions. However, the uptake of e-mobility depends on

- Appropriate regional infrastructures;
- A shift in mobility patterns from vehicle «ownership» to «usage»;
- Close cooperation between the three e-mobility constituent sectors «Automotive», «Green Energy» and «Information & Communication Technologies» (ICT);
- Intelligent vehicle-use concepts embedded in the urban transport environment.

Against this background the three-year FP7 project **ELMO^S – Electromobility Solutions for Cities and Regions** – promoted more sustainable mobility through the development of electromobility solutions for cities and regions. The project delivered concepts for a better exchange of electromobility knowledge at regional and EU level, concepts for new business models and cross-border field tests. Pooling, connecting and applying so far scattered knowledge in the field of electromobility played a pivotal role in advancing regions' capacities to drive sustainable transport-related economy for the sake of smart and sustainable growth. Aiming at integrating research agendas and conflating so far isolated pilot actions in transnational electromobility solutions and cross-border field trials, 10 partners from 6 neighbouring regions including 6 research-driven clusters (RDCs) joined forces. The moderate size of the consortium along with the geographic and cultural proximity is of great value: The four regions Alsace Franche-Comté, Greater Berne, Stuttgart and Vorarlberg offer

a strong cultural and historical coherence, both in mentality as well as e.g. in the nature of academic life, performance and citizens mobility behaviour. Likewise, this applies to the two eastern regions Slovenia and West Transdanubia. Following an integrated innovation approach that combines product and process innovations with service, design and social innovations, is only be achieved in a close regional and transnational collaboration of RDCs enterprises, public authorities and users while making use of synergies and complementarities between the regions. To fully unfold the potential for «smart specialisation» through cross-regional collaboration, one needs to take into account RDCs' different degrees of maturity, varying regional infrastructures and earlier experiences in the field of green mobility solutions. A first step has been taken by gathering and analysing available knowledge in the regions and RDCs competitiveness and innovativeness, mapping regional RTDI infrastructures, financial actors and instruments as well as related policies and action plans.



The subsequent paper presents selected results from the comparative analysis of the participating regions and is structured as follows: First the state of play in electromobility is illustrated. Next the regions' profiles are introduced, followed by the discussion of electromobility-related policies at the different governance levels and RDCs' role in driving green mobility solutions. Finally the potential for smart specialisation is discussed.

ELECTROMOBILITY – STATE OF PLAY

The electrification of transport (electromobility) and burgeoning of EV industry cannot be understood by simply looking at cars. Rather, it is the interplay of various private and public stakeholders from automotive, energy and ICT industry, research organisations to public authorities and policy makers as well as citizens.

AUSTRIA

EV Target	EVSE 2011	EVSE Target
250'000	489	12'000

FRANCE

EV Target	EVSE 2011	EVSE Target
2'000'000	1'600	97'000

GERMANY

EV Target	EVSE 2011	EVSE Target
1'000'000	1'937	150'000

HUNGARY

EV Target	EVSE 2011	EVSE Target
-	7	7'000

NETHERLANDS

EV Target	EVSE 2011	EVSE Target
200'000	1'700	32'000

SLOVENIA

EV Target	EVSE 2011	EVSE Target
14'000	80	3'000

SPAIN

EV Target	EVSE 2011	EVSE Target
2'500'000	1'356	82'000

UK

EV Target	EVSE 2011	EVSE Target
1'550'000	703	122'000

Since 2010, European original equipment manufactures introduced 16 EV models driving the growth of EV market and a greater variety of EV models is being offered each month. For example, Audi, BMW, Mercedes Benz, Volkswagen, Citroen, Peugeot, Volvo, Skoda and Lada, plan to release 15 new models between 2013 and 2016 (Proff & Kilian, 2012).

During 2011, German drivers purchased 1'858 EVs, 1'796 were sold in France, 1'547 in Norway, and 1'170 were purchased in Britain (EC 2013, Beltramello 2012). According to the Automotive Industrial Data (AID), EVs only made up 0.23% of new car sales in Europe in the first quarter of 2013. Those numbers make EVs only a small fraction of the vehicles on the roads today.

Although the current EV market is small and ambitious policy targets are most likely to be missed, the outlook is encouraging. For example, Pike Research forecasts 1.8 million BEVs to be on Europe's roads by 2020, along with 1.2 PHEVs and 1.7 HEVs. Germany, France, Norway, the UK, the Netherlands and Sweden are anticipated to be the top six European countries for BEVs on the road in 2020.

Presently, the automotive industry predicts that in 2025 electrically chargeable vehicles will make up 2% to 8% of the European market, depending on how quickly the various technological, infrastructure and socio-economic challenges can be addressed. Projections by the Electric Vehicle Initiative (EVI 2013) based on announced goals of its member countries show that US will maintain the lead in the number of EVs on the road, introducing additional 1 million vehicles by 2015. China could also become an important market with its set target of 5 million vehicles and 10 million charging points by 2020. France expects to have 2 million and Germany 1 million vehicles by 2020, UK 1.55 million and Spain 2.5 million.

However, EVs technology and associated services must pass through several stages of market development, optimization and scale-up. Moreover, consumer acceptance, utility readiness and EV infrastructures are subject for improvement. The increasing availability of vehicle charging infrastructure that enables vehicles to charge at home, at the workplace, and in public places is expected to facilitate market growth. Being in its nascent stage, just as EVs, the market for charging infrastructures, also referred to as **Electric Vehicle Supply Equipment (EVSE),** has untested busi-

ness models, suffers from use cases of the charging stations and lacks detailed knowledge of driver behaviour.

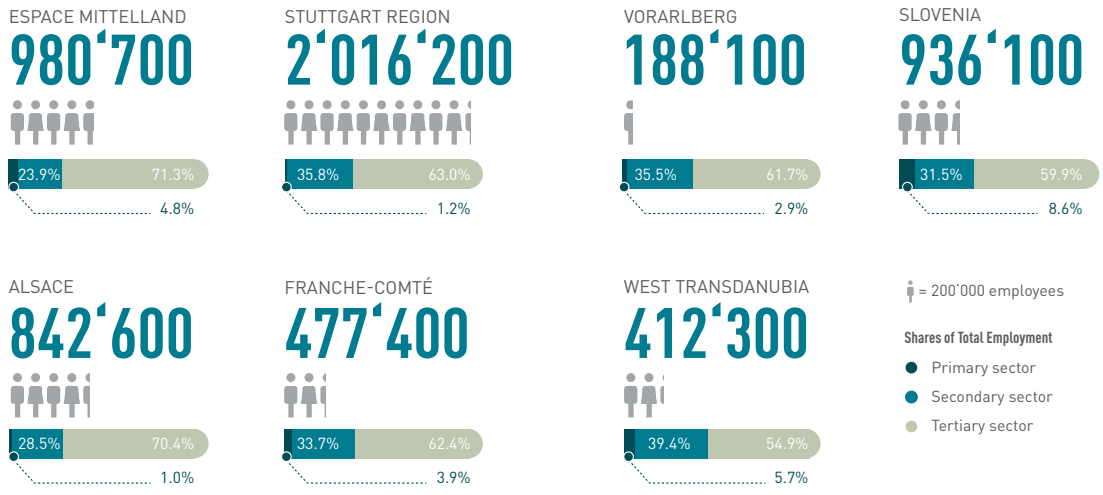
As of November 2012, about **15'000 EV charging stations** had been installed in Europe. But EV charging has become complicated with different standards in use in various countries. A common standard for charging EVs in Europe was only introduced recently, suitable for both, AC and DC charging. So far, «AC charging» (or slow charging) which provides alternating current to the vehicle's battery from an external charger (e.g. a standard household socket) is the most common mode of charging. Charging times range from 4 to 12 hours for a full charge. Fast charging stations, also known as «DC quick charging», provide a direct current of electricity to the vehicle's battery from an external charger with charging time from 0.5 to 2 hours. The situation for EVSE varies largely across Europe (see previous table). Germany, France, the Netherlands, Spain, Austria and the UK are leading countries. The increase in charging stations (including national targets) is part of an eight billion Euro «Clean Power for Transport Package» launched by the European Commission in January 2013. A minimum of 10% of charging stations should be publicly available.

The current market conditions can be summarised as «vicious circle» where investors do not invest in infrastructure as there are not enough EVs, while OEMs do not offer EVs at competitive prices as there is insufficient demand. And consumers do not purchase EVs due to high prices and a lack of dedicated infrastructures.

REGIONS' PROFILES

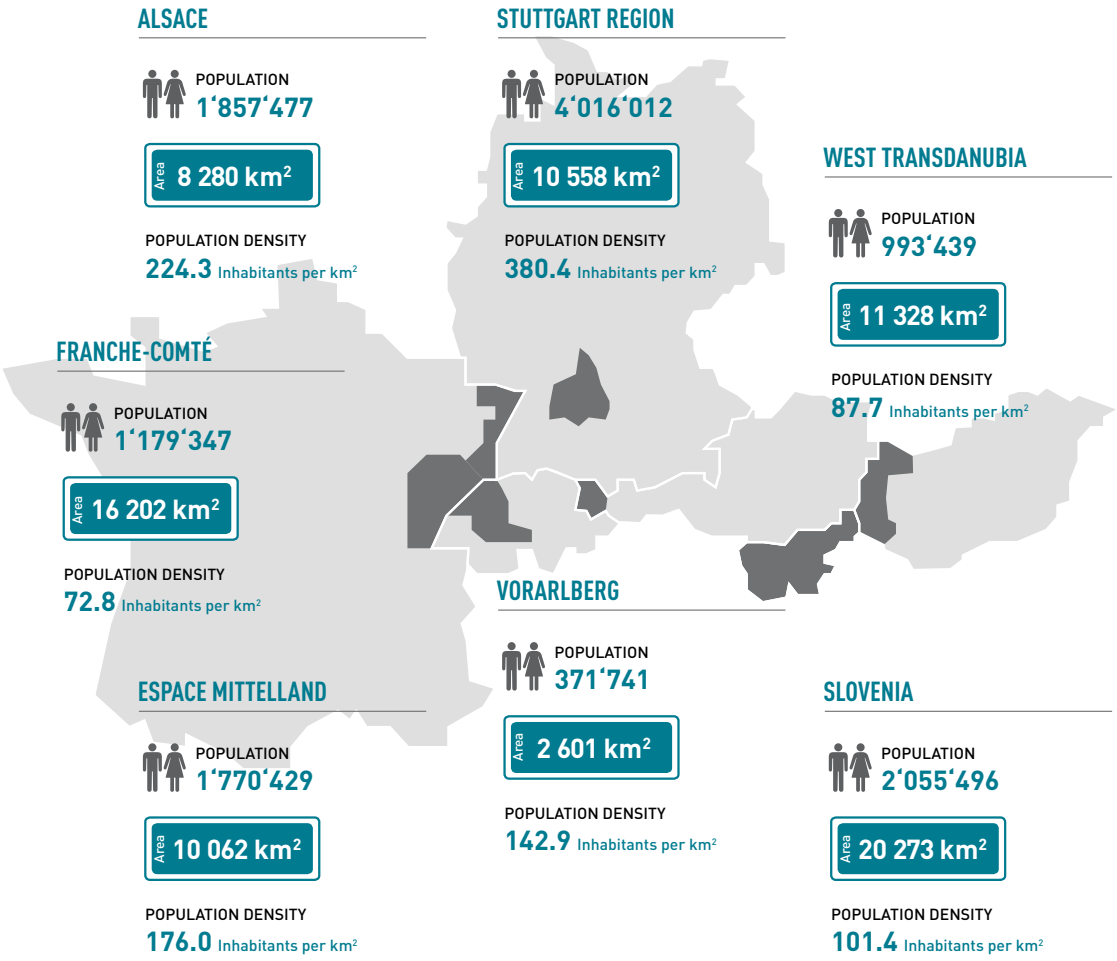
Regions' opportunities for future research-driven economic development in e-mobility, their specific requirements for green mobility solutions and associated challenges are influenced by settlement structures as well as research infrastructures and economic conditions. In the following the ELMO^S regions are briefly introduced.

[Snapshot] EMPLOYMENT



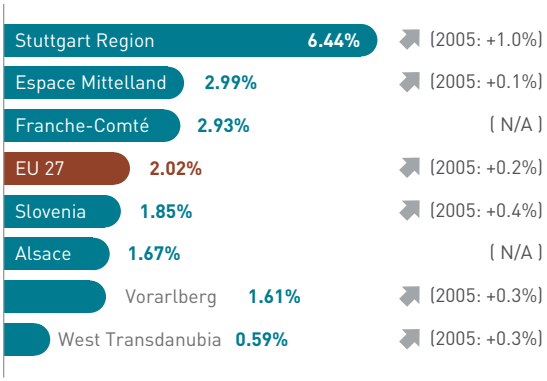
Source: Eurostat

[Snapshot] BASIC INFORMATION



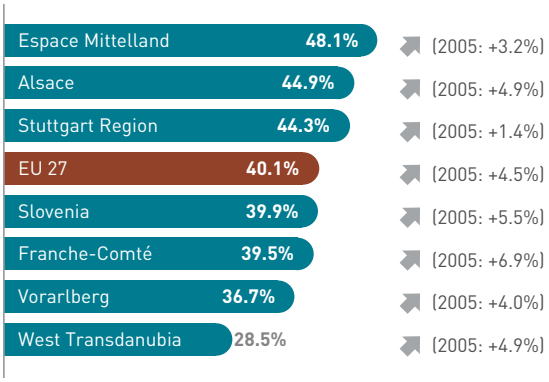
[Snapshot] RESEARCH INFRASTRUCTURES

R&D Intensity (2009) – R&D Expenditure as % of GDP



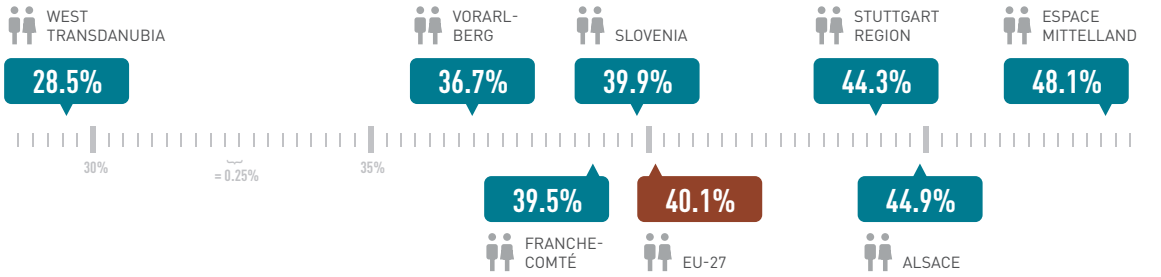
Source: Eurostat [hrst_st_ract]

% of Population with Tertiary Education Attainment (2012)



Source: Eurostat [edat_lfse_11]

Human Resources in Science & Technology (2011)



Source: EUROSTAT [hrst_st_ract]

The above figures illustrate the regions' developments for science and technology indicators. The domains covered are research infrastructure, research and development intensity (R&D) plus human resources in science and technology (HRST).

Research Infrastructure: With 23 universities including universities of applied sciences and other academic research organisations, Stuttgart Region is by far at the top position in absolute numbers. Alsace and Franche-Comté rank second with 6 universities, whereas three universities are located in Espace Mittelland and only one university in Vorarlberg and West Transdanubia. However, taking a look at the universities density (UD), i.e. the number of universities per million inhabitants, it becomes evident that Vorarlberg with a density of 0.27 ranks second after Stuttgart Region with 0.57. Espace Mittelland and Franche-Comté show an equal density of 0.17 slightly below Slovenia with 0.19. West Transdanubia ranks lowest with a recorded value of 0.10.

R&D Intensity: The EU-27 had an R&D intensity ratio of 2.02% in 2009. In other words, expenditure on R&D was equivalent to 2.01% of the GDP. The most R&D-intensive region is Stuttgart Region with a ratio of 6.44%, followed at some distance by Espace Mittelland (2.99%) and Franche-Comté (2.93%). All three regions are well above the EU-27 average, whereas Vorarlberg, Alsace, West Transdanubia and Slovenia rank below the EU-27 average. In particular, this applies to West Transdanubia the least R&D-intensive region. With a business sector R&D intensity Vorarlberg is slightly above the EU-27 ratio of 1.25%, just as Stuttgart Region (5.9%) and Franche-Comté (2.6%). Alsace (0.9%) and West Transdanubia shows a significantly lower value.

Human Resources in Science and Technology (HRST): The stock of HRST can be used as an indicator to determine how developed the knowledge-based economy is. In 2012, Espace Mittelland shows the highest share of population with tertiary education (34.2%), followed by Stuttgart Region (31.6%) and Alsace (29%). All three regions exceed the EU-27 ratio of 27.7%, whereas the other four regions show lower values. These numbers correspond with the recorded values of HRST relative to the size of the economically active population. In 2011, Espace Mittelland ranked top among the ELMO^{S} regions with a ratio of 48.1%, followed by Alsace (44.9%) and Stuttgart Region (44.3%), while EU-27 recorded a ratio of 40.1%. Slovenia, Franche-Comté and Vorarlberg are slightly, and West Transdanubia clearly below EU-27 average.

POLICIES AT DIFFERENT GOVERNANCE LEVELS

Many actors are involved in the formulation and implementation of RTDI and cluster policies, requiring efficient coordination mechanisms to be established. Therefore it is essential, to take into consideration the **multilevel policy governance** role in making RTDI and cluster policy interventions more efficient. As a matter of fact, interdependency of EU, Member States, regions and actors grows with the progress of globalisation; it follows that all of the basic factors that facilitate successful R&D and innovation can be affected by efficient and well-directed policies carried out by the EU, its Member States and European regions.

At all governance levels policy makers need to explore novel strategies and approaches to cope with the challenges posed by complex and rapidly changing socio-economic political environments, including globalisation, environmental challenges, changing innovation processes, and so on. The regional dimension is of key importance in innovation policies because interactive learning and innovation processes are often spatially bound, and are strengthened and improved by geographic proximity. With respect to ELMO^{S}, Research, Technological Development and Innovation (RTDI) and Cluster Policies establish conditions to boost investment in research and development, innovation, resource efficiency and the uptake of sustainable green mobility.

Against this background, the subsequent sub-chapters compare electromobility-related RTDI and Cluster Policies as well as of Action Plans implemented in the six partnering regions.

RTDI Policies

In total 4 regional and 24 national policy measures related to electromobility have been identified. Subject to the responsible governance level, two distinct types of policy production can be distinguished: Firstly, countries where policies are designed and implemented at the regional and national level. Second, countries where RTDI policies are solely designed at the national level, but implemented at national and regional level («top-down approach»). While the former applies to Germany and Switzerland, the latter is characteristic for France with its unitary state system plus Austria, Slovenia and Hungary.

According to the mode of policy production, in **Alsace/Franche-Comté, Slovenia, Vorarlberg** and **West Transdanubia** regional RTDI actions, linked to electromobility are implemented «top-down», limiting the possibilities for policy formulation at the regional level. Compared to these regions in **Stuttgart Region** and **Espace Mittelland** electromobility related RTDI policies are also designed by the regional/cantonal government, which allows to formulate more targeted policy measures and enhances the flexibility to respond to actual region-specific needs.

Basis for structural actions in **Alsace/Franche-Comté** – including regional innovation policy – is the CPER State-Region agreement (Contrat de Projet Etat Région). Under this agreement various electromobility-related RTDI programmes have been set-up by the French Government. For example, the «ANR, Non-Thematic Research Programme 2011-2013» focusing on innovative technologies, «FUI, the French Single Inter-Ministry Fund» addressing competitive clusters and the «ADEME» programme which intends to stimulate, coordinate and facilitate environment protection and en-

ergy management. Responding to the recent financial crisis, the French «Investments for the Future» programme consists of a wide range of instruments in favour of innovation such as the development of world-class research units (including automotive, ICT, green energy).

Contrary to Alsace/Franche-Comté the RTDI in the region **Espace Mittelland** is fostered on national and regional level, but mainly found in an indirect form. It is less detailed with respect to thematic priorities. RTDI programmes for electromobility are included in the economic strategy and in the guidelines on mobility development (national mobility policy). Key policy stakeholders are the National Government, Cantonal Government and in contrast to Alsace/Franche-Comté also private initiatives. At this stage, three policy measures relate to electromobility have been formulated, of which one is restricted to the Canton of Berne, namely the Economic Strategy 2025 of the canton Berne. It aims at innovation in clean-tech and knowledge transfer. The two national programmes «Energy Strategy 2050» and the general «Mobility Policy» focus on sustainable mobility and basically address the transport and energy sector.

Being essentially of horizontal nature, **Slovenian** policies are less focused on specific thematic or sectorial priorities, but address the overall development of research and knowledge. Key governmental stakeholders is the Ministry for Higher Education, Science and Technology (MHEST), responsible for RTDI policies, the Ministry of Economy, the «Office for Development and European Affairs» and the «Office for Local Self-Management and Regional Development», which in charge of innovation policies Examples for related policies are the «Centres of Excellence» programme focusing on priority technological areas and horizontal linkages and the «Competence Centres» programme supports the strengthening technological development capabilities.

In comparison, **Stuttgart Region**, with its complementary RTDI policies at the different government levels is the pioneer among the ELMO^{s} regions, when it comes to fostering electromobility by RTDI policies. Stuttgart can distinguish between two types of innovation policies: First and most important, policies designed at national and implemented at regional level (e.g. «Leading Edge Cluster competition», «Electromobility Model Regions Program», and «Showcase Electromobility»). Second, policies designed and implemented at regional level complementing national policies with a strong focus on the support of SMEs. Nevertheless, the national government is the main source of funding and support for innovation activities. National RTDI policies follow the long-term «Hightech Strategy 2020 for Germany» under which the «National Electromobility Development Plan» and the Industry-Science Research Alliance have been established. In addition, the «National Platform E-Mobility» was launched as an advisory board and think-tank in support of the overall national strategic RTDI planning. At the federal state level of Baden-Wuerttemberg, RDTI policies are based on the «State Initiative E-Mobility», transforming national visions to the State's objectives. At the regional level, the State's roadmap is complemented by a regional roadmap on sustainable mobility integrating e-mobility development into the overall traffic planning for the region. Policies implemented within the region focus on the support of research and demonstration efforts, both in the public and private sector. The large number of RTDI policies in Stuttgart Region are broken down to single activities such as «Pilot Regions eMobility». This activity focuses on the daily use of EVs and its contribution to national environmental targets. Summarizing, the Stuttgart Region is a good example of a multilevel governance structure.

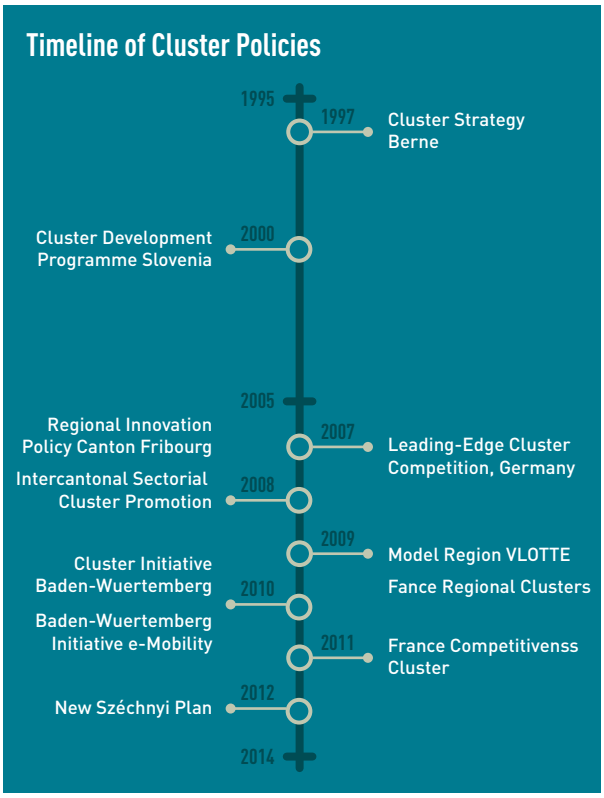
As with Alsace/Franche-Comté and Slovenia, national programmes are of utmost importance for **Vorarlberg** as concerns RTDI in electromobility. Key policy actor is the «Energy and Climate Fund Austria», an organisation represented by the Federal Ministries of Agriculture and Infrastructure. Under this framework the «Model Region VLOTTE» was established prioritising infrastructures for electromobility, including electric cars and charging stations, new business and mobility models plus green energy production systems (e.g. PV and small hydro power plants). The programme «Model Regions for Electromobility» was launched to spread electric vehicles to commercial and private use in urban surroundings with at least 100,000 inhabitants. «Smart Cities» programme aimed at creating a district/city in Austria adopting a zero emission.

Being confronted with the transition from a socialistic to a democratic regime, economic development in **West Transdanubia** was during the past 15 years concerned with other factors than RTDI. Compared to the other regions the regional innovation system is less developed. As in France, RTDI policies are highly centralised leaving limited regional autonomy in RTDI policies resulting in a dependence on national frameworks. Correspondingly, the national «New Széchenyi Plan» is the only programme related to electromobility.

Cluster Policies

Cluster policies by means of **facilitating policies** are directed towards the enhancement of specific conditions that could improve clusters' performance. **Traditional framework policies**, such as SME policies, research and innovation policies, and regional policy often use the cluster approach to increase the efficiency of a specific instrument. And **development policies** strive for creating, mobilising or strengthening business strategies and cooperation between organisations and people through knowledge sharing at regional or cluster level.

In total 11 cluster policies measures were identified, of which 6 have been formulated by the national government and 5 by the regional/federal state government. As with RTDI policies, the main governance level responsible for cluster policies is determined by the political system in the respective country: With regard to **Alsace/Franche-Comté, Slovenia, Vorarlberg** and **West Transdanubia** cluster policies are in the responsibility of the national governments, whilst in the case of **Stuttgart Region** both, the national and regional governments are in charge of policy formulation. As regards **Espace Mittelland** cluster policies are assigned to the cantonal governance level. With different foci all **electromobility-constituent sectors** are addressed within the framework of cluster policies, whereas ICT and Energy are the sectors most frequently cited. Unlike the other ELMO^S regions, no specific sector has been defined by the French national cluster policies as point of reference for Alsace/ Franche-Comté. Three national policy measures in Germany, Austria and Hungary plus one regional instrument relevant to Stuttgart Region are directed towards electromobility. Irrespective of the governance level, nearly all identified policies have research organisations as their target groups – 9 out of 11. The other major target group is private business entities with a share of 73 per cent of citations. Only a minority of cluster programmes name public authorities and citizens as target groups. Concerning concrete actions defined in the programmes the majority of programmes support cluster governance structures, alongside business entities and sector-specific research activities. However, each programme is based on different principles, follows different approaches and has different objectives according to its political and economic framework.



The **French** cluster policy, for example, distinguishes between competitiveness clusters and regional clusters. Competitive clusters are vibrant thematic world- class clusters set up at the national level. The 71 clusters are working on future-oriented sustainable fields of activity such as aeronautics, agro-food, renewable energy, ICT, health etc. Pole Véhicule du Future in the region **Alsace/Franche-Comté** is one of them. Competitive clusters adopt a 5-year strategic plan based on the «Triple Helix» approach and are meant to set up collaborative RTDI projects and promote an innovative environment. In this context, a strong priority is given to SMEs. Their future focus will be on market-driven projects, which create homegrown jobs. Regional cluster clusters, in contrast, targeted co-operations between larger and smaller companies, accompanied by research entities and education centres. They focus on the revitalization of the countryside.

In **Switzerland** no national cluster programmes have been established but three cantonal measures relevant for **Espace Mittelland**, namely the «Cluster Strategy Economic Development Agency Berne», the «Regional Innovation Policy Canton Fribourg» and the «Intercantonal Implementation Programme» of the intergovernmental conference. These programmes are directed towards the economic development of the region by stressing the importance of cluster activities, while being less specific as the French policies with regard to the concrete actions. Founded in 1996, tcbe.ch – ICT Cluster Berne, was one of the first clusters in the region initiated as a bottom-up initiative.

The national cluster development programme in **Slovenia** was launched in 2000; in 2004 18 clusters were operational, bringing together 350 companies and 40 education/research institutes. Unfortunately, the clusters were not sufficient and with the change of the government in 2004 the cluster support programme ended. The clusters which could establish themselves during the previous period such as the automotive cluster in Slovenia were able to apply further R&D funds, but not for own operational costs. The lack of support given for cluster management structures and the fact that no further cluster programmes were initiated is what clearly distinguishes Slovenia from the other ELMO^S regions.

Compared to the other regions, **Germany** can be considered as one of the precursor for cluster policies in Europe. First policies in Germany were launched in the mid 1990ies resulting in a number of support programmes at the national, federal-state and regional level combing bottom-up and top-down approaches. Since then the cluster landscape has gradually changed in response to new challenges. Contrary to Slovenia, both recent leading national cluster programmes – «Leading-Edge Cluster Competition» (2007-2017) and «go-cluster» (since 2012) – consider cluster management excellence as one of the key success factors of the cluster approach. With regard to **Stuttgart Region** and under the responsibility of the Ministry of Finance and Economy, the national policies

are complemented by the cluster policy of the Federal State of Baden-Wuertemberg. The first regional cluster competition was launched in 2008, the second in 2011. In total 26 state-wide cluster organisations were established. With the support of the Federal State this policy was supplement by the establishment of a State Agency for e-mobility and fuel cell technologies, the e-mobile BW GmbH. It became the State's cluster management organisation for e-mobility and successfully applied for one of Germany's leading edge clusters. «CARS – Clusterinitiative Automotive Region Stuttgart», arose from the preparation of the regional strategy «Strategy 2020». The European Commission has twice awarded the regional cluster policies in Stuttgart. Nowadays, CARS and e-mobility BW GmbH are coordinating all large-scale e-mobility demonstration projects in Baden-Württemberg.

For **West Transdanubia** the establishment of regional cluster initiatives was the first step of the implementation of technology and knowledge-based programmes at the regional level. From 2000 to 2005 five cluster initiatives were initiated in five sectors in the most advanced industrialised centres such as Györ, Sopron, Szombathely, and Zalaegerszeg. Although two of these were less successful, the overall experience led to the formation of further clusters. The establishment of cluster organisations has been key in advancing the regional innovation systems. For example, in 2006 «Pannon Cluster» was established to coordinate the cluster activities in West Transdanubia. The aim was to intensify the investment in West Transdanubia by supporting the cooperation and exchange activities of 23 industrial parks in the region. In 2012 a new application was set up as part of the New Széchenyi Plan, called «Development of Entrepreneurial Co-operation and Clusters», which can be regarded as a further fund for the development of the accredited clusters. The key policy actor of the plan is the «National Development Agency» addressing mainly the sectors of transport, ICT and e-mobility.

In comparison to the other ELMO^S regions, **Vorarlberg** disposes only one so-called cluster that deals with timber architecture. Thus, there is no official cluster in Vorarlberg relating to e-mobility. VLOTTE, which is not an official cluster, nevertheless, focuses on the clustering of electromobility in the region. The Austrian government originated the project VLOTTE in 2009 as a model region in e-mobility. The main project idea was the support of implementation of EVs in the region for several years. One of the major outcomes are the construction of power plants distributing the energy to the changing infrastructure including charging stations, which are located at public hot spots.

Action Plans

In general, regional and national **Electromobility Action Plans (EAPs)** comprise a vision and strategy for electrification of mobility or in a wider sense sustainable green mobility, define thematic priorities, objectives, actions and measures while outlining the potential of electric/future mobility, challenges ahead and regional/national strengths.

With the exception of **West Transdanubia**, action plans have been implemented in all regions at different governance levels: Due to the centralised unitary state system in France, for **Alsace/Franche-Comté** the decisive governance level is the nation and related national action plans such as «Electric and Hybrid Electric Vehicles Development National Plan» launched in 2009 by the French Ministry of Transport with the assistance of national agencies, local authorities and major private companies in the automotive sector. Likewise, nation action plans have been implemented

ACTION PLANS' VISIONS

"**Vorarlberg** shall produce more green energy within the region then the consumption is in 2020."

"Making **Stuttgart Region** the most sustainable transport region in Germany"

"The region of **Thun** shall become the Swiss competence centre for e-mobility and renewable engery."

"**France** will take the opportunity of the development of EV and HEV to tackle climate change and to help restructuring the whole sector, fostering innovation for green growth that creates jobs and achieves sustainability."

"**Slovenia** will achieve a 25%-share of renewable energy sources in gross final energy consumption and a 10%-share in transport."

"Making e-mobility work all over **Baden Wuertemberg** from 2020 onwards"

"**Germany** shall become a lead market for electric mobility solutions."

"Electric mobility - towards a sustainable modernisation of the **Swiss** transport system"

in **Slovenia**, where the Ministry of Environment and Spatial Planning functions as implementing unit. In addition, with the «Sustainable Electromobility Plan» (SEP), more recently Ljubljana became the first city in the country with a municipal action plan for electromobility.

In contrast, the federal state system in Germany led to the implementation of action plans at all governance levels which are of importance to **Stuttgart Region**. The «National E-Mobility Development Plan» is complemented by the «Roadmap Electromobility» introduced by the federal state of Baden Wuertemberg and the regional action plan «Roadmap Sustainable Mobility». Analogous this applies to **Espace Mittelland** with the «Swiss Road-map to Electromobility» plus the two regional action plans «Association Inergie» and «E-Mobility Economic Area Thun».

Contrary to the other regions, the region is the most relevant governance level in the case of **Vorarlberg**. At this layer the action plan «Energy Future Vorarlberg 2050» has been implemented, which is supplemented by two further regional action plans, namely the «Vision Rhine Valley» and «101 Grandchild qualified Measures till 2020».

Further differences among the regions exist with regard to the **target groups** of the action plans. While the relevant action plans for Alsace/Franche-Comté, Stuttgart region, Vorarlberg as well as the Swiss national action plan, likewise, address enterprises, research, citizens, public authorities and cluster, in Espace Mittelland both regional action plans exclude research organisations and one public authorities. A slightly different picture occurs in Slovenia where one action plan excludes research and the other public authorities.

The **thematic priorities** covered by the action plans are rather divers and include among others the following aspects:

- Establishment of charging infrastructures
- Development of batteries, energy storage, EV & HEV
- New mobility business models

- Fleet management
- Consumer incentives
- Demonstration projects
- Renewable energy sources & efficient energy usage

THE ROLE OF RESEARCH DRIVEN CLUSTERS

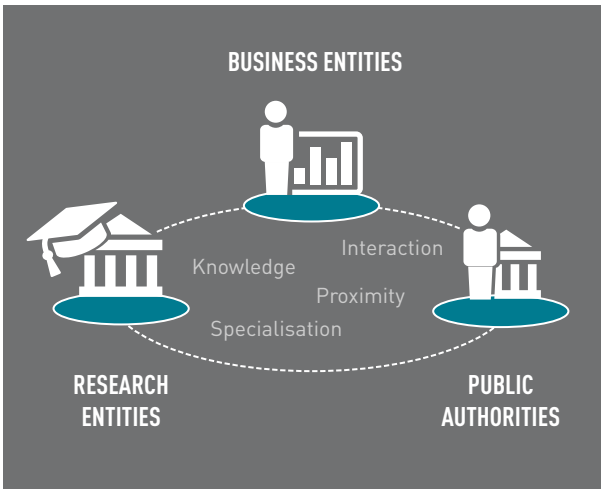
Research-driven Cluster (RDC)

primarily rely on R&D as source of innovativeness and competitiveness.

They comprise at least three types of legal entities, namely the

«Triple Helix»

associating research entities (universities, research organisations), business entities and public authorities



In Europe a huge diversity of research clusters exist: they differ in terms of their stage of development, some are networks of only SMEs, some are organised around key research and development organisations, and yet others have customer or technological market needs to sustain their prosperity. In all cases, research clusters may embody the characteristics of the modern innovation process, and can be considered as reduced scale innovation systems. Their specific nature, including their spatial coverage, differs according to technology, market conditions, and other factors that influence the geographic extent and relative strength of linkages.

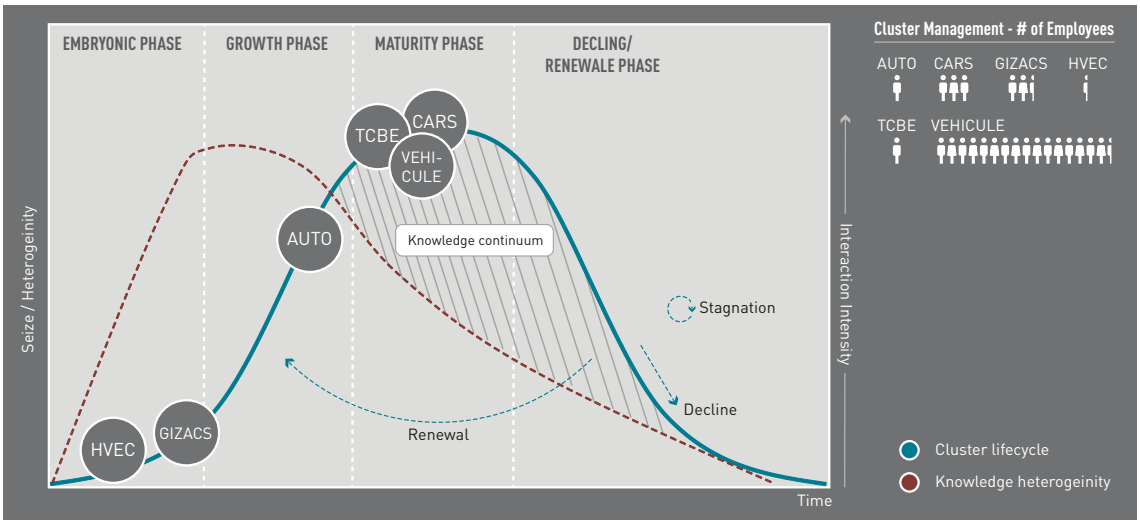
Next to RDCs taken into account within ELMOs (see definition on the left), broadly speaking, there exist two other types of research clusters: Firstly, cluster focusing on R&D cooperation between business and research entities and secondly, clusters encouraging cooperation among business entities.

RDCs entail a high potential to stimulate electromobility-related RTDI activities at the regional level and increase the competitiveness of regional economies: highly trained workforce and R&D are among the key conditions for innovation and economic success of a country, a region or a cluster. Bridging R&D actors, regional administrations and the business community, RDCs are viewed as a response to the growing local demand for research and development. Integrating this research-industry-government cooperation and interactions in the process of knowledge capitalisation, RDCs represent the triple helix model of innovation crucial for regional development.

RDCs' Foundation

With regard to their composition and development stages the participating RDCs are rather heterogeneous. While composition refers to the number of the different triple helix stakeholders involved in the cluster, the development stage relates to the RDCs position in the cluster lifecycle. Concerning the latter, four stages are distinguished:

The embryonic phase describes the emergence of a cluster. Key characteristics are a small number of enterprises, great heterogeneity of accessible knowledge and competencies, and a hardly existing institutional environment and loosely linked businesses. At this state the cluster is often not perceived as such. **The growth phase** is marked by the entry of additional business entities, start-ups and so on. Cluster boundaries become visible and the perception of the cluster increases. The growing number of enterprises and institutions within the cluster creates opportunities for innovation, knowledge exchange and cooperation. While firms benefit from the exploitation of synergies and network relations, heterogeneity of accessible knowledge and competencies decreases. In the **maturity phase** the RDC reaches the state of equilibrium. It neither shows high growth nor remarkable decreases in the number of business entities. To sustain cluster dynamics, connections of clustered firms to external partner are crucial. Finally, the **declining/renewal phase** is characterised by a decreasing number of enterprises. As a result of knowledge homogeneity plus highly specialised enterprises focusing on specific markets and technologies the cluster is negatively locked into its previously successful development paths, which might hinder its ability to respond to changing market conditions.

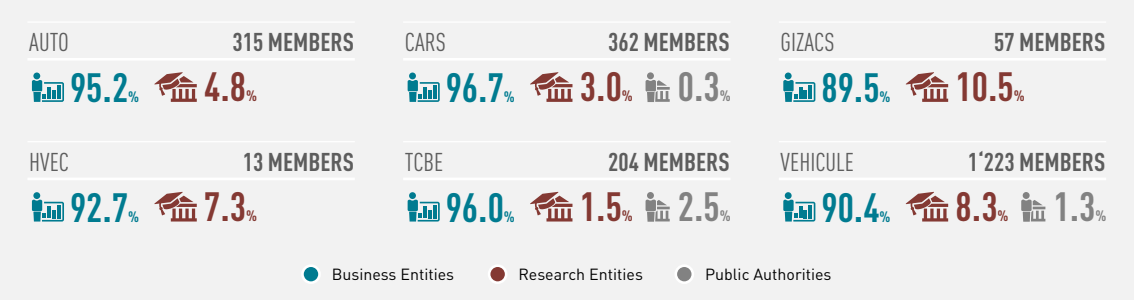


As the figure above illustrates, the participating clusters cover the first three stages of the cluster lifecycle. «Cluster Automotive Region Stuttgart» (CARS), tcbe.ch – ICT Cluster Bern (TCBE) and Pôle Véhicule du Futur (VEHICULE) are in a maturity phase, autocluster.ch (AUTO) is in its growth phase, whereas the «Hungarian Vehicle Engineering Cluster» (HEVEC) and the «Automotive Cluster Slovenia» (GIACS) are in an embryonic stage of development.

According to the different development stages and regional specifics the number of **cluster members** and their **composition** vary considerably (see figure below). With shares ranging from 89.5% (GIZACS) up to 96.7% (CARS), business entities account for the majority of members in all clusters.

Public authorities are involved in the cluster activities of the three most advanced clusters, namely CARS, TCBE and VEHICULE, which therefore, comply with the RDC definition. Accounting for shares of 10.5% and 8.3% **research entities** are most strongly represented in GIZACS and VEHICULE, followed by HVEC (7.7%). According to the high shares of entrepreneurial members, for AUTO (4.8%) and CARS (3.0%) the share of research entities is significantly lower. With only 1.5% TCBE shows to be the cluster with the lowest share of research entities. In the following a brief overview of each cluster is given, starting with the embryonic clusters.

[Snapshot] CLUSTER COMPOSITION



Established in 2001 and organised as business interest association, **GIZACS** unities of 52 industrial and services companies plus five independent R&D organisations (10.5%). Next to cluster manager, one full-time and one part-time employee are involved in the clusters management. The cluster expands every year and is financed by membership fees (31,1%), projects (17,7%) and service fees (51,2%) such as organisation of events. In 2011 the cluster's budget totalled 296'595 Euro. The clusters overall aim is to reinforce the competitiveness and create greater added value.

HVEC was founded in 2009 by six Hungarian engineering SMEs, all with large experience in international projects. Managed by the MAJÁK Non-Profit Ltd, the cluster is mainly financed by projects (64%) and membership fees (31%), whereas service fees account for 5% of the total annual budget. A part-time cluster manager is in charge of RDCs management. The cluster aims at coordinating the activities of Hungarian engineering companies operating in the field of vehicle or vehicle part development, including passenger cars but also trucks, buses, airplanes, boats and new mobility solutions.

Founded by Espace Mittelland, Greater Zurich Area and the cantons of Solothurn and Zurich, **AUTO** is the Swiss cluster for the automotive supply industry, managed by two part-time employees. Since 2007 the cluster is formally incorporated as a non-commercial association. Of its approximately 315 members most are SMEs. Core fields of activity include facilitating national and international business-to-business, supporting innovation networks and RTD business-academia collaboration and innovation cycles. AUTO is financed 15% by membership fees, 50% by platform services, 25% by projects and 10% by public funding/subsidies.

In Stuttgart Region two complementary RDCs are established: CARS addressing the automotive sector as a whole and Electric Mobility Cluster South-West dealing with the e-mobility subgroup on leading edge research only. However, the comparison is confined to CARS as partner of ELMO^{S}. With the **CARS** founded in 2001, the regional development agency Stuttgart (WRS) aims to link and

align the automotive relevant activities of the Development Agency Region Stuttgart (WRS) more closely with each other and to expand them into new areas. Today CARS with its 326 members is structured as a multidimensional and need-driven initiative that is flexible to respond to dynamic changes of the industry and the region. Two full-time and two part-time employees conduct the cluster management. At the core of the cluster there are two renowned and successful OEMs (Daimler and Porsche), a group of very competitive suppliers, which include the world's largest automotive supplier Bosch, and a concentration of innovative research entities. SMEs account for 80% of the entrepreneurial members. Contrary to the other RDCs, CARS is financed through the WRS own budget with a share of 41%. In addition, projects contribute with a proportion of 52% and public funding with only 7%.

Founded in 1996, **TCBE** – just as AUTO – is organised as a non-commercial association. One of the reasons for the cluster foundation was a lack of well-educated ICT workforce in the region. The majority of the members are SMEs. Only 19 of the 210 cluster members employ more than 100 people. Two part-time employees are responsible for the cluster management, which has since its establishment continuously be professionalised and shifted its priorities from location promotion to benefit and support for cluster members. Networking, internationalisation and education are amongst the main pillars of the clusters activities. The cluster's financing model bases on comparable proportions of membership fees (30%), public funding (35%) and projects (35%).

Awarded as «competitiveness cluster» by the French government in 2005, **VEHICULE** as non-profit organisation coordinates the particular competencies of its geographical remit and missions around solutions for future vehicles and mobility. In 2011, the cluster united 1'123 members. VEHICULES strategy is directed towards vehicles and technologies for urban and peri-urban mobility striving for sustainable regional development. In total 119 collaborative projects were approved between 2009 and 2011. In comparison to the other cluster, VEHICULE is mainly financed by public sources (73,7%), of which the major part comes from regional government including subsidies from local authorities such as urban communities, cities etc. In addition, 3 of the 14.5 full-time equivalents are assigned employees from PSA Peugeot Citroën are fully involved in the cluster management. This is the reason why the cluster in big parts is also private sector funded.

RDCs' Competitiveness

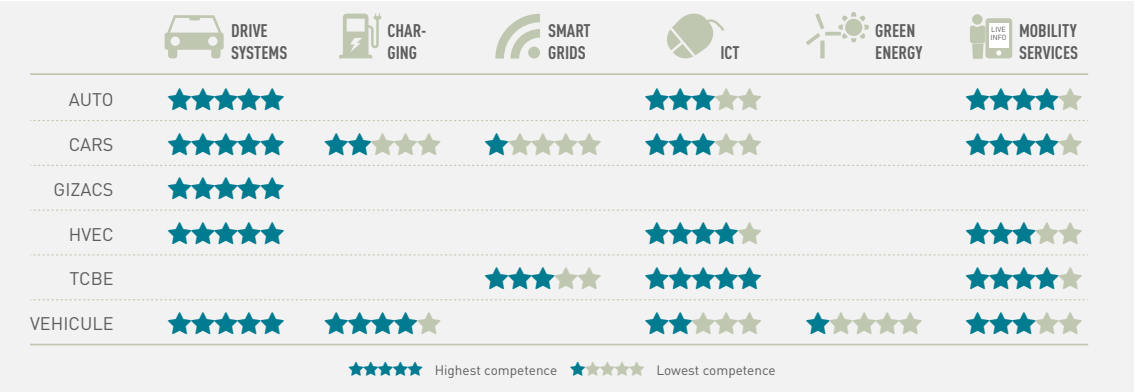
The clusters' contribution to **regional development** is rather heterogeneous. For example, AUTO's overall and electromobility-related contribution to regional development is comparatively low, whereas GIZACS's contribution is surprisingly high. CARS, as one of the leading automotive clusters in Germany and Europe, plays a significant role with respect to the region's image and technological development in Stuttgart Region. Moreover, the cluster contributes – both, in general and with its electromobility activities – to skills development and regional income. The same applies to TCBE, the difference being that only the cluster's basic activities generate the regional benefit, where skills development in ICT is most marked. Regarded as one of the major automotive clusters in France, VEHICLUE's contribution to regional development is rather low, except for regional branding. In view of its contribution to employment and increased income the cluster was affected by massive downsizing in the French automotive industry. In spring 2012 PSA Peugeot Citroën, for example, cut 8'000 jobs. Due to the sector's serve crisis employment growth is expected to be negative. Expecting a slow and gradual uptake of electromobility – at least in the next five years – this

situation will not change. Being in an early development stage, HVEC's contribution to the regional development derives from technological development rather than other factors.

With respect to the RDCs' **competitive position** at national, European and global scale, results reveal identical patterns for CARS and VEHICULE. Although, VEHICULE's position is a little weaker, both RDCs have strong position in their home country. At European and global level, CARS outweighs VEHICULE. Nevertheless, it is, in particular, VEHICULE's global outreach in terms of research-related knowledge exchange and cooperation, which positively affects its competitive position. The general competitive position of AUTO and GIZACS is as well rather strong at the national level. Despite, neither of them can compete with their electromobility-related activities on European or international markets. The difference between the general and electromobility competitiveness is most pronounced in case of TCBE. The cluster performs well at national and moderate at European and global scale, but is on none of the three markets competitive as regards electromobility. In comparison, HVEC has a rather strong position in the national market, in general as well as in electromobility, whereas the opposite is true for European and global markets.

The outlined results correspond to the findings of the European Cluster Observatory where Stuttgart Region received a 3-star ranking in automotive, Franché-Comte and West Transdanubia a 2-star ranking. Moreover, the RDCs national competitiveness is reflected in their location quotients (LQ). The LQ indicates whether or not a sector has a high share of a region's employment compared to the reference area (nation, EU). A value above 1 indicates that the region is specialised in the sector. In 2011 the LQ (national) amounts to 4,9 for Franché-Comte, 3.4 for Stuttgart Region, and 3.0 for West Transdanubia. Taking EU27 as reference area, West Transdanubia ranks first (LQ = 5.9) followed by Stuttgart Region (LQ = 5.3) and Franché-Comte (LQ = 4.3).

[Snapshot] RDCs FIELDS OF COMPETENCE



The comparison of RDCs' fields of competence reveals that all four automotive clusters have high levels of expertise in **drive systems** – albeit with varying emphases. VEHICULE's members are mainly concerned with HEV and EV components, modular systems and vehicle design (e.g. engines, air cooling systems, smart sensors). AUTO's members, in contrast, are specialised in parts and components (mechanical and electric devises), where materials, manufacturing skills and systems form major unique selling propositions. Being an engineering cluster, HVEC's core competences comprise lightweight design, simulation, CAD, prototyping and material sciences. Within GIZACS, companies excel in design, development and production of mechatronic drive systems and electric

motors to improve safety, decrease energy consumption and minimise the impact on the environment for worldwide OEM customers and their suppliers. Based on heavy investments in RTDI and some public incentives CARS was able to close the earlier existing competitive gap to global competitors. Today, cluster members are fast developing. Lightweight vehicles including new materials, structural optimisation, vehicle bodies and platform solutions, production processes for new materials are related areas of competence. In addition, Bosch, ZF, GETRAG and other suppliers entered the market with electromobility products such as hybrid and electric drivetrains, power electronics, and so on.

Mobility services build another core competence of AUTO, CARS, VEHICULE and TCBE, not at least driven by changing user behaviour and companies' diversification strategies. Today owning a car is considered less important. Over recent years the number of young car buyers is decreasing, while the number of car sharing users increased. Acknowledging this trend, Daimler as large OEM has with its car2go car-sharing service taken first steps from producer to mobility provider. Fleet management and electromobility related logistics (CEP services, delivery solutions) are further fields of competence. Although less pronounced, car-sharing services, next to car park infrastructure and management, also build fields of expertise at VEHICULE. TCBE companies foremost offer smart mobility solutions.

Except for GIZACS all RDCs have a certain degree of **ICT** expertise, exemplifying the increasing integration of the electromobility constituent sectors. While ICT competencies are at the heart of TCBE covering basically all areas including embedded systems, vehicle-to-vehicle and vehicle-to-grid communication. HVEC also has a rather accentuated expertise in ICT, while these are less marked in case of the other automotive clusters. VEHICULE's expertise centres around human-machine interfaces, simulation, smart and embedded systems and smart mobile communication. As VEHICULE, CARS subcluster's (CARS-IT) competencies comprise embedded systems, autonomous driving, driver's assistance, vehicle-to-vehicle and vehicle-to-grid communication, traffic management and flow optimisation.

With regard to **charging**, VEHICULE particularly focuses on charging stations, whereas Conductix-Wampfler, SEW Eurodrive and other CARS members are mainly concerned with developing inductive charging solutions. Closely linked to this are the RDC's competencies in the field of smart grids. Yet smart grids go hand in hand with use of ICTs. That is why TCBE companies have developed high levels of expertise in this thematic field.

POTENTIAL FOR SMART SPECIALISATION IN THE ELMO^{S} REGIONS – BUILDING BRIDGES

To foster a smart, sustainable and inclusive economy and to actively proceed against current challenges the European Union set up five ambitious objectives, which are the employment, education, social inclusion, climate energy and innovation.

Smart Specialisation Strategies

... are multi-annual strategies defining a policy mix and budgetary framework, focusing on a limited number of globally competitive areas to stimulate smart growth, and therewith, concentrating human and financial resources in the most promising areas of comparative advantage. Similar to the cluster approach, such strategy is based on a strong partnership between regional authorities, the business community and stakeholders from research and academia.

Research and innovation are identified as key factors for the increase of regional growth and employment. Innovation is the most important factor to create economic growth and new jobs in a region. In order to foster European regions the European Commission's Cohesion Policy has set the target to decrease differences between regions and to ensure growth across Europe and to overcome the current crises. For this reason a research and innovation strategy for smart specialisation (RIS3) was developed.

Smart specialisation (S3) is a new innovation policy promoting the efficient and effective use of public investment in research. S3 aims at increasing regional innovation by means of enabling regions to deeper focus on their strength and unique characteristics. Instead of spreading investments too thinly across single technology fields, S3 wants to build on a wide-ranging regional analysis of existent resources and technological skills. For doing so, the inclusion of regional partners is crucial. Following the idea of the triple helix, S3 strongly bases on the cooperation between business, public and research entities. Despite that, a comparison between regions in terms of their competencies is foreseen, in order to avoid duplications. S3 regarded as an innovation instrument helps regions to identify their strength and high-value added activities, in order to strength their competitiveness. The implementation of the S3 in a region requires several single milestones. Firstly, each single region needs to identify their niche areas of competitiveness. Secondly, the cooperation between innovation partnerships should be emphasized. And thirdly a multi level implementation should be assured. Thirdly, an even stronger focus is given to R&D and innovation. Fourthly, cross-sectoral connections should be aspired and a critical mass and scale of activities should be given.

However, smart specialisation is not to be interpreted as an impulse to pure specialisation that exploits the economics of localisation, but as **«specialised diversification»** that exploits the economies derived from related variety. That is, regions should pursue a diversified portfolio of related activities, to find sufficient areas of specialisation to enable competitiveness while allowing for diversification and preventing regions from being exposed to the risks of market condition changes or other unpredictable external events (COM (2010) 533 final). Forasmuch, S3 strategies should be well prepared including the evaluation of existent regional resources and e.g. technological skills. In addition, such strategies need to be deeply rooted in the region, and therefore, necessitate the analysis of both the current state of play and the potential for future developments. Also a plan for the integration of necessary regional partners to a S3 strategy is crucial.

Electromobility is expected to become a central topic in several regions. Hence, it is even more important for regions engaging in this field to specialise. Specialisation in the here used sense,

means avoiding duplications in a specific working field in comparison to other regions. In consequence, finding a unique selling proposition can sustain the regional competitiveness. As was outlined in the previous section, detail regional analyses were carried out in the framework of ELMO^S, including amongst others the identification of regional strengths and weaknesses. But, more important the analysis emphasises the regional potential for a possible S3 strategies. Based on these findings potential fields for smart specialisation in Alsace/Franche-Comté, Espace Mittelland, Stuttgart Region and Vorarlberg, as most advanced cluster regions have been elaborated.

Traditionally **Vorarlberg** was a touristic region. In addition, textile counted as one of Vorarlberg's former key competences. Although the region has never been a typical location of the automotive sector, some important automotive suppliers allocated there. Rather, Vorarlberg is known for its competencies in renewable energy. It builds a fundamental pillar of the regional economy. In the former years, the region constantly increased its competencies, skills and knowledge in the field of green energy. Renewable energies and energy efficiency are today significant business areas in the region and can be seen as unique characteristics. Illwerke vkw, the largest electricity provider in the region, generates electricity exclusively from hydroelectric and other renewable energy sources. With the regional commitment to VLOTTE, Vorarlberg stepped into the topic of electromobility by establishing a fully-fledged infrastructure for electric vehicles. This development included the provision of electric vehicles as a first step, followed by charging stations, new business and mobility models and so on. Today, Vorarlberg disposes of a well-established e-mobility infrastructure, consultancy competencies, in combination with unique selling proposition in green energy. In addition, Vorarlberg has acquired in-depth knowledge of the users. Taken together these competences and infrastructures can build a starting point for the formulation of the region's S3 strategy. As regards the involvement of regional partners, Vorarlberg lacks a critical number of research entities. The region's geographic proximity to Lake Constance and the borders of Germany and Switzerland provide favourable conditions to overcome the research gap by making use of complementary research infrastructures through cross-sectorial connections with the AUTO in Zürich and cooperation with outward research entities from Stuttgart Region. Further potential is seen in the expansion of electromobility around the Lake of Constance and therewith, increase the accessibility of electromobility in peripheral sub-regions.

Espace Mittelland poses long-term competencies in the field of ICT, represented by TCBE. ICT is one of the electromobility-constituent sectors and functions as architecture inside and outside electric vehicles. In parallel it opens new business opportunities with regard to different modes of communication. The meta-themes in the field of ICT in terms of electromobility arise at the intersection of automotive and energy sector and play a crucial role in a variety of areas (see section 2.2.3). On the other hand, AUTO represents strong competencies in the Swiss automotive supplier industry. Its know-how and technology are featured in almost any vehicle produced for the global market. Combining ICT and automotive competencies, the region Espace Mittelland can claim strong cross-sectoral collaboration as the unique selling point. A related S3 strategy could centre on cross-sectoral innovation in the field of «smart cars». Especially, regarding the expertise of the automotive suppliers which base on a broad spectrum of parts and components, automatic systems, steering systems and electronic, the regional ICT competencies could help to broaden the value chain by expanding the competencies and giving access to product development in early stages. This in turn, would offer new market niches. Doing so, would also help to dissolve established boundaries between regional automotive and ICT sector as well as between manufacturers

and suppliers. In relation to the integration of regional partners into such long-term strategy, similar to Vorarlberg, Espace Mittelland challenges the involvement of research entities and a strong R&D infrastructure in such a plan.

In comparison to Vorarlberg and Espace Mittelland, **Alsace/Franche-Comté** and **Stuttgart Region** are traditional automotive regions. Both regions are European hubs for the automotive industry and still home of large companies such as PSA Peugeot-Citroën, Daimler AG and Porsche AG, plus international and regional suppliers. Alsace/Franche-Comté is well experienced in design and production of vehicles with a focus on drive systems. And although, Stuttgart Regions has similar capabilities, more recently they have expanded their competence base towards the creation of an overall ecosystem of applied and interactive innovation for integrated sustainable mobility. Following the regions tradition, Alsace/Franche-Comté will focus its future activities on the development of smart cars including innovative car components. Cross-sectorial collaboration of automotive, ICT and energy sector will be utilised for the further development of charging infrastructures. A S3 strategy in Stuttgart Region, in contrast, could include a stronger specialisation on service innovation. Already at present Stuttgart Region has implemented concepts such as e-bikes, multifunctional smart cards, car sharing, charging points and EV fleets. The expansion of such user-oriented services necessitates a stronger involvement of end users into regional projects in order to ensure a fast adaption of e-mobility solutions by the public. Involvement of strategic partners into S3 strategies, should for neither region pose a great challenge, as their electromobility-related RTDI infrastructures are well developed. Moreover, stakeholders in Stuttgart Region enjoy considerable confidence in cooperation and an open-minded exchange of knowledge and ideas. Integrating regional projects to national action plans enables Stuttgart Region to widen the scope of decision-making. Likewise, regional stakeholders' commitment to cooperation and specialisation is high in Alsace/Franche-Comté. However, due to the high centralisation of the French government, compared to Stuttgart Region Alsace/Franche-Comté is less flexible in implementing new ideas.

Literatur

Beltramello, A. (2012). Market Development for Green Cars. *OECD Green Growth Papers*, No. 2012-03, Paris: OECD Publishing.

EVI (2013). Global EV Outlook. Understanding the Electric Vehicle Landscape to 2025. Paris.

European Commission (2013). Clean power for transport – Frequently asked questions. Press Release, Brussels, 24 January 2013.

Proff, H. & Kilian, D. (2012). Competitiveness of the EU Automotive Industry in Electric Vehicles. Final Report.

Terstriep, J, Welschhoff, J & David, A. (2014). Green Mobility. A cross-regional Comparison. Deliverable D1.1 of the project «Electromobility Solutions for Cities and Regions» (ELMO^S), European Commission – 7th Framework Programme, Brussels: European Commission, DG Regions. Available online: http://www.future-mobility.eu/downloads/index.htm.

Autorinnen

Alexandra David, Judith Terstriep & Jessica Welschhoff

Kontakt: terstriep@iat.eu

Forschung Aktuell 2015-02

ISSN 1866 – 0835

Institut Arbeit und Technik der Westfälischen Hochschule

Gelsenkirchen – Bocholt – Recklinghausen

Redaktionsschluss: 30. Januar 2015

http://www.iat.eu/index.php?article_id=91&clang=0

Redaktion

Claudia Braczko

Tel.: 0209 - 1707 176

Fax: 0209 - 1707 110

E-Mail: braczko@iat.eu

Institut Arbeit und Technik

Munscheidstr. 14

45886 Gelsenkirchen

IAT im Internet: http://www.iat.eu