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REGIONAL MAPPING REPORT - GERMANY

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Has this deliverable addressed any of the target group indicated in the application form?

Yes / **No**

If yes, please describe the involvement of each individual target group in the table below.

Target group	Number reached by the deliverable	Description of target group involvement
SME		
Regional public authority		
National public authority		
Higher education and research		
Business support organisation		

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1 Introduction

In context of the project smart factory hub (SFH) this is an outcome of the regional mapping and classification. Its purpose is to analyse the regional structures in the manufacturing industry, e.g. in machine engineering companies, as a basis for further planning and implementations in the SFH project. The regional mapping is structured by three parts: the strategic background; the support environment; and the description funding schemes. It covers particularly smart specialization measures, priorities, indicators, implementation schemes, instruments, emerging trends in the manufacturing sector, analysis of existing support ecosystems, and analysis of the main regional actors. Moreover, the supporting institutions and available support services are highlighted, in order to determine possible inclusion of these institutions in a common hub and thus offer complementary services to SMEs and other target groups. The research thereby focusses on the implementation of the smart specialization strategy initiated by the European Commission in the Europe 2020 strategy.

This report is provided as a single report, similar to reports from other countries, where each partner delivered a mapping covering their region. As a result, regional mapping reports are prepared for Austria, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Romania, Serbia, Slovakia and Slovenia.

This work is structured in four main chapters, which all together give an overview about the structures, schemes and actors of the German support environment.

Chapter 2 “Strategic Background” describes the implementation of the Smart Specialization Strategy in Germany. It describes the strategic realms and measures for national implementation and the interrelations of national strategies.

Chapter 3 deals with the support environment on a national level. The question answered is, which institutional and organisational structures are implemented to support the target groups and therefor to foster the goals set in the national implementation of smart specialization.

Chapter 4 describes the schemas implemented in Germany to support the smart specialization strategies. More specifically it describes formats of support or funding available for the target groups such as public bodies, research organisations, agencies or industrial companies.

A further outcome of the research work for this report is the list of regional actors, which are active and therefor relevant for projects in the realm of the national smart specialization strategy. This is provided in an extensive, additional table referenced in the last chapter.

2 Strategic background

The smart specialisation strategy (RIS3) is initiated by the European Commission in the Europe 2020 strategy. Europe 2020 is the EU's growth strategy for the coming decade. In a changing world the EU needs to become a smart, sustainable and inclusive economy. These three mutually reinforcing priorities should help the EU and the Member States deliver high levels of employment, productivity and social cohesion.

Smart specialization is implemented in Germany on different levels. In general strategies, planning and implementations of policies in the fields of research and technology management is done on two levels of German government: on the national governmental level coordinated by federal ministries, and on level of the 16 federal states, in which the RIS3 is more concretely specified and implemented. This is described in the chapter Implementation of RIS3 in Germany with "High-tech Strategy".

On a national level the partnership agreement (Quelle) combines German Republic and European structural and investment funds. The new high-tech strategy (Link) of Germany has its origins in the year 2006 some years after the Lisbon Strategy or Lisbon Process (Link) in which the EU already intended to make Europa the most competitive and dynamic economic region in the world. However, different publically managed sources such as (Quelle1, Quelle2) state that the version from 2014 is strongly influenced or defined by the European smart specialization strategy. Also the implementations in the federal states indicate a strong connection between smart specialization and the national directives. Thus, the official implementation of RIS3 strategy for Germany is called high-tech strategy and covers the German strategy for investments in research and innovation. It dictates the measures for investments especially in the field of research and development.

2.1 Implementation of RIS3 in Germany with High-tech Strategy

The implementation of the smart specialisation strategy, which is called the high-tech strategy, was established in September 2014.[1] There are five main things that National/Regional Research and Innovation Strategies for Smart Specialisation (RIS3 strategies) as integrated, place-based economic transformation agendas do:

- They focus policy support and investments on key national/regional priorities, challenges and needs for knowledge-based development.
- They build on each country/region's strengths, competitive advantages and potential for excellence.

[1] Source: NATIONAL/REGIONAL INNOVATION STRATEGIES FOR SMART SPECIALISATION (RIS3), March 2014, download at: http://ec.europa.eu/regional_policy/sources/docgener/informat/2014/smart_specialisation_en.pdf

- They support technological as well as practice-based innovation and aim to stimulate private sector investment.
- They get stakeholders fully involved and encourage innovation and experimentation.
- They are evidence-based and include sound monitoring and evaluation systems.

The issue of the EU's growth strategy "Europe 2020" is to be prepared for the coming decade. By becoming a smart, sustainable and inclusive economy the EU and the Member States can be a guarantor for employment, productivity and social cohesion in a changing world. This is planned to be reached by 2020 by focussing on employment, innovation, education, social inclusion and climate/energy with each member state realizing its own national targets in each of these areas. The strategy is supported by concrete actions at EU and national levels.

National and regional authorities across Europe shall design smart specialisation strategies in entrepreneurial discovery process, so that the European Structural Investment Funds (ESIF) can be used more efficiently and synergies between different EU, national and regional policies, as well as public and private investments can be increased.

The aim of the EU's growth strategy "Europe 2020" is to make innovation a priority. For this all regions need to consider the relation of the different aspects of smart, sustainable and inclusive growth. In the regional context integrated smart specialisation strategies can be used to respond to complex development challenges. This can be applied to leading research and innovation (R&I) hubs and also in less developed and rural regions by establishing knowledge-based jobs and growth.

RIS3 is a key part of the proposed EU Cohesion Policy reform supporting thematic concentration and reinforcing strategic programming and performance orientation.

The focus of RIS3 is on economic development efforts and investments according to each region's relative strength. It is accomplished by focussing on investment and creating synergies, considering economic opportunities and emerging trends, and taking action to boost the region's economic growth. This makes sure that EU funding on the one hand is valuable and has some impact also in times of tighter budgets and scarce(r) public resources. On the other hand it can create synergies between regions and the industry.

To improve the innovation process RIS3 requires smart, strategic choices and evidence-based policy making. Priorities are set on the basis of a bottom-up entrepreneurial discovery process supported by strategic intelligence about a region's assets (1), its challenges (2), competitive advantages and potential for excellence (3).

Another aim of RIS3 is to make sure that overall policy goals are met, businesses are supported private investments can be used. This is supposed to be implemented by a policy mix, i.e. the combination of policy instruments available in a given regional environment – grants, loans and other support. RIS3 makes it possible to drive, steer and adjust policies and programmes by

using developing indicators. This way extended learning, sharing experience and good practices between regions is made possible.

The aim of the European Structural and Investment Funds[2] together with the Europe 2020 strategy is to achieve smart, sustainable and inclusive growth for the European Union. This aim should be realized through structural policy measures to realize an economically strong, social and sustainable Europe. To meet these goals, Member States are financially supported by the EU.

The most important financial instruments are the European Regional Development Fund (ERDF), the European Social Fund (ESF), the European Agricultural Fund for Rural Development (EAFRD), the Cohesion Fund (CF) and the European Maritime and Fisheries Fund (EMFF). With the exception of the Cohesion Fund, all of these instruments are used in Germany.

2.2 Strategic measures

The high-tech strategy follows early directions which were introduced in 2006 and had a strong focus on research policies and sales potential of technology fields. Its focus is on the research policy in Germany. In the years 2010 and 2014 the strategy was further developed and has the aim to make Germany a technologically and economically highly capable and attractive research location.

Subsequent developments considered the needs of the society and the sustainable fulfilment of these demands. The revision of the strategy in 2014 focusses on a wider field. Its purpose is a holistic approach including the research and innovation policies. The measures can be categorized by strategic aspects, financial measures, and supportive actions.

The strategic directions of impact are identified and categorized into five pillars[3]: Prioritization of future tasks for value adding and life quality; Interlinking and transfer; Economical innovation climate; Frameworks that encourage innovation; Transparency and participation; Implementation and bodies of the high-tech strategy. These pillars are illustrated in the following Figure 1.

[2] Source: Partnership agreement between Germany and the European Commission for the implementation of the European Structural and Investment Funds in the 2014- 2020 funding period, download at: https://ec.europa.eu/info/sites/info/files/partnership-agreement-germany-summary-jun2014_en.pdf
[3] Source: “Weiterentwicklung der Strategie”, https://www.hightech-strategie.de/de/Strategie-14.php, viewed on: 22nd May 2017

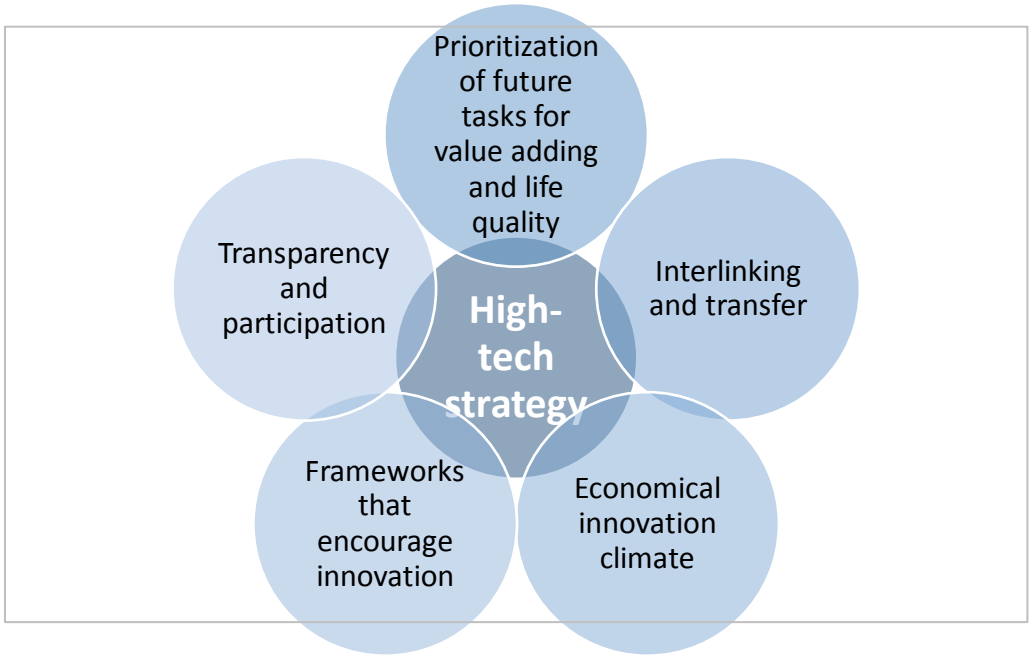

Figure 1: Five pillars of the German high-tech strategy

With the prioritization of future tasks for value adding and life quality in the high-tech strategy the German federal government sets the priorities on research and innovation. This includes the digital transformation, society, sustainable economics, energy, innovative work places, healthy living, smart mobility and civil security.

The priority is to interlink and transfer aims at creating new instruments for an improved regional, national and international network of industry and science. The approach is to provide platforms and support for interfaces and collaboration, to strengthen the competencies and counter the weaknesses.

Economical innovation climate needs to be supported in terms of dynamics and outcome. Especially small and medium enterprises and start-ups are responsible for the biggest part of innovation in German industries. To enable their market penetration and technological advance lies in the focus of this priority.

Frameworks that encourage innovation need to be developed to support the German innovation climate. Within the high-tech strategy the Federal Republic of Germany supports especially the securing of personnel recruitments and skilled labour, financing and investment in innovations. It investigates and develops societal, technological and legal conditions for this.

Transparency and participation is a pillar of the German high-tech strategy since it encourages the engagement of the society as a crucial part of the innovative change. The challenges to be worked on and strengthened are reduction of technology aversion, participation of citizens and social innovation.

These pillars are concretized in the following.

1. Prioritising future challenges relative to prosperity and quality of life.

With the new High-Tech Strategy, we are establishing thematic priorities in research and innovation. In the process, we are concentrating on areas that feature especially dynamic innovation and that hold potential for economic growth and prosperity. And we are concentrating on areas in which we can help address global challenges and thereby enhance the quality of life for everyone.

Our six priority tasks relative to future prosperity and quality of life are as follows:

- The digital economy and society – with innovative solutions, we are addressing the challenges inherent in digital technologies, and we are seeking to use opportunities for value creation and prosperity in Germany.

- The sustainable economy and energy – the manner in which we produce and consume needs to become more resource-efficient, environmentally friendly and socially compatible. In short, it needs to become more sustainable.

- The innovative workplace – we are focusing on the profound changes taking place in the modern workplace, since good jobs are an important basis for creative ideas and economic innovation.

- Healthy living – we are strengthening research aimed at helping people live healthy, active and independent lives.

- Intelligent mobility – we are pursuing research in support of integrated transport policies that optimise the different modes of transport in terms of their efficiency, capability and interactions.

- Civil security – complex systems and infrastructures – for example, for energy supply, communications, mobility and logistics – need to work properly in the everyday lives of people.

2. Consolidating resources and promoting transfer.

Innovations occur at the interfaces between different disciplines, topics and perspectives. We thus plan to strengthen cooperation between companies, universities and research institutions, to bring such organisations together with international partners and to continually expand existing cooperation arrangements. To those ends, we will use new measures to strategically expand universities' options for cooperation with industry and society, to close gaps in commercialisation and to advance internationalisation of leading-edge clusters, core projects and other, comparable networks.

3. Strengthening the dynamism of innovation in industry.

We are promoting the development of a competitive, employment-strong industry whose products and services are fully competitive with the products and services of the most innovative competitors worldwide. To that end, we plan to use the potential inherent in key technologies, for the benefit of industry – for example, the great potential of microelectronics and battery technologies. We plan to expand the group of companies that participate in programmes for innovative small and medium-sized enterprises (SMEs) by making the funding conditions for such companies even more user-friendly. We want to increase the numbers of innovative start-ups in Germany, by improving the existing pertinent instruments and by connecting start-ups to global centres of growth and value creation. And we want to develop new potential for innovation in structurally weak regions.

4. Creating favourable conditions for innovation.

Innovation requires stimulating environments that promote creativity, excellence and entrepreneurship. We thus plan to focus more intently on promoting innovation-friendly conditions, with a view to intensifying the pace and strength of innovation. We are planning new initiatives aimed at ensuring that we have enough skilled personnel – including initiatives in STEM/MINT subject areas, in efforts to enhance the attractiveness and permeability of vocational training and in efforts to improve a culture of welcome for foreigners working in Germany. We plan to further harmonise technical regulations and standards. We plan to develop an open-access strategy that will improve the framework for effective, continuing access to publicly financed publications. Via innovative public procurement, we plan to provide new incentives for innovation in industry. In addition, we plan to make Germany more internationally attractive as a centre for venture capital investments.

5. Strengthening dialogue and participation.

Innovation needs to be enshrined in the very heart of society. We are thus working, by expanding and improving science communication, to strengthen the openness of all people to societal and technological innovations and changes. We plan to enhance the options and opportunities for interested citizens to help shape innovation-policy processes. We will develop new participation formats to that end, including formats for citizens' dialogues and public participation in research. We plan to make research funding more transparent, and we intend to establish new processes for strategic foresight.

3 Support environment

The support environment of the smart specialization strategy RIS3 describes basic entities that support companies and research in the smart specialization activities.

3.1 Clusters

Cluster are defined by the Smart Specialization platform S3 or RIS3[4]. To accelerate economic growth and evolve conditions for innovation, research and technologies two pillars of the implementation part of the Smart Specialization Strategy are important. Firstly, in an operational sense the regional innovation structures and opportunities need to be strengthened. Secondly, in a directive sense the priorities of the economic domains are set. The activities within the implementation of RIS3 comprise especially the mobilization of stakeholders and involved parties. This is done through target and vision setting, future scenarios and research routing through roadmaps. Another value of this is the alignment of the acting parties which results in even higher potentials of innovation. Through this alignment companies, research organizations, training and education institutions, investors and other involved entities learn from and with each other, share resources and increase their mutual outcomes. This alignment can only be achieved by a legal or institutional framework called an organization or a cluster. These groups come purposeful together, complement and bundle their competencies and result in a higher competitiveness.

Therefor cluster organizations are a highly preferred partner for developments in the area of research, technology and innovation. The even can be used as a governmental body in each of the priority areas. Some requirements on cluster organizations are flexibility, communication, experience, available resources, planning, and leadership.

There are three General Directorates of the European Union which sign accountable for innovation and regional strategies, namely the Directorate-General for Regional and Urban Policy, Directorate-General for Research and Innovation, and the Directorate-General for Industry. Since the end of the 1990s cluster political programs have been established to support regional competitiveness and innovational strength. They are focused on promotion and support aspects, but also deals with the improvement of parameters, easing of knowledge and technology transfer as well as the enhancement of innovation dynamics. Other aims are to support European collaboration of different cluster actors as well as efficient cluster management organizations and communication with and about the cluster actors. Finally they also want to strengthen cooperation between regions, institutions and cluster political actors.

Besides the European Commission also nation states have the aim to improve parameters and establish sustainable regional and industry related cluster development. Even though the focus

[4] Source: S3 Cluster Organisations, http://s3platform.jrc.ec.europa.eu/cluster-organisations, viewed on 22nd May 2017

and instruments of cluster development plans vary between countries they all involve demand-orientated support. The cluster platform Germany gives an overview of the different cluster political measures by using standardized criteria.

With high expertise in the Federal Republic of Germany numerous cluster initiatives were established since the mid-1990s. These set grounds for further innovation. Examples are the programs “go-cluster: Exzellent vernetzt!” by the Federal Ministry for Economic Affairs and Energy and the top-cluster competition for the development of efficient cluster structures by the Federal Ministry if Education and research.

3.2 Purpose-related funding Initiatives

The implementation of new products, services and business ideas requires improvement and support on different levels[5]. Some of the levers include the improvements of living quality, increase of economy, expansion of regional companies, founding of new companies for new work places, making current workplaces attractive and available, avoiding brain drain and keeping young, high potentials. The more specific a funding or support is, the more effective it can change in the intended direction. Two examples for purpose-oriented funding initiatives are regional initiatives and public-private-partnerships. These national, purpose-based initiatives are usually more effective on a regional level with high special vicinity since it supports the achievements and harmonization of interests and facilitates the knowledge and experience transfer.

The German Federal Ministry for Education and Research (BMBF) tries to achieve that by establishing an innovation climate that fosters the aforementioned levers. Funding programs that are regional allow a far more precise promotion of economical or societal challenges. The planning and creation of such a funding program considers interdisciplinarity and a mixture of branches, competencies and institutions. Technologies and competencies need to be bundled in a complementary way so that they become more effective.

The BMBF also supports partnerships such as the “Forschungscampus” that consists of companies and academic institutions working together on research topics based on mutual interest. These joints are intended on a broad and long lasting level so that it is possible to work on complex and resource demanding research areas. The objects of research are usually characterized by a high risk of its outcomes and therefore also by a high potential to yield fundamental or disruptive innovations. These initiatives can be created in many branches such as energy, material or construction technologies. The funding is usually partly sourced by the companies or universities themselves and is strongly aligned to the casual business and research processes of these institutions.

[5] Source: Unternehmen Region - Die Innovationsinitiative für die neuen Länder, https://bmbf.de/de/unternehmen-region-die-innovationsinitiative-fuer-die-neuen-laender-548.html, viewed on 22nd May

3.3 Implementation bodies of the high-tech strategy

The high-tech strategy is a strategy with policies on a national level. The implementation of it lies in the responsibility of federal ministries, which are divided in thematic fields. These fields are especially relevant for society and economy and directly influence the implementation of the S3 strategy. These federal ministries are shown in the following[6].

- The Federal Ministry of Education and Research
- Federal Ministry for Economic Affairs and Energy
- Federal Ministry of the Interior
- Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
- Federal Ministry of Transport and Digital Infrastructure
- Federal Ministry for Family Affairs, Senior Citizens, Women and Youth
- Federal Ministry of Labour and Social Affairs
- Federal Ministry for Food, Agriculture and Consumer Protection
- Federal Ministry of Health
- Federal Ministry for Economic Co-operation and Development
- Federal Ministry of Foreign Affairs

The group responsible for the development of the high-tech strategy is the department for fundamental issues, strategies and digital transformation from the Federal Ministry of Education and Research.

3.4 Joint Research Centre

An even stronger cooperation of entities than by research clusters is the establishment of joint research centres, such as the European Institute for Innovation and Technology (EIT), the European joint programming initiative, or joint technology initiatives. Their purpose is to foster excellent science, industrial leadership and societal challenges on an operational level. The scientific quality is ensured through science councils or the Marie-Skłodowska-Curie actions (MSC) in the Horizon 2020 programm. In the development of the competitive industrial landscape some technologies are important such as information and communication technologies (ICT), nanotechnologies, biotechnologies, new materials, innovative processing and space science. This development depend on strong support in financial area, whereas the accessibility of venture capital is a crucial success factor. The challenges in society reach all aspects of every day's life such as health, food, agriculture, energy generation, traffic.

[6] Source: high-tech-strategie.de, https://www.hightech-strategie.de/de/Uebersicht-8.php, viewed on 22nd May.

3.5 Innovation Networks

The Europe 2020 initiative encourages also networks of industrial companies and research organization that come purpose-based together. The goal is generally to penetrate a research field through the exchange of practical experience and bundling resources for research. This research is mainly defined by activities in innovation management such as future scenario analyses, investigation of fields of applications for certain technologies or analyses of technology fields. These networks are strongly aligned by the individual research aims of the participants. Usually these networks are privately funded and therefor limited on the competitive advantages of just a small group of companies. However, they are often lead by a research organization.

3.6 Centres of excellence, competence centres and non-academic research institutions

Centres of excellence are long-term organisations usually consisting of a party providing a shared team and facility to develop a field of applied research or a specific technology. Regional competence centres are non-profit companies or agencies for the neutral, cost-free distribution and mediation of independent consulting, knowledge, competencies, the support of integrating a company into a network for innovation, or support for the implementation of innovative measures such as energy efficiency, sustainability or reduction of environmental stress.

4 Smart Factory support schemes and programmes

The European Structural and Investment Funds closely ties with the Europe 2020 strategy, which aims to achieve smart, sustainable and inclusive growth for the European Union. Structural policy measures thus form a key pillar for the achievement of an economically strong, social and sustainable Europe. In order to achieve these goals, the EU provides financial support to the Member States. The most important financial instruments are the European Regional Development Fund (ERDF), the European Social Fund (ESF), and the European Agricultural Fund for Rural Development (EAFRD), the Cohesion Fund (CF) and the European Maritime and Fisheries Fund (EMFF). With the exception of the Cohesion Fund, all of these instruments are used in Germany.

The core support in the German high-tech strategy is the financial funding. The strategy is implemented especially by each of the federal states of German republic. In the case of the Interreg Danube Program especially the states Baden-Württemberg and Bavaria are relevant and therefore discussed in the following.

4.1 Financial support program of the state Baden-Württemberg

As defined in the partnership agreement between Germany and the European Commission the ERDF is the central funding schema used in the national regions. It is defined on the official source as following[7]. The ERDF programme of Baden-Württemberg 2014-2020 "Innovation and Energiewende" focuses on maintaining the top position of Baden-Württemberg as one of the most innovative and economically strong regions in the European Union as well as on boosting the Energiewende and reducing CO2-emmissions. With these goals Baden-Württemberg makes a measurable contribution to the Europe 2020 strategy for smart, sustainable and inclusive growth.

The programme will be implemented on the one hand through tailor-made funding instruments in the field of innovation and the Energiewende. On the other hand stakeholders in cities and communities are invited to commonly develop sustainable regional development concepts.

To achieve this Baden-Württemberg launched already in March 2013 a competition: RegioWIN for the best regional development concepts (=integrated territorial investments). The winner regions of the first selection round were awarded in January 2014. The stakeholders of these winner regions are invited to draft and propose flagship projects which will be cofinanced by ERDF. The programme amounts to € 246,6 Mio. for the period 2014-2020. 30% of this amount is reserved for RegioWIN.

[7] Source: “OP Baden-Württemberg ERDF 2014-2020” http://ec.europa.eu/regional_policy/en/atlas/programmes/2014-2020/germany/2014de16rfop001, viewed on 22nd march 2017

The programme concentrates on two funding priorities:

1. Research, technological development and innovation
   The high innovative potential and competitiveness of the economy in Baden-Württemberg should be strengthened through specific investments and the following measures: Boosting applied sciences as well as world-class research, supporting the cooperation between enterprises, universities, research institutes and stakeholders in the field of technology transfer in clusters and networks, improving the access of small and medium sized enterprises to the results of applied sciences through technology transfer, developing methods for phosphor recycling, supporting high-tech start-ups and fostering innovation in small and medium sized enterprises with the potential for technological leadership in the rural area. The ERDF programme is closely linked to the innovation strategy of Baden-Württemberg.

2. Reducing CO2-emissions
   There is a great potential to reduce CO2-emissions through energy efficiency measures. An energy efficiency network which covers the whole of Baden-Württemberg will assist enterprises for a better use of energy. Moreover, the CO2-emmission of cities and communities should be reduced through exemplary awareness raising projects based on integrated strategies and concepts. In addition, innovative pilot projects in the timber construction industry should also contribute to reducing CO2-emissions.

Some of the expected results include realising and enlarging 17 research and innovation infrastructure projects to support innovation activities especially of small and medium sized enterprises, offering technology transfer activities to 3.600 SME's, supporting 90 SME's which have the potential for technological leadership, supporting 27 start-ups in the high-tech-field, creating a network of energy efficiency for the whole of Baden-Württemberg, supporting 40 local and regional strategies for reducing the CO2-emissions in cities and communities and exchanging best practise examples, reducing the annual greenhouse gas emissions by 6.700 tonnes.

On the regional aspect, the broader districts within the Baden-Württemberg area include Stuttgart, Karlsruhe, Freiburg and Tubingen. The exact sum of the Regional Development Fund (ERDF) for BW is 246,585,038.00 EUR. Thematic priorities address technical assistance, research and innovation and low-carbon economy. This funding scheme sums up to a total operating budget of 493,170,076.00 EUR.

4.2 Financial support program of the state Bavaria

As defined in the partnership agreement between Germany and the European Commission the ERDF is the central funding schema used in the national regions. It is defined on the official source as following[8]. The strategy and the priorities of the ERDF OP 2014-2020 of the Land Bavaria aim at the creation of a business environment that promotes innovation and sustainable economic growth while ensuring attractive jobs and contributing to an environmentally friendly development of the region, in particular in the structurally weaker areas of Bavaria. Great attention will also be drawn to risk prevention and to sustainable integrated urban development projects. These priority settings will deliver a significant contribution to the implementation of the Europe 2020-Strategy for an intelligent, sustainable and inclusive growth.

Bavaria sets major accents for a development based on economic growth and employment considering the needs identified in the socio-economic and subsequent SWOT-analysis, as well as the country specific recommendations and overarching strategies, in particular the Regional Innovation Strategy (RIS3). The following priority fields will be supported through the operational programme:

Promotion of innovation, knowledge and technology transfer, enhancing the competitiveness of SMEs through the creation and the extension of advanced capacities for product and service developments and through internationalisation initiatives, promotion of measures to reduce CO2-emissions, including measures to increase energy efficiency and the use of renewable energies in small and medium sized enterprises (SMEs), supporting investment for adaptation to climate change, including ecosystem-based approaches, protection of the environment and promotion of resource efficiency.

The funding priorities are reflected in the following priority axes: Strengthening research, technological development and innovation, strengthening the competitiveness of SMEs, climate protection, flood protection, sustainable development of functional areas.

It is expected that this funding scheme will lead to 1.050 new jobs in research and science in supported organisations, support to 1.000 SMEs for the development of new products and services, reduction of the green-house gas emissions by over 11.700 t CO2-equivalent per year, 15 new projects for flood protection, promoting 27 new sustainable integrated urban projects and 613.000 square metres of open space created or rehabilitated in urban areas.
The Bavarian state is divided into seven broader districts: Oberbayern, Niederbayern, Oberpfalz, Oberfranken, Mittelfranken, Unterfranken and Schwaben. The Regional Development Fund (ERDF) for Bavaria provides a budget of 494,704,308.00 EUR. Thematic priorities include technical assistance, research and innovation, SMEs competitiveness, Low-carbon economy, climate change and risk prevention, environment and resource efficiency, financial information. The total operating budget for this funding scheme is 1,411,766,474.00 EUR.

[8] Source: “OP Bayern ERDF 2014-2020” http://ec.europa.eu/regional_policy/en/atlas/programmes/2014-2020/germany/2014de16rfop002, viewed on 22nd march 2017

4.3 Support measures

This chapter describes the measures of support which are in accordance with the German high-tech strategy and therefor RIS3. It is intended to provide a basis for decision support of selecting the correct support measures.

4.3.1 Web platforms and portals

Platforms are centrally organized web accesses and groups that provide knowledge and information as basis for actions done in the realm of smart factories. They provide a framework or an environment for alliances or networks to collaboratively initiate actions, developments, entrepreneurship. The knowledge provided includes relevant trends and developments in the research area and supports the definition of the business or research field. Thus the platforms do not conduct value adding by itself but provides the necessary knowledge for it.

One of the biggest portals for smart factories is the German "Plattform Industrie 4.0" (http://www.plattform-i40.de). It is part of the adopted future projects of the high-tech strategy 2020 and aims especially at the creation of structures for the thematic, efficient, and cross-company collaboration in the area of smart factories. It is divided into five working groups "Research and Innovation", "Cyber Security", "Legal Frameworks", and "Work, Education and Training". These groups aim at in depth communication with companies of various sizes and branches, clusters, project consortiums and governmental structures on regional, national and international level.

4.3.2 Encouragement of Venture Capital

Venture capital is a subsidy in the beginnings of start-ups given by a so-called business angel to the starting company. This money is usually necessary for the establishment of a start-up. The public subsidy does not include directly this investment. It rather is a financial support as implemented by the funding program INVEST by BMWI[9]. Business angles get 20% of their investments back, if they invest in start-ups with at least 10,000 euro in the early phases. The margin is usually charged with taxes. Also these ones can be refunded. Further, on the one side, the program supports the search for a fitting venture capitalist and, on the other side, encourages and supports the potential business angels to provide the investments.

4.3.3 Entrepreneurship and innovation

An important part of the high-tech strategy is the assurance of skilled workers availability for technical and innovative jobs (https://www.hightech-strategie.de/de/Fachkraeftebedarf-fuer-technische-und-innovationsorientierte-Berufe-sichern-124.php). Economic growth, societal wealth and social progress depend on qualified workers. In this meaning the measures of the

[9] Source: "INVEST - Zuschuss für Wagniskapital", http://www.bmwi.de/Redaktion/DE/Dossier/invest.html, viewed on 22nd May

high-tech strategy try to exploit the potential of older people, migrant and young people in the phase between school and apprenticeship. The concept of the German government for this exploitation and therefor for the securing of skilled workers availability is based on five pillars:

- Secureness of jobs
- Support for managing private life and business
- Equal chances for education from the beginning
- Possibilities for education and training
- Integration of high-potential immigrants

Different alliances and initiatives on national level such as „Nationalen Pakt für Ausbildung und Fachkräftenachwuchs", „Allianz für Aus- und Weiterbildung" (https://www.bmbf.de/de/allianz-fuer-aus-und-weiterbildung-1071.html), and „Chance Beruf" are engaged in the development of improved school and apprenticeship qualifications.

4.3.4 Innovation Vouchers

Innovation vouchers are a funding program that finances external research and development activities for companies. The south-German region Baden-Württemberg introduced in 2008 innovation vouchers[10]. It is a concept to support small and medium enterprises in the planning, development and implementation of innovative products, services and process technologies. In 2012 the funding of high-tech start-ups was added to potential subsidy recipient with maximum 5 years age.

4.3.5 Research infrastructure investments

The aim of funding measures for research is development and maintenance of the research landscape on a state level regarding its capability, attractiveness, and sustainability. Thereby applied, close to industry research is in focus and of major value.

Especially the sustainability through a higher attractiveness is a crucial factor for a successful international competition and the establishment and differentiation of German academic and scientific institutions. This includes universities with their core competencies and innovation capacities, which are acting in behalf of regional companies. The expansion of the research infrastructure is also a crucial factor for technology transfer. It transforms knowledge into new, innovative and marketable products and services and then again raises the regional competitiveness.

Through regionally active research institutes acting as innovation promotors companies and the industrial landscape become a sustainable system. Companies benefit from the accessibility of technological knowledge, are more intensively bound into the innovation process, and thus these

[10] Source: Innovationsgutscheine Baden-Württemberg, https://wm.baden-wuerttemberg.de/de/innovation/innovationsgutscheine/, viewed on 22nd May 2017

measures contribute to a higher innovation and success rate of small and medium companies. This interconnectedness yields a new forms of collaborative innovation methods such as open innovation and living labs and thus contributes to the competitiveness of innovations made in these regions.

The objects of promotion and investments are the research infrastructure with facility extensions and new buildings, capacities for the development of new methods and services, personnel, and research equipment including small and big machinery investments. A condition is connectedness to the current fields of specialization of the institutions.

Successful examples of these funding measures are the regional funding programs EFRE by MWK (VwV EFRE FEIH - 2014 - 2020[11]) RegioWIN[12]. It supports institutions of higher education for applied research in Baden-Wuerttemberg as well as the companies responsible for the constructions, extensions, and their subordinate offices.

4.3.6 Intermediaries for technology transfer

Intermediaries for technology transfer are centres, departments or persons that reduce the aversion towards new technologies through the support of the adaption of these technologies by SMEs. Their core functionalities are transparency in the research landscape regarding competencies and the creation of connections e.g. through research cooperation between industry and research. The support includes the financing of single technology transfer managers. However, all institutions for science and research (in terms of the „Unionsrahmen für staatliche Beihilfen zur Förderung von Forschung, Entwicklung und Innovation (Unionsrahmen), ABl. L 347 vom 20.12.2013, S. 289“) are eligible for a funding of this kind.

The support or funding includes mediation for cooperation between science and industry as well as the development of novel collaborative innovation plans through intermediaries.

4.3.7 Support of clusters and collaborative research

The aim of this support schema is to strengthen the applied research, more specifically research projects close to industry with high relevance for the regional economy. Some approaches comprise the deep interlinking between research institutions and companies to foster regional innovation capacity. Clusters thereby are organizations of different institutions, companies or legal persons with a common purpose or vision in the case of RIS3 the research and innovation towards smart factories. Its main function is the alignment of the acting parties which results in even higher potentials of innovation.

[11] Verwaltungsvorschrift des Ministeriums für Wissenschaft, Forschung und Kunst zur Stärkung von Forschung, technologischer Entwicklung und Innovation an staatlichen Hochschulen in Baden-Württemberg, download at: https://efre-bw.de/wp-content/uploads/VwV-EFRE-Zur-St%C3%A4rkung-von-Forschung-Entwicklung-und-Innovation-an-staatlichen-Hochschulen-FEIH-2014-2020.pdf
[12] Source: http://regiowin.eu/

The support measures can be one of the following types:

- Financing of centres for applied research at institutions of higher education.
- Applied research projects at institutes for applied research.
- Applied research projects at close-to-industry research institutes.

As stated at the beginning, the focus lies on the interlinkage of industry and research and the strengthening of research. Therefor the objects of subsiding are project in the pre-competitive phase of product creation and the inclusion of the according stakeholders. The subsidies cover the costs for cross-locational interlinking, and expenses for the according research and development program, as well as the purchase of large-scale equipment.

4.3.8 Support for high-potential SME

This subsidy should contribute to the regional innovation force and to help maintain the national technology leadership through the performance of single regions. The technology and innovation leadership could only be maintained through continuous investments in SMEs with high innovative capabilities, competitiveness and high aspiration for internationalization. Therefore, in this support concept, only SMEs with high potential for international technology leadership are supported.

An example is the German funding program “Spitze auf dem Land!”[13]. It provides the opportunity for applications within the EFRE program on the level of communities and municipalities.

4.3.9 Competence Center

The support of the creation of competence centres is a sustainable measure for the regional development. The aim is especially to reach the potential of regional companies in the intended fields of the RIS3 strategy. With the establishment of regional competence centre the availability of independent consulting and knowledge on new technologies and measures should be spread throughout the federal state on a wider level.

To ensure an effective establishment and working of these centres centrally managed networks for the experience exchange are created on a regional or national level. An example for this is the “Network Energy Efficiency” consisting of such regional competence centres[14]. The state Baden-Wuerttemberg has a high contribution of nuclear reactor produced energy. Companies should be given the opportunity for consultation of alternative energy sources and planning. This

[13] Source: “Spitze auf dem Land!“, https://efre-bw.de/foerderungsuebersicht/spitze-auf-dem-land/, viewed on 22nd May 2017

[14] Source: Regionale Kompetenzstellen des „Netzwerks Energieeffizienz“, https://efre-bw.de/foerderungsuebersicht/regionale-kompetenzstellen-des-netzwerks-energieeffizienz/, viewed on 22nd May 2017

benefits in terms of the national strategy to reduce the amount of this kind of energy and therefor to encounter the requirements of climate protection. With this network the consisting energy offers and infrastructures are considered in an objective manner

4.3.10 Support of regional investments through public bodies

Regional investment are especially important for the RIS3 strategies. Investments in regional infrastructure have a high impact on the region's companies and research institutes. In the case of the regional investments the regionally acting and responsible governmental bodies are supported. This way their knowledge and experience about their own region is used to evaluate the necessity and appropriateness for investments. Supported entities can be public bodies such as communities, municipalities, counties, or administration unions. In the following are two types of regional investments described: start-up accelerators and

Start-up accelerators are regional, technology field specific conventions or boot camps with the purpose to supervise and consult high-tech start-ups and spin-offs from universities, research institutes or private companies. The support of start-up accelerators needs facilities and infrastructure for the supervision. The support can thus be in monetary form or through the provision of adequate working environments. Focusses and technological topics of these accelerators lean on the specific competence fields of the regional strategies. Institutions that can be financially supported are public bodies on the level of federal states, counties, municipalities, economy support institutions, regional chambers, and non-academic research institutions.

The other example of investment refers to the infrastructure and therefor the bases of technological innovation. In the RegioWIN program[15] regional investments in innovation infrastructures are subsided that bring forth near to industry outcomes. It is a competition that aims at the regional developments through innovation and sustainability. Participating institutions are institutions for technology transfer, trade or industry chambers, municipalities or communities. The outcomes can be projects that exploit the potential of the industrial core competences of the federal state, new innovation methods that are collaborative, or founding of companies that support the challenge of skilled employee availability through novel training programs. Example outcomes of such subsided programs can be the creation of technology, competence or entrepreneurial centres.

4.3.11 Grants and Subsidies for innovation projects

Grants and Subsidies can be given in different occasions for different purposes. Generally the beneficiaries receive values in form of financial subsidies, which follows a more or less detailed program of milestones and conditions. The subsidies are granted, if the subsiding body, e.g. the BMWI, sees certain conditions fulfilled. The conditions are usually goals that align in the overarching strategies. Usually, the subsidies are also tied to a demonstration of the developed

[15] Source: Innovationsinfrastruktur, https://efre-bw.de/foerderungsuebersicht/innovationsinfrastruktur/, viewed on 22nd May, 2017

outcomes in a prototype or a model. The following examples are especially funded by the operational European program EFRE as formerly described. The receiving entity can be a natural or juristic person as well as groups of persons. The decision for assignment of the subsidies are done in different ways but usually in a strong competition among project proposals.

An important type of grant is the subsidy for innovative process technologies and flagship projects to develop innovation infrastructures described in the following. In the current German high-tech strategy an example is innovation in the area of wood construction[16]. These technology innovations substitute finite resources that are commonly used in the construction industry and produce major parts of the CO_2 emissions and therefor contribute to the challenges of sustainable production and environmental friendliness. Technology innovations in this area help to reach the strategic goals set for each of the federal states.

[16] Source: Innovation im Holzbau, https://efre-bw.de/foerderungsuebersicht/innovation-im-holzbau/, viewed on 22nd May 2017

5 List of regional actors

More than 100 regional actors could be identified throughout the Industrie4.0 mapping platforms http://www.i40-bw.de/de/ and http://www.plattform-i40.de/I40/Navigation/DE/Home/home.html for the southern part of Germany. Within the list, some aspects were particularly apparent:

- To an equal amount SMEs and large enterprises were active in I4.0
- Most of the actors were in the “mechanical engineering” business
- To an equal amount, actors were users, solution providers or both
- Two actors appeared disproportionally often: Bosch and Siemens

6 List of annexes

- XLS file “D3.2.1_Regional mapping Database_SFH_final_USTUTT.xlsx”

Figure 2: FILE - D3.2.1_Regional mapping Database_SFH_final_USTUTT.xlsx