



Project no.: REGIONS-CT-2013-320043-CLINES

Project full title: Cluster-based Innovation through Embedded Systems technology

Project Acronym: CLINES

Deliverable no.: D2.5

Title of the deliverable: Regional Match-Analysis

Contractual Date of Delivery to the CEC:	M13
Actual Date of Delivery to the CEC:	M13
Organisation name of lead contractor for this deliverable:	TUM
Author(s):	Nastaran Matthes, Christian Thiel Mark de Colvenaer, Geert Adriaens, Christian Nielsen, Arne Skou , Cristina Murillo, Cristina Urtiaga
Participants(s):	Partners 1, 2, 3, 4 , 5
Work package contributing to the deliverable:	WP2
Nature:	R
Version:	1.0
Total number of pages:	26
Start date of project:	01.09.2013
Duration:	36 months

Abstract:

A match analysis that assesses how, in each region, the main business needs are in line with the trends identified, and if the needs are supported by local research, and public policies.

Keyword list: smart cities, embedded systems, technical competencies, match analysis, research, public policies, smart city trends

Table of Contents

SUMMARY	3
INTRODUCTION	4
1 BAVARIA	4
1.1 BUSINESS NEEDS FROM TRENDS VS. BUSINESS STRATEGIES	4
1.2 TOP BUSINESS STRATEGIES VS. PUBLIC POLICIES	7
1.3 TOP BUSINESS STRATEGIES VS. RESEARCH FOCUS TOPICS VS. PUBLIC RESEARCH POLICIES	9
1.3.1 <i>Local Research Focus Topics</i>	10
2 FLANDERS.....	13
2.1 INDUSTRY VIEWPOINT - BUSINESS NEEDS FROM TRENDS VS. BUSINESS STRATEGIES	14
2.2 POLICY VIEWPOINT - TOP BUSINESS STRATEGIES VS. PUBLIC POLICIES	15
2.3 RESEARCH VIEWPOINT - TOP BUSINESS STRATEGIES VS. RESEARCH FOCUS TOPICS VS. PUBLIC RESEARCH POLICIES	15
2.3.1 <i>Local Research Focus Topics</i>	15
3 BASQUE COUNTRY, SPAIN.....	16
3.1 BUSINESS NEEDS FROM TRENDS VS. BUSINESS STRATEGIES	16
3.2 TOP BUSINESS STRATEGIES VS. PUBLIC POLICIES	18
3.3 TOP BUSINESS STRATEGIES VS. RESEARCH FOCUS TOPICS VS. PUBLIC RESEARCH POLICIES	20
3.3.1 <i>Local Research Focus Topics</i>	20
4 BRAINSBUSINESS/AAU	22
4.1 BUSINESS NEEDS FROM TRENDS VS. BUSINESS STRATEGIES	22
4.2 TOP BUSINESS STRATEGIES VS. PUBLIC POLICIES	24
4.3 TOP BUSINESS STRATEGIES VS. RESEARCH FOCUS TOPICS VS. PUBLIC RESEARCH POLICIES	25
4.3.1 <i>Local Research Focus Topics</i>	25
5 CONCLUSION.....	26

Summary

The deliverable 2.5 “Match-analysis of regional business strategies against projected business needs and identified regional research focus topics” is a document delivered in the context of work package 2 “Regional RTD mapping and analysis” for the CLINES project.

The identification of the level of integration between existing regional research agendas and regional business strategies is the second main objective of WP2. In this activity we have used the data compiled to analyse and identify if the current regional business strategies support the technological solutions that have the potential to satisfy the market needs identified in D2.2 “Trend Roadmap”.

This report forms the basis of the outputs in the next project stage where the final results from work package 2 will be used to bring an embedded systems innovation ecosystem into existence as outlined in the Joint Action Plan (WP4).

Introduction

Resource efficiency, investment in greener products and services, using new and existing technologies, and developing internal and external markets for eco-efficiency requires integration of university, industry, and government, in addition to performing their traditional functions, each assume the roles of the others.

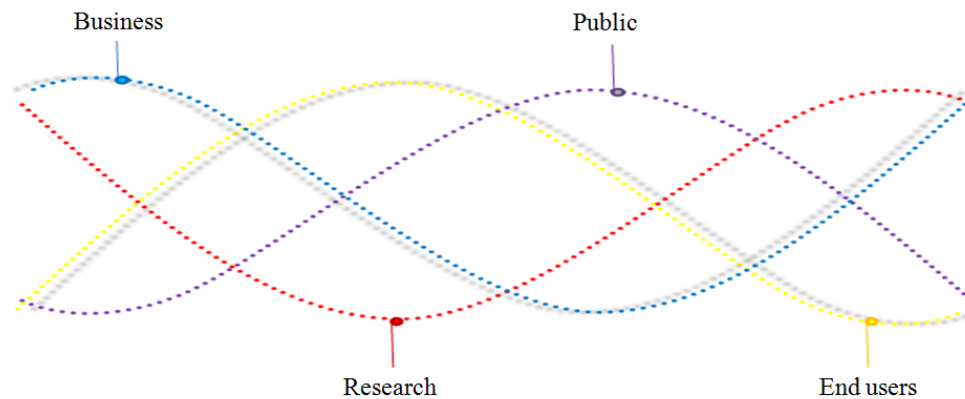


Figure 1. Triple Helix knowledge exploitation

This match analysis looks at the triple helix integration inside the participating regions: Are the business needs identified supported by research that can close existing technology gaps, and are the business needs supported by regional public policies.

1 BAVARIA

This section combines D2.1 “Description of Cluster Competencies”, D2.2 “Trend Roadmap” and D2.3 “SWOT Analysis” in one regional match analysis for Bavaria.

1.1 **Business Needs from Trends vs. Business Strategies**

The world’s urban population is expected to double by 2050. ¹ By 2030 the world population will reach the magic number of 8 billion people and six out of every ten people will live in a city. Another important aspect of demographic change is the rising proportion of the elderly population in many parts of the world. Major urbanization demands are new ways to target problems of overcrowding, energy consumption, resource management and environmental protection. ICT has a major role to play in mastering the changes.

In D2.2 “Trend Roadmap” we have already identified trends around the 3 dimensions of Smart Cities: Smart Mobility, Smart Environment and Smart Living. Table 1 lists some samples of Smart City products across the three Smart City project types:

¹ World Health Organization (2013)

Table 1: Smart City trends identified in the deliverable 2.2

Smart City dimension	Visionary products	Key technologies
Smart Mobility	Fully-connected self-driving/parking cards Smart embedded computing roads and vehicles, Real time traffic management system, Travel Card, Electronic Journey planner, Comprehensive planning and mobility assistants, Car 2X, Integrated multi-modal travel, intelligent traffic routing, monitoring the parking area	Geo-sensors, data mining, smart cards, radio frequency identification, tracking, Big Data analysis
Smart Environment	ICT enabled Smart Grid, Metering, pollution control, electric cars, Intelligent garbage	Embedded sensors, Smart Meter/AMI, energy storage, smart grid technology, distribution automation, distribution management systems, network monitoring, data storage and analytics, home energy management
Smart Living	Tele check of vital health parameters in real time, outdoor lighting, power and lighting management in buildings	Smart plugs, light sensors, power management automation software, Smart Application, Big Data analysis

The most important trends include the integration of applications, the increasing networking towards cyber-physical systems and the participation of a growing number of people; each providing different demands to the Smart City products.

As shown in D2.1 the Bavarian ecosystem covers basically the whole value chain for Smart City domains Smart Mobility, Smart Energy and Smart Living with a strong focus on the Embedded Systems. Figure 1 presents a very detailed picture of what the companies in Bavaria focus on. Industry in Bavaria is currently sufficiently well positioned to play a significant role in the market for future networked Embedded Systems.

Smart City products are people-oriented. These products should be usable, and in order to sell, they require a customized marketing strategy. Embedded system companies do not devote resources to fulfilling these two requirements for their products, as described in Deliverable 2.1.

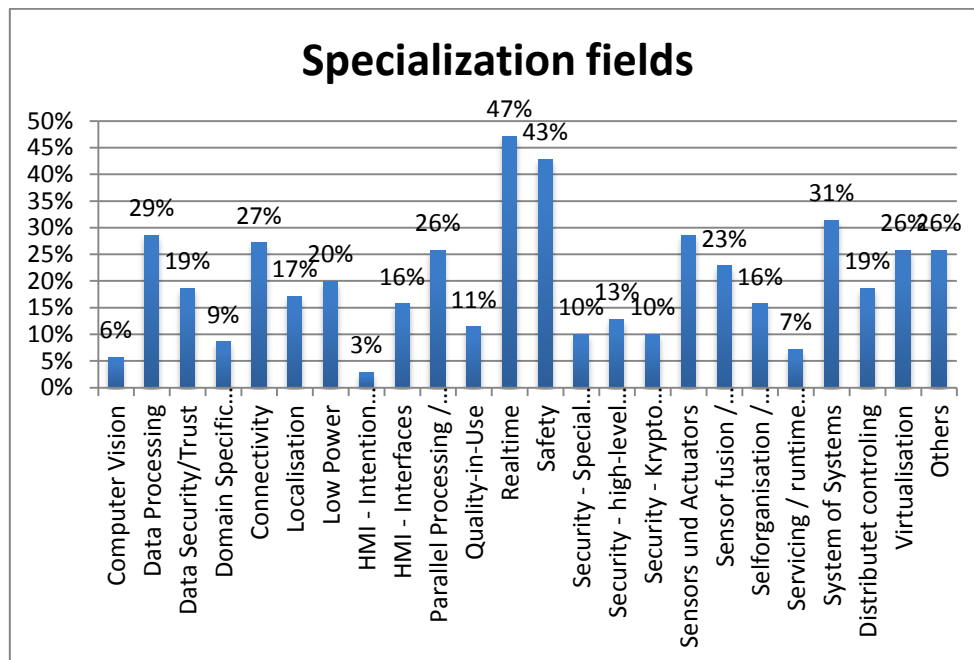


Figure 2. Specialization fields of Bavarian Ecosystem

The global market volume resulting from all the different Smart City solutions is very large. In transport, research organization Markets and Markets predicts the Smart Transport market to reach \$156.3 billion in 2020. Estimates forecast the Smart Energy technologies market (including smart grid) reaching \$220 billion worldwide by 2020. Additionally, Arup conservatively estimates both smart waste and assisted living technology markets to reach \$5 billion³ each globally.

An estimated global market size of \$220 billion is forecast by 2019 for Smart Grid technology globally, whilst \$500 billion will be spent globally on Smart Grid initiatives by 2030.

We asked Bavarian companies in Deliverable 2.1 for the main sales regions, and found out that only 30% of the responding companies have important sales outside Europe.

There is great potential for Bavarian businesses in the global, growing market for Smart City products. Regional Smart City projects provide these businesses with a platform to export their services outside of Europe. An important precondition for exporting is the interoperability of products. International cooperation is necessary for the implementation of internationally recognized norms and standards.

Conclusion

Priorities regarding to business strategies for a cluster action plan:

- Smart City products should be people-oriented and require a customized marketing strategy.
- Future business within the Smart city domain will be generated on global market.
- Interoperability of Smart City products is necessary for exporting of the services.

² Zpryme Research

³ Arup estimates based on interviews with industry experts

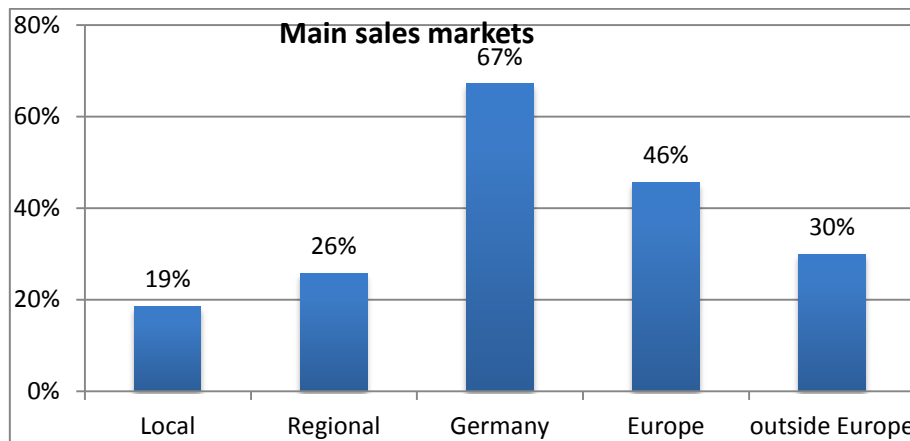


Figure 3. Main sales Markets of Bavarian companies

1.2 Top Business Strategies vs. Public Policies

In Deliverable 2.1 we have identified the following public programs and policies which are already in place in Bavaria and relevant for CLINES:

- **Bavarian Technology Policy:** The Bavarian state government has defined the following fields of application and technology as priorities for Bavaria over the long term: Life Sciences, ITC, Smart Energy, Clean tech and technology-based services⁴.
- **Energy Innovative:** The objectives of the energy policies pursued by the Bavarian Ministry of Economic Affairs are efficiency, supply security and environmental sustainability. The guidelines to that end are outlined in Bavaria's energy concept, "Energy innovative"⁵. The focus here is on the areas of transport and energy storage and the efficient use of energy.
- **Bavaria Digital:** With "Digital Bavaria"⁶, the Bavarian State Government is delivering a new level of quality in the policies that make Bavaria a great place to do business. The aim is to create and expand areas of competence in connection with digitalization. This is happening within the framework of preliminary research projects about areas of competence such as IT Security, Networked Mobility and Digitalized Production (Industry 4.0)
- **Perspective Munich:** Perspective Munich embodies the principles of sustainable, permanently environmentally friendly development and urbanity in keeping with the times, based upon the fundamental values of the European city.

With these programs the Bavarian government contributes to promoting Smart City products in Bavaria. However, as can be learned from SWOT analysis there are still legal frameworks needed that offer the best opportunities to develop local sustainable solutions: a stable legal framework for the Smart Grid, legal regulation for the use of transport data and legal requirements for the processing of health data. Cities and government traditionally consider the topics energy, transport and health separately. The deployment of smart solutions needs more interaction between these different verticals. Cross-departmental considerations are an essential requirement for the planning of Smart City solutions.

⁴ <http://www.stmwi.bayern.de/wirtschaft-standort/wirtschaftspolitik/>

⁵ <http://www.energie-innovativ.de/>

⁶ <http://www.stmwi.bayern.de/digitalisierung-medien/bayern-digital/>

In Deliverable 2.3 “SWOT Analysis” a range of the local founded pilot research projects and references are identified that provide a good opportunity to increase the knowledge in the area of the system integration or Smart Cities. Pilot projects and reference cities are indispensable both for local demand and export of smart technologies. Efficient networking between the different existing pilot projects for Smart Cities is an important approach in this context. However, such projects are implemented without any overarching strategy up to now.

The fields of application and technology that are the focal points of Bavarian technology and innovation policy are future markets where the companies assume a growth potential for them in the next years. Figure 3 present the results of CLINES –questionnaire regarding to future business expectancies.

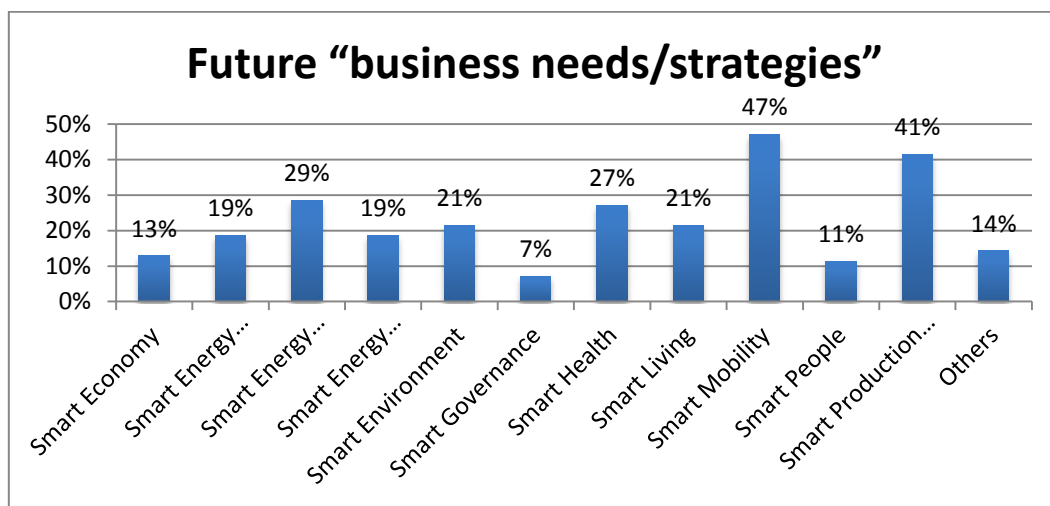


Figure 4. Future business expectancies

The excellent collaboration between regional decision-makers and the Bavarian Ecosystem is reflected in identified future markets that are similar to the fields of the application and technology as priorities for Bavaria by the Bavarian government.

One of the biggest assets of Bavaria is an established strong cooperation between research, industry and Bavarian Government. The "Bavarian Cluster Initiative" is designed to strengthen this cooperation. The existing and longstanding cooperation and the regular meetings between all regional decision-makers ensure an early involvement of the cluster ecosystem in the development of new strategic guidelines.

Successful deployment of Smart City solutions requires collaboration between multiple actors in the vertical value chain. The Bavarian cluster initiatives facilitate already the collaboration between multiple diverse actors. But still structured cross-sectoral approaches are needed to look at smart products as part of a more integrated approach. A structured inter-cluster cooperation approach can promote the collaboration between verticals. The cross-sectoral approach leads to additional opportunities for companies.

Conclusion

Priorities regarding to public policies for a cluster action plan:

- Legal frameworks to develop local sustainable solutions are needed that offer the best opportunities to develop local sustainable solutions.
- Cross-departmental interaction between different verticals: energy, transport and health should be promoted.
- Structured inter-cluster cooperation is needed to look at smart products as part of a more integrated approach.

1.3 Top Business Strategies vs. Research Focus Topics vs. Public Research Policies

As already in D1.2 mentioned companies, research institutions, universities are organized in the framework of the Bavarian cluster-like initiative. These clusters create platforms to exchange experiences between companies and research and give impulse to intensive cooperation.

It is the reason why regional knowledge transfer is strong between companies and research. Experts work closely together on topics like: Embedded Systems, safety & security, renewable energies, energy efficiency in power generation and ICT services. The following table lists the most CLINES relevant cluster organisations that serve as focal points for industries involved with Smart Cities and Embedded Systems:

Table 2: Clines relevant cluster organisations

Cluster	Definition
Security Network Munich	Approximately 350 people are involved in the Security Network Munich. They are hailing from about 140 organizations (companies, research institutions, associations etc.).
Working Group Multicore	The participants include 90 experts from industry and research.
The Munich Circle	As a non-profit international association at the crossroads of business, academia, public policy and society, the Munich Circle acts as an independent platform
Energy Technology Cluster	The cluster offers cooperation forums, meetings with companies and institutes, studies on current problems and the identification and initiation of business-relevant joint projects involving supra-regional partners
Cluster Automotive Bavaria	The automotive cluster consists of about 730 companies and institutes from the automobile sector and all areas that are relevant for the automobile domain.

With the funding instrument “FuE-Program” the Bavarian Government supports the cooperation between companies and universities. The goal is to accelerate the use of information and

communication technology in new products and applications and to improve the competitive position of Bavarian companies further.

Further local funding instruments for R& D projects are BayINVENT, Bavarian Research Foundation and BayEMA.

The great scientific potential already leads to above-average potential for technology-oriented start-ups from universities and research institutions. University start up initiatives like UnternehmerTUM, LMU Entrepreneurship Center deliver technical support while setting up a business.

1.3.1 Local Research Focus Topics

The academic landscape in Bavaria is an efficient cornerstone of both research and development, providing drive for innovations. Nine state universities, 24 universities for applied sciences, the University Of Television And Movies as well as countless private institutes educate skilled trainees and open up interesting opportunities for innovative companies of every industry to cooperate,⁷ Figure 5.

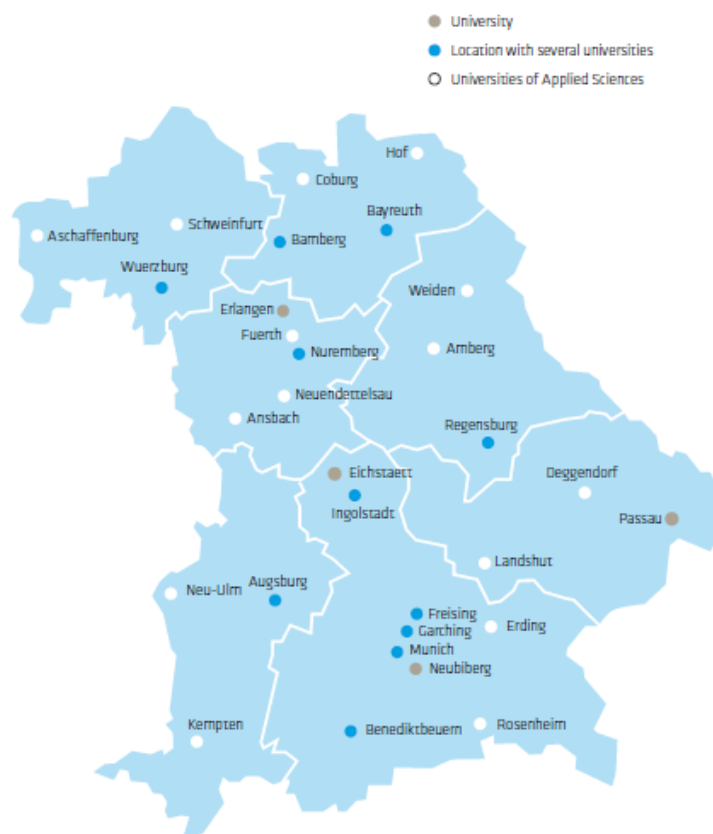


Figure 5. The Academic landscape in Bavaria

The Bavarian research, technology and innovation policy in coming years focus in particular on the following current application and technology fields: ⁸

⁷ Bavaria A Guide for Investors 2014

⁸ Overall concept for the Research, Technology and innovation policy the Bavarian state Government 2011

- Life Sciences (Life Sciences, especially biotechnology and systems biology)
- Information and communication technologies
- Efficient production technologies, mechatronics, automation, robotics
- New materials, smart materials, nano and micro technology
- Clean Tech - resource-saving energy, transport and Environment-technologies, Renewable resources (including biofuels), electric mobility Innovative, technology-based services

Due to the events in Japan derive energy research and the development of innovative energy technologies increasingly attention. In addition to the core issue of energy here are the topics transport and storage of energy (chemical storage, new materials, smart grids, etc.) as well as more efficient energy consumption (building efficiency, smart home etc.) in focus. The Bavarian state government has highlighted the importance of energy research in its Energy Concept “Energy Innovation”.⁹ The most central research topics are developed in the economic framework “Bavarian alliance for energy research and technology”. On this technical basis promotes Bavarian government research projects in the whole range energy research and technology development. Figure 6 gives an overview of these projects.

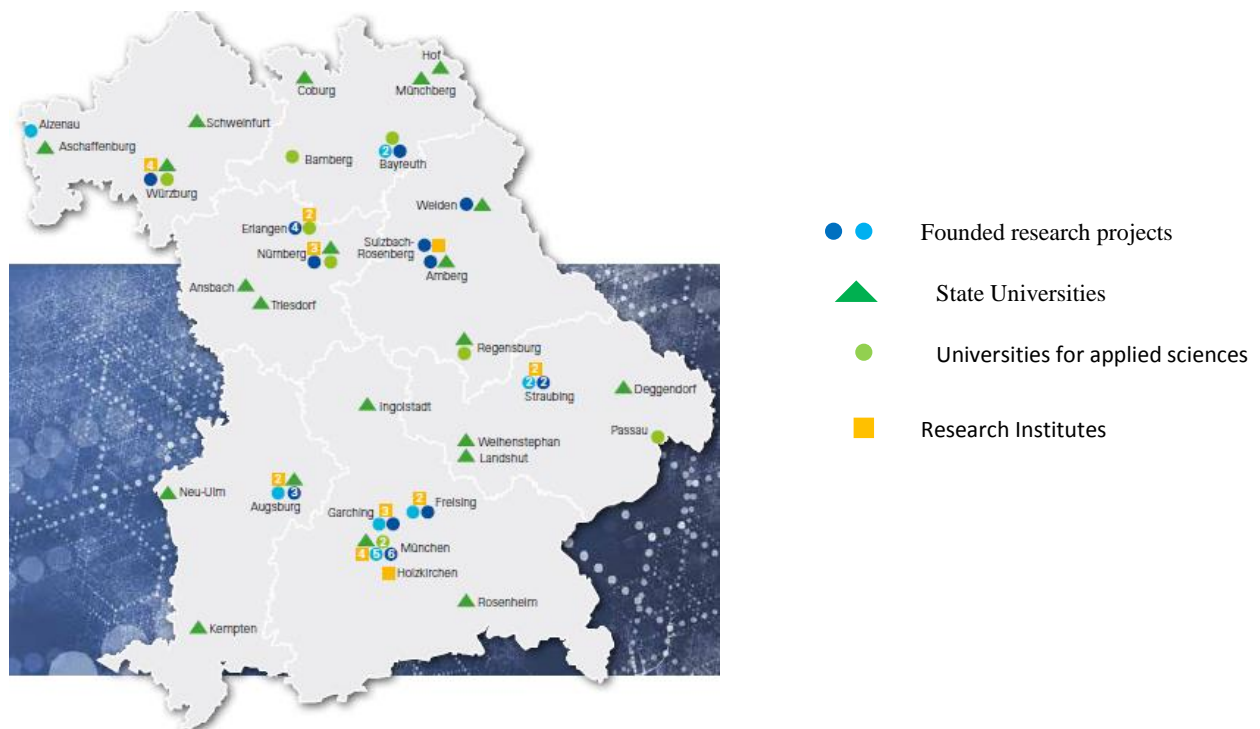


Figure 6. Founded research projects by Bavarian State Government

The dense university network allows an uncomplicated technology transfer between research and business practice. To ensure feasibility and smooth access to innovative resources, the universities of applied sciences in particular provide for an apprenticeship close to business and numerous options when it comes to mutual efforts between economy and science.¹⁰

⁹ Energy research and technology in Bavaria, ENERGIE INNOVATIV April 2013

¹⁰ Investorstudy Bavaria

Along with the universities, the Free State has a historically grown and elaborate non-academic research landscape including research institutes renowned throughout the world.

Bavarian research institutes have several programs related to Smart City topics:

Fraunhofer institute for Embedded Systems and Communication Technologies (ESK)¹¹: Fraunhofer ESK undertakes applied research geared toward new information and communication technology (ICT) processes and methods. The activities focus on designing these increasingly distributed, heterogeneous and networked ICT systems to be more reliable, flexible and resource efficient, thus ensuring that they contribute to improved products and production environments in the automobile and traffic, energy, automation, building and security engineering and telecommunication industries. Some of the current research projects are: Future Vehicle Software Architectures, Smart Grid traffic models, Software Defined Car, Secure, Simple and Fast Communication in the Vehicle, Communication for E-Car Energy Management, Intelligent and reliable Sensor Networks, Intelligent charging infrastructure for e-vehicles, Smart Microgrid Information and Control, Shared e-mobility, Autonomous Traffic Warning System WithCar to X Communication

Fortiss institute for software intensive systems¹²: As an institute associated with the Technical University of Munich acts Fortiss as a technological think tank, bridging the notorious gap between fundamental research in academia and its fruitful implementation in an industrially and commercially feasible context. Fortiss pursues applied and market-oriented research in the field of Cyber-Physical Systems and Services, with a special focus on the automotive industry, industrial automation, Smart Energy systems and future public administration and governance.

Fraunhofer Institute for Integrated Circuits (IIS)¹³: The IIS is one of the world's leading application-oriented research institutions for microelectronic and IT system solutions and services. CLINES related research topics are: Energy Management, Sensor System, Communication Systems and Safety and Security Technology.

Fraunhofer AISEC¹⁴: At Fraunhofer AISEC, the main focus is the development of application-oriented security solutions and their custom integration in existing systems. The core competences of AISEC lie in the areas of hardware security and the security of embedded systems, product and intellectual property protection, network security, and security in cloud- and service-oriented computing.

The Bavarian Center for Applied Energy Research (ZAE Bayern)¹⁵: ZAE promotes energy research as well as education, further training, consultation, information and documentation in all fields significant to energy research. ZAE Bayern works on the interface between evidence-based fundamental and applied- industrial research. Every year the institute performs a great number of projects with the industry, from SME to large groups, as well as with university and non-university research partners.

¹¹ <http://www.esk.fraunhofer.de/>

¹² <http://www.fortiss.org/home/>

¹³ <http://www.iis.fraunhofer.de/>

¹⁴ <http://www.aisec.fraunhofer.de/>

¹⁵ <http://www.zae-bayern.de/>

Energie Campus Nürnberg (EnCN): EnCN is a research platform for the development and presentation of a closed renewable energy chain that includes, among other things, the combination of power generation from renewable sources, efficient energy storage and transport and intelligent supply with efficient utilization and exploitation.

Helmholtz Center Munich: Helmholtz Zentrum München is the German Research Center for Environmental Health. It investigates important common diseases, which develop from the interaction of lifestyle, environmental factors and personal genetic background, focusing particularly on diabetes mellitus and chronic lung diseases.

However, highly fragmented research in individual disciplines and isolated research question is a key challenge identified in SWOT analysis. There are still no sustainable building interdisciplinary research fields. Interdisciplinary research and education in all areas of the Smart City solution's value chain should be promoted.

Conclusion

Priorities regarding to public research strategies:

- Fragmented research in individual disciplines
- Sustainable development of interdisciplinary research fields

2 Flanders

This paragraph combines D2.1 Description of Cluster Competencies, D2.2 Trend Roadmap and D2.3 SWOT Analysis in one match analysis. This match analysis has as objective to define the key priorities which have to be taken into account when developing a cluster action plan related to the development of innovative smart city solutions based on embedded systems. This analysis focuses on Flanders as a region and looks at the priorities from an Industry, Policy and Research viewpoint.

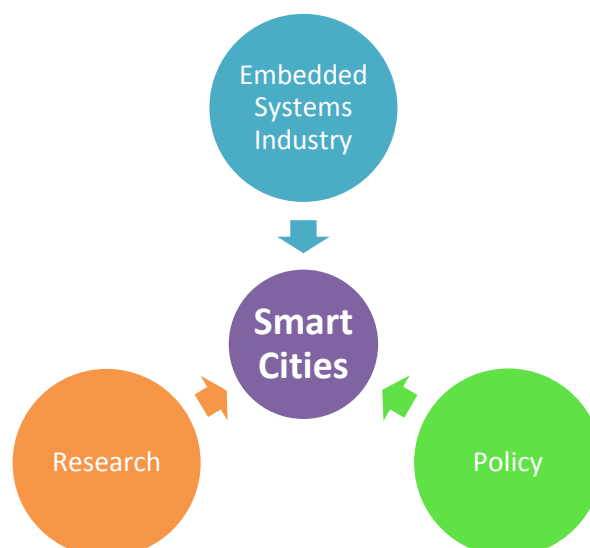


Figure 7. Triple Helix viewpoint

2.1 Industry Viewpoint - Business Needs from Trends vs. Business Strategies

Analysis

As mentioned in D2.1 Description of cluster competencies, Flemish embedded systems companies perceive smart mobility, smart living and smart environment as the top 3 smart city challenges on which to focus when they want to make money within 3 years.

However, as can be learned from the SWOT analysis, the smart city business case for Flanders is not clear. Until now only pilot activities were setup. Few projects resulted in a sustainable smart city product or service

- The Flemish smart city market remains small. A lack of coordination between different cities or the different political levels in Flanders hinders the creation of a relevant scale, which is needed to build sustainable smart city solutions.
- The legal framework for smart city solutions is not clear yet. The likelihood of changes in this legal framework causes more sustainability risk for smart city business models.
- The DSP Valley community lacks companies with upstream value chain activities. Most companies focus on design and development of ES components and are not focused on developing and implementing smart city systems. They have to rely on a limited number of 'smart city' solution providers to enter the local 'smart city' market.
- Although the focus of the Flemish ES industry on upstream value chain activities can be seen as a drawback, it can turn out to become an advantage as major smart city projects are implemented by big corporate companies. Those corporates search for niche players to provide certain specific solutions. If an embedded systems expert can sell his expertise and solutions to a global player, a global market could open up for this small, local embedded systems expert.
- Due to the financial crisis, cities are confronted with budgetary constraints. Budgets are more and more allocated to the core business of urban communities, which is: delivering community services to their citizens. The budgetary freedom to run innovative smart city projects is limited.
- Smart City solutions based on the potential of embedded systems are 'highly' innovative projects. Certain government agencies (e.g. IWT) focus on financially supporting those 'highly' innovative projects. However, for this financial support to be granted, a solid business case is needed to prove the return on public money invested.

Conclusion – Priority 1

Solid business cases are of key importance for sustainable smart city solutions. A cluster action plan has to focus on creating the most optimal conditions for smart city solutions to flourish: market scale through cooperation and internationalization, legal stability, etc.

2.2 Policy Viewpoint - Top Business Strategies vs. Public Policies

Analysis

The growth of people living in cities, the rising proportion of the elderly population, resource scarcity and the virtualisation of communities are key societal challenges relevant to policy makers. Smart solutions are needed to cope with those challenges. This is one of the findings described in D2.2 Trend roadmap.

Smart solutions require a smart vision but Flemish cities are not smart enough yet. Smart city initiatives are still in their infancy. As can be learned from the SWOT analysis, Flemish cities lack a coherent vision for smart solutions. Measures are fragmented and there is no co-operation or sharing of experiences.

Although the Flemish government has defined a ‘smart specialization strategy’, detailed in its VIA and NIB programs, the implementation is still confronted with the complexity of the Flemish political ecosystem. On a regional level, policy making and policy execution is spread over several mono thematic agencies and departments, whereas smart city solutions need an integrated multi-thematic approach.

Furthermore, the Flemish government and city councils are confronted with budgetary constraints due to the stalling economy and societal challenges such as ageing. Those budgetary constraints point at a need for cost-effective smart solutions and could be a catalyst to develop this kind of solutions.

Conclusion – Priority 2

A prerequisite for the success of smart city solutions is a coherent political vision as basis for a coordinated implementation plan. A cluster action plan has to focus on activities that support the creation of this coherent vision, e.g.: case development, impact analysis, inspiration sessions, joint projects, knowledge exchanges and experience sharing. A clear political vision will be beneficial to smart city solution providers who want to build a sustainable smart city business case.

2.3 Research Viewpoint - Top Business Strategies vs. Research Focus Topics vs. Public Research Policies

2.3.1 Local Research Focus Topics

As can be concluded from the different analyses, technology is not the major bottleneck for the implementation of smart city solutions. Technology, which is readily available, can be a solid base to solve short-term smart city challenges. However, smart city technology can still be improved (cfr. D2.2 Trend roadmap – technological challenges) and innovative technology always offers new opportunities to fill unmet smart city needs. Solid research programs are valuable to support smart city initiatives.

Flemish research centres have several programs related to smart city challenges

- iMinds, the Flemish research center on ICT, has sustainable mobility, Green ICT and a healthy society as research priorities. Research topics include: ICT applications that enhance mobility of people and goods, traffic management systems, multimodal transport,

mobile context aware services, vehicle to vehicle communication, Smart Grids, Use of ICT in reducing ecological footprint, reduction of energy consumption by ICT, Independent living via wireless networks and sensors, large scale image processing, computer-aided detection. iMinds is also creating a separate group on the "Internet of Things".

- VITO is focusing its research on 3 challenges: transition to a society which is less dependent on fossil fuel, transition to a more sustainable industry, improving quality of life by better management of our environment.
- VITO (Energyville) has specific infrastructure to test innovative smart grid solutions
- The Scientific & Technology Centre for the construction sector focuses its research on ventilation, accessibility, security, health, comfort, environment, new materials, etc. It also has several labs to facilitate testing of new concepts.
- IMEC runs programs on CMOS scaling, Heterogeneous integration, Electronics for healthcare and life sciences, Wireless communication, Image sensors and vision systems, Large area flexible electronics, Energy, Sensor systems for industrial applications
- the newly (July 2014) created Strategic Research Center for the Manufacturing Industry ("SOC Maakindustrie"), which combines Flanders' Drive and Flanders' Mechatronics Technology Center also has a strong research focus on Smart Vehicles and Smart Mobility

The key challenge is to bridge the gap between the research world and the real smart city world and to transfer research results into sustainable organisations running and implementing smart city solutions. This challenge is not new and numerous initiatives are taken to overcome it. But with a specific focus on embedded systems and smart cities, it is worth re-emphasizing the importance of a better coordinated cooperation between research and industry.

Conclusion – Priority 3

A cluster action plan has to focus on the cooperation between research and industry. Relevant activities have to focus on the transfer of research results to industry, on making research more market and user driven, on measures to bridge (financially) the valley of death, etc.

3 Basque Country, Spain

This paragraph combines D2.1 Description of Cluster Competencies, D2.2 Trend Roadmap and D2.3 SWOT Analysis in one match analysis. This match analysis has as objective to define the key priorities which have to be taken into account when developing a cluster action plan related to the development of innovative smart city solutions based on ICT. This analysis focuses on Basque Country (Spain) as a region and looks at the priorities from IECT sector, other sectors and business models viewpoint.

3.1 Business Needs from Trends vs. Business Strategies

At this point we must consider the business needs in relation to the business strategies of Basque companies in the IECT sector. In this sense, the companies have established business strategies for the mid-term, around the concepts of smart city and smart energy, as is reflected in the graph on the questionnaire we distributed to the companies. Likewise, and within the field of the smart city, the areas where the companies have more products and services are smart mobility, smart people and smart environment, as can be seen in the second graph.

FUTURE BUSINESS STRATEGIES

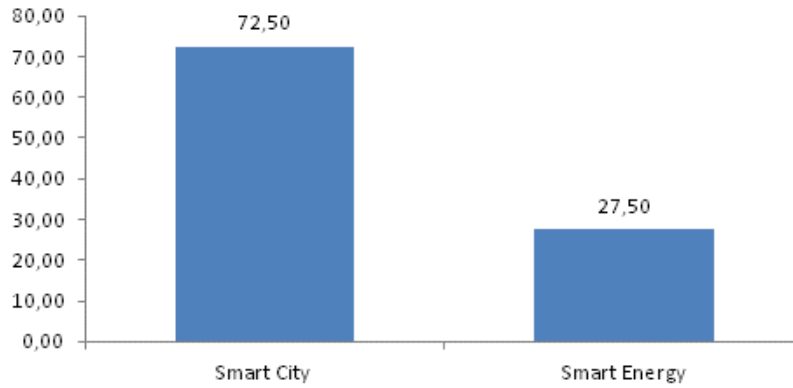


Figure 8. Future business strategies

Smart City

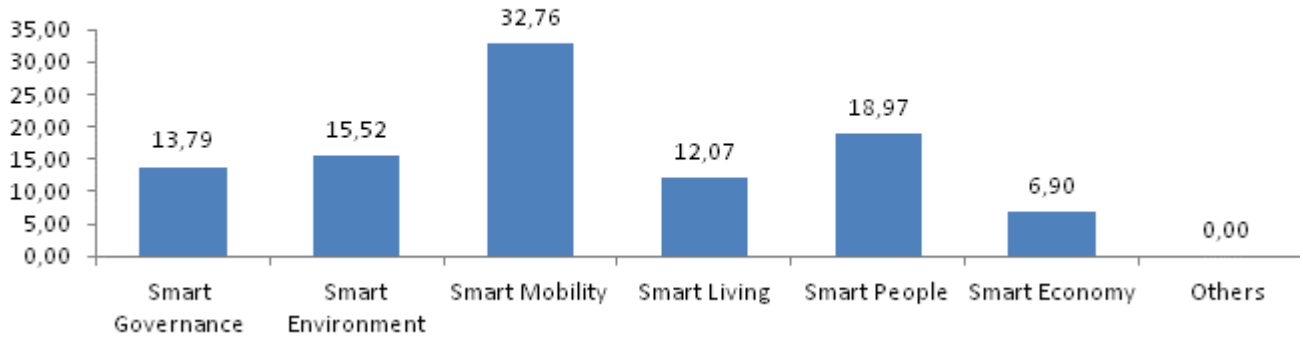


Figure 9. Future focus areas within Smart City

And in the case of smart energy, in generation and distribution systems.

Smart Energy

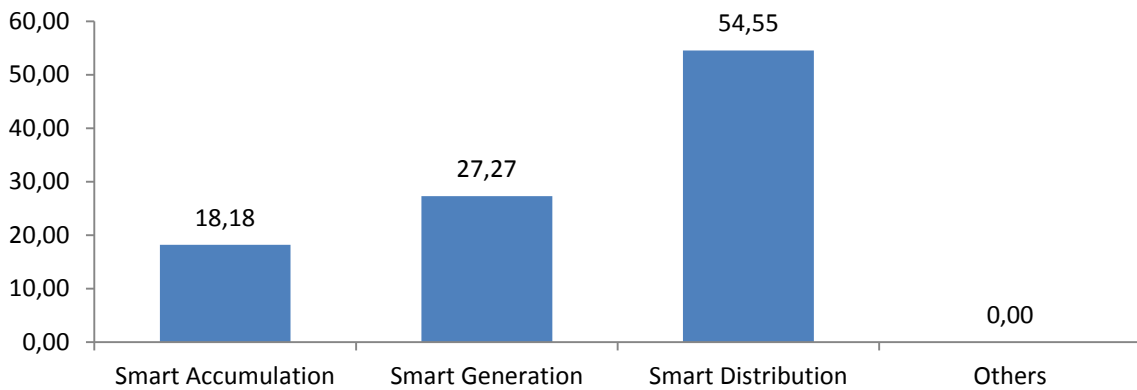


Figure 10. Future focus areas within Smart Energy

Other fields where the companies are specialised and where they were they base their business models is related to person-machine, machine-machine, self-organisation and data processing, sensors and actuators, and data/server/cloud-oriented products and services.

Additionally, in relation to the target markets of Basque companies, geographically speaking, the figures clearly show that many are fairly strong on international orientation, accounting for around 70% of the members, though it is clear that companies could do even better internationally (especially if they intend to grow from small to medium to large). Thus, the internationalisation task for a project like CLINES remains very important, and hopefully the joint forces of the international clusters can help increase the international activity of the combined ecosystems. This point we will analysis in the WP5.

Conclusion – Priority 1

Solid business cases are of key importance for sustainable smart city solutions. A cluster action plan has to focus on creating the most optimal conditions for smart city solutions to flourish: smart mobility, smart environment, smart people, etc.

3.2 Top Business Strategies vs. Public Policies

After analysing the existing policy input in the Basque Country in relation to embedded systems and the smart city concept, we found several, as we have also mentioned in the D2.2 Trend Roadmap, and those are:

- Plan for Science, Technology and Innovation 2020
- RIS 3 Strategy
- Euskadi 2015 Digital Agenda
- Euskadi-Innova
- NanoBasque Strategy

Since the policies themselves have been described in the D2.2 deliverable, this section will only concentrate on the Plan for Science, Technology and Innovation 2020, and on the RIS 3 Strategy:

Table 3: The existing policy input in the Basque Country

Public Policies
<ul style="list-style-type: none"> • Plan for Science, Technology and Innovation 2020 (PCTI, Spanish acronym): provides a shared vision of the future, combining the necessary establishment of objectives and a budgetary allocation commitment from public institutions (top-down politics) with the contribution of system agents to define specialisation priorities (bottom-up politics). • The encouragement and promotion of Science, Technology and Innovation is a transversal process that concerns many aspects of social life, and in this connection, requires a full system of governance, which includes all capacities and responsibilities. • The coordinated Plan for Science, Technology and Innovation activities in the Basque Country begins with an overall vision of the activities developed by Basque institutions to encourage inter-institutional cooperation and collaboration, as well as the complementarity of measures and a push for coordinated projects.

RIS 3 Strategy

'Research and Innovation Smart Specialisation Strategy'

- The Research and Innovation Smart Specialisation Strategy (RIS 3) is one of the different overall strategies developed by the EU: Europe Strategy 2020, Horizon 2020, Innovation Union, European Strategy related to Key Enabling Technologies (KETs), and Common Strategic Framework, developed for the application of Structural Funds.
- RIS 3 is an essential condition for access to the European Cohesion Funds, and could have impact on the funds related to Research, Innovation and Economic Development.
- RIS 3 intends to define regional R+D+i strategies, which are “smart”, in the sense of concentrating their resources and investments in the areas where there are synergies with existing and potential productive capacities in the region. Smart specialisation means to identify the characteristics and actives of each region, to highlight their competitive advantages, and to accompany the participants into a shared future vision. The main objective of the whole process of RIS 3 is to support the productive transformation in order to create employment and social welfare in the medium-long term. For this reason, a set of starting criteria is defined, and will be considered in the election of the priority areas.

In both documents, the Basque Government has defined three smart specialisation criteria related to advanced manufacturing, energy and biosciences (where human health is at the core of the activity). In addition, a series of niches have been identified, with different level of maturity related to territory. This is also related to the Basque country companies' business strategies, because the companies are focusing their business in these areas:

- Energy:
 - Generation
 - Transport and distribution
 - Power electronics and capital assets
- Territory:
 - Leisure, entertainment and culture
 - Urban planning and regeneration
 - Ecosystems
- Biosciences:
 - Health
 - Agrifood sector
- Advanced manufacturing:
 - Transport
 - Metal
 - Capital assets
 - Intelligence, materials, equipment...

Conclusion – Priority 2

A cluster action plan has to focus on creating the most optimal conditions for smart city solutions will be beneficial to provide solutions around energy, territory, biosciences, advanced manufacturing with a clear political version.

3.3 Top Business Strategies vs. Research Focus Topics vs. Public Research Policies

Regarding the client typology on which the companies focus their guidelines and business models are in the industrial, public and service sectors, as the graph shows:

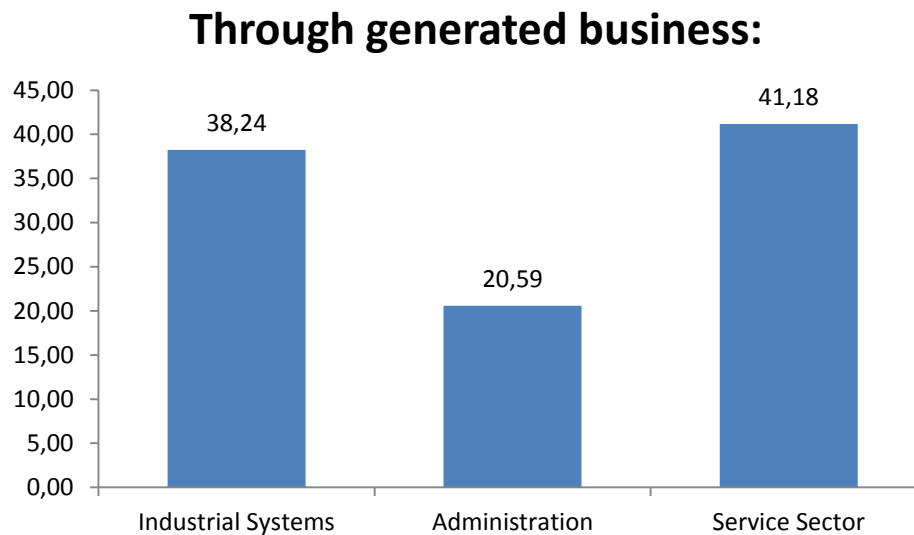


Figure 11. Current markets

In the industry sector, a new business model for IECT sector companies that is being envisioned and worked towards is the one related to advanced manufacturing, also known as industry 4.0. However, there is a series of needs that companies in the IECT sector have to face, such as:

- Need to collaborate with other sectors, such as the tool-machine sector.
- Need for training and to create new knowledge to provide machines with intelligence.
- Development of new business models focused on providing services related to the smart factory concept.

3.3.1 Local Research Focus Topics

In this section, we describe the smart specialisation strategy and the guidelines of PCTI 2020, whose objective is to generate a real benefit for companies and society through the improvement of the system's productivity.

Thus, Euskadi is adopting the methodological procedures established by the European Union in its "smart growth" strategy, according to which the priorities of a European region must be sustained by:

- Recognisable strengths: a competitive business network with driving sectors that are capable of exploiting innovations
- Differential scientific-technological capabilities
- Capability to respond to social challenges and market demands
- Having specific support tools, in terms of public-private support and collaboration programmes, in order to develop well-defined strategies

The research lines that are being developed are those where companies have capabilities in which they are competitive and stand out from others. This is why, considering business capabilities, scientific-technological capabilities and the capacity to respond to demand, three large priority areas in Euskadi: advanced manufacturing, energy and the biosciences-health binomial.

Advanced manufacturing includes the greatest concentration of capabilities, in both accumulated scientific-technological resources and R+D results, and in the dimension of recipient business sectors and research operators.

Business activity in **energy** is very focused on certain economic sectors that constitute one of the main vertical sectors in Euskadi, which also includes the presence of important driving companies. There is a significant concentration of scientific-technological capabilities.

The priority in **biosciences** stands out due to the concentration of agents and the knowledge developed in the past few years, especially in the human health sector, where all the scientific-technological agents have an important participation.

In addition to these priority areas, a series of activities related to the territory with potential for scientific-technological and business development as “**niches of opportunity**”. Specifically, the following activities are labelled as areas of opportunity: agrifood sector; ecosystems and environmental regeneration; creative, tourism and cultural industries; and activities related to urban development and territorial planning.

Lastly, we must state that the basic strategic and economic guidelines of the 2020 Euskadi PCTI, considering the level of maturity achieved by the scientific and technological policies and the need to improve the efficiency of investments made in R+D+i, Euskadi has the opportunity to focalise the strategy, action and resources further, **with the main objective of generating a real benefit for companies and society through the improvement of the System’s productivity.**

Likewise, the foundations of the PCTI establish **five great objectives** meant to concentrate resources and investments in R+D+i in order to contribute to employment and economic reactivation; balance the mix of research activity to correct the competitive disadvantage with other countries; elevate the level of efficiency of the science, technology and innovation system through the development of an integrated system for oversight and evaluation; internationalisation of R+D+i to attract and create new knowledge; and increase the number of companies that create innovation to improve their competitiveness and sustainable development.

Regarding investment, we must indicate that there has been a sustained investment from the public sector and an increase in private investment, so that investment in R+D in 2012 made up 2.12% of the GDP. The objective for 2020 is double: on one hand, to continue with the growth trend and maintain, and even exceed the European average in the established vertical priorities and disciplines; and on the other, to increase the efficiency and effectiveness of expenditure in R+D, getting better practical results in their impact on employment and business competitiveness.

In this line of action, a large part of the growth in investment must be led by the private sector, the true driving force in the creation of wealth and employment.

Conclusion – Priority 3

A cluster action plan has to focus on the collaboration between research, industry and administration. Also another relevant activity are training to create new knowledge and development of new business models focused on providing new services.

4 BrainsBusiness/AAU

This section combines D2.1 “Description of Cluster Competencies”, D2.2 “Trend Roadmap” and D2.3 “SWOT Analysis” in one regional match analysis for the AAU-cluster in the North Denmark Region.

4.1 Business Needs from Trends vs. Business Strategies

In the D2.2 “Trend Roadmap” we identified the three Smart City groups: Smart Mobility, Smart Environment and Smart Living, as being the overall top three areas where companies expect to generate business over the next three years within the Smart City terminology. And as described in D2.1 “Description of Cluster Competencies”, the embedded systems companies in the North Denmark Region were in line with the general perception in the three other clusters of the CLINES project, as shown in the chart below, with a focus on transportation (Smart Mobility), home automation (Smart Living) and energy (Smart Environment).

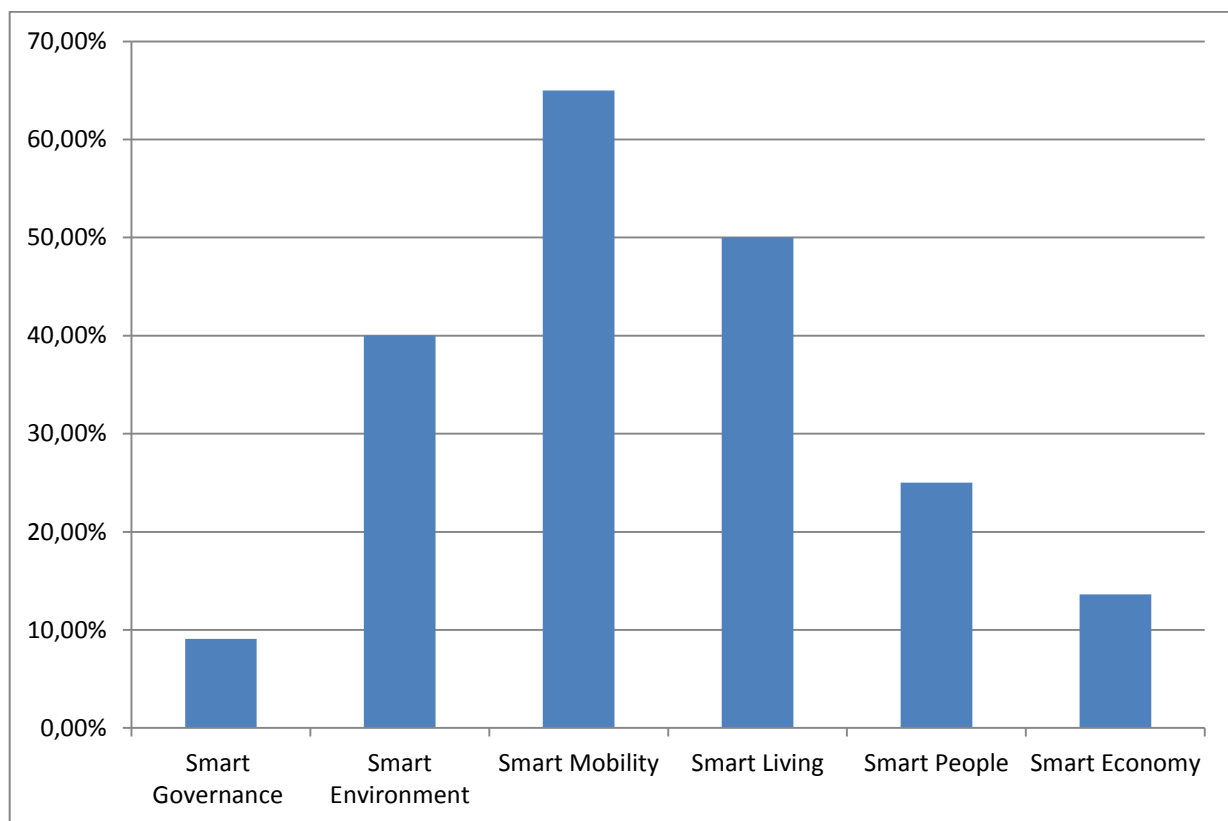


Figure 12. Business expected in Smart City domains

More than 50% of the companies surveyed in the North Jutland Region were active players within energy, hardware and telecommunications and the D2.3 “SWOT Analysis” showed generic strengths within especially wireless communication and consultancy development services due to

strong skills and competences within Engineering Design Processes stemming from the presence of Aalborg University. However, the North Denmark ecosystem of embedded system companies is lacking chip manufacturers, and practically none of the companies have product distribution among their activities or deal directly with end customers, meaning that the ecosystem does not cover the whole value chain for the Smart City domains Smart Mobility, Smart Environment and Smart Living.

So, even though the embedded system companies are well positioned to play a significant role in the market for future networked embedded systems because of their competencies – especially within wireless communication – the ecosystem is lacking some elements of the value chain.

To some extent, this might be due to the fact that the companies operate in a very small home market, which forces them to focus on global niche markets. And because of their size compared to larger corporate players, these companies operate primarily as subcontractors. This could turn out to be a great opportunity for the embedded system companies in the North Denmark Region, as strategic partners were highlighted as a key element in business models related to Smart Cities, mainly because most Smart City projects are rather capital intensive in terms of e.g. upfront investment and these projects are therefore mostly implemented by big corporate companies that search for niche players to provide specific parts or services into the whole Smart City solution.

In relation to this, we found that 90% of the surveyed embedded system companies in the North Denmark Region expect that future business within the Smart City domain will be generated on international markets, as shown in the following chart;

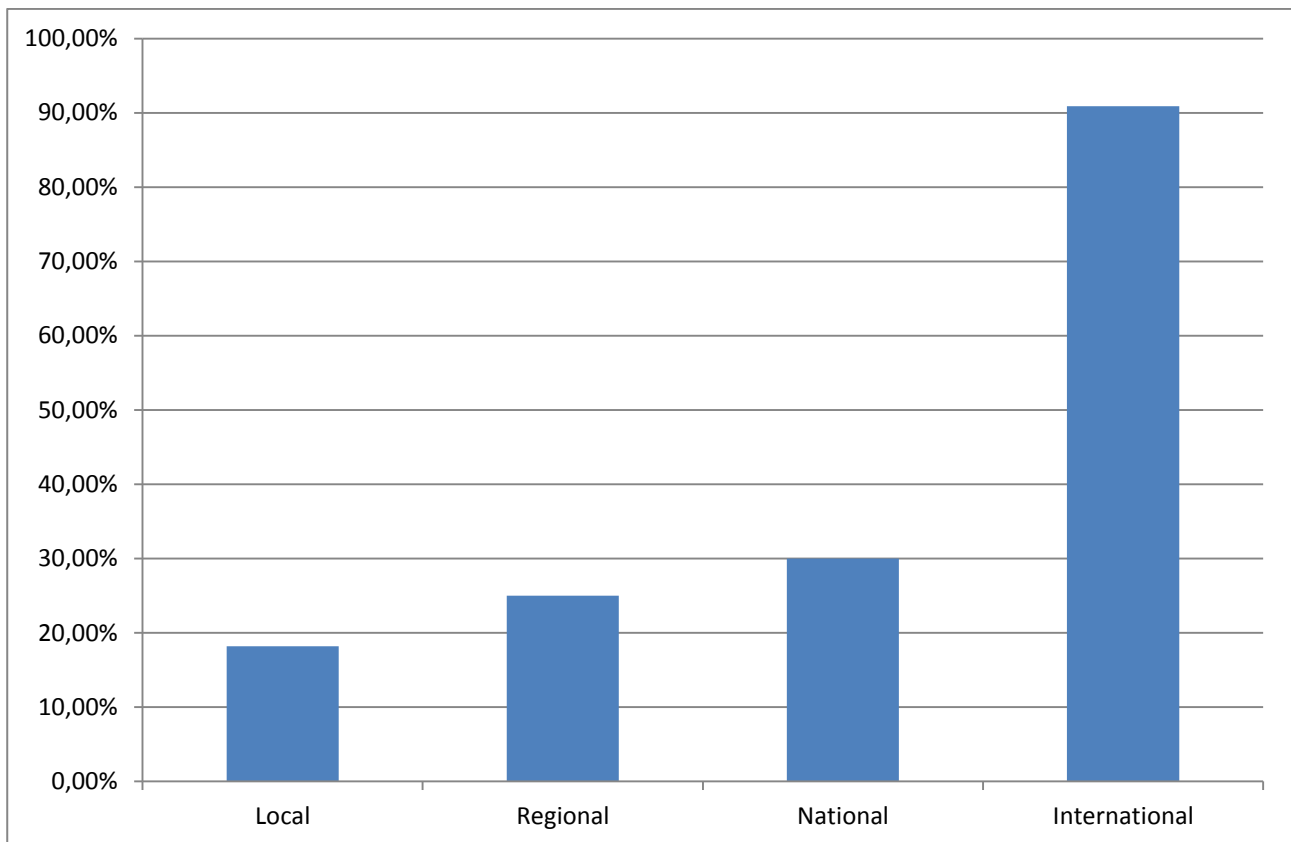


Figure 13. Market geography

All in all there is a large potential for North Denmark business in the globally growing market for Smart City solutions, especially within wireless communication. However, within the North Denmark Region an overall strategy within the ICT area as well as a more concerted effort in general is still lacking.

4.2 Top Business Strategies vs. Public Policies

In D2.2 “Trend Roadmap” key societal challenges relevant to policy makers were described and Smart solutions have been proposed as vital to cope with these challenges. In the EU, the Smart City concept was a high priority, for example in the Horizon 2020 framework and in a number of current and future strategic city networks.

In the North Denmark Region, Smart City initiatives are still in their infancy. The region still has experiences from some projects within the Smart City concept, e.g. CiViTaS and ARCHIMEDES (greener and more use of public transportation), both with the engagement of Aalborg Municipality; the Intelligent Traffic Systems project (mobility), The Aalborg Care Consortium (living), The Totalflex project (environment), and the DGNB project (environment).

However, what can be learned from the D2.3 “SWOT Analysis”, the North Denmark Region lacks an overall strategy within the ICT area as well as a more concerted effort. And until just recently, a coherent political vision in terms of the Smart City concept was lacking. But, a new Business Strategy from Aalborg Municipality (the regions by far largest and most important municipality) will change this, hopefully from 2015. Although the proposal has not been voted through yet, the draft indicates that an initiative called “Smart Aalborg” will be at the centre of the strategy plan running from 2015 to 2018. Smart City Aalborg has been a substantial subject from the fall 2013 until spring 2014, with initial deliberations in April 2014.

It has been proposed that Aalborg Municipality, together with relevant partners (including Aalborg University), construct a number of significant cross-disciplinary lighthouse projects as well as create a continuous implementation of the Smart City concept in the municipality's strategic development plans. The focus of this “Smart Aalborg” initiative will be to create synergy between technology, the society, and the citizens with the aim of building a more sustainable, innovative, and active city of Aalborg. The thinking behind “Smart Aalborg” is a partner-based model, where relevant partners should participate in the overall focus as well as the individual lighthouse projects. This will include Aalborg University, other knowledge and educational institutions, the business community and citizens.

The five lighthouse projects are;

Table 4: The lighthouse projects

Name:	Description:	Smart City domain:
Open Data Lab	The creation of an open big data platform	Smart Mobility / Smart Living
Digital infrastructure to citizens and companies	The dissemination of well-developed and comprehensive of broadband, fibre-optic broadband, and mobile Internet	Smart Mobility

Smart City 9220 (Aalborg East)	A Horizon 2020 urban renewal project	Smart Mobility / Smart Environment
Industrial symbiosis	The establishment of projects about resource efficiency by utilizing waste or energy surplus	Smart Environment
Green Agents	Supporting more sustainable and green citizens with “Green Agents” as main supporters as well as the development of Apps to support this	Smart Environment / Smart Living

Obviously, this huge Smart City initiative contributes to promoting Smart City solutions in the North Denmark Region by providing adequate framework conditions – at least in terms of some of the budgetary constraints, which most Smart City projects faces.

Some of these proposed lighthouse projects will be a steppingstone for new sustainable Smart City solutions for local entrepreneurs, businesses, research and the society. However, as found in the D2.3 “SWOT Analysis” there are no coordinated funding source for Smart City projects and no cooperation between funding stakeholders within this area. The region itself lacks programs or calls for tenders that directly promote development of R&D and innovation in the Smart Mobility, Smart Living, and Smart Environment sectors – however, this would be a good opportunity once the new EU Regional funding scheme is opened again in 2015.

4.3 Top Business Strategies vs. Research Focus Topics vs. Public Research Policies

4.3.1 Local Research Focus Topics

As already mentioned in D2.1 “Description of Cluster Competencies” and in the D2.3 “SWOT Analysis”, one of the biggest assets in the North Denmark Region is Aalborg University, including the university’s reputation in the North Denmark ecosystem. Aalborg University is home for Denmark’s largest engineering education and faculty, providing unique access to Innovation Accelerators (in terms of human capacity) for the companies. And within the region, there is a very strong cooperation between research, industry and the municipality as well as strong university-industry collaboration between embedded system companies and the university, resulting in countless university-industry projects, both small and large-scale, making it a great environment for knowledge transfer between companies and researchers. Experts work closely together within the following CLINES relevant topics:

- Embedded Systems and Sensors (strongly connected to the Center for Embedded Software Systems, *CISS*, at Aalborg University),
- Wireless Communication and ICT (strongly connected to the Center for TeleInFrastructure, *CTIF*, at Aalborg University as well as the BrainsBusiness cluster),
- Smart Grid and Intelligent Buildings (strongly connected to the innovation network *InfinIT*, which locally is coordinated by *CISS*),

- Energy efficiency in power generation and renewable energy (strongly connected to the *Department of Energy Technology* at Aalborg University and the national clusters EnergyVision and VE-NET as well as the Smart Grid projects),
- Life Science and health technology (strongly connected to the BioMedCom cluster and the *Center for Sensory-Motor Interaction* at Aalborg University)
- Health improvement research (Danish Center for Healthcare Improvements together with the “Idea Clinic” from Aalborg Hospital)
- Selling mobility data through new Business Models (Business Model Design Center)

5 Conclusion

This deliverable combines D2.1 “Description of Cluster Competencies”, D2.2 “Trend Roadmap” and D2.3 “SWOT Analysis” in one match analysis.

The project partners have identified the key priorities for each region. Creation of the most optimal conditions for smart city solutions and market scale through cooperation and internationalization are CLINES top priorities regarding to the business strategies for a cluster action plan. A coherent political vision and overall strategy within the ICT are identified as a prerequisite for the success of the Smart City solutions. Furthermore a cluster action plan has to focus on the collaboration between research and industry.

These priorities have to be taken into account when developing a cluster action plan related to the development of innovative Smart City solutions based on Embedded Systems.