



mKETs-Pilot lines project

The goal of the mKETs-PL project is to prepare and foster a common understanding and consensus for future actions in Europe focusing on multi-KETs pilot lines



mKETs-PL working document

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1. Policy perspective

The Slovenian Government adopted the *National Research and Development Programme for the 2006-2010 Period* in the year 2005. Targets of the strategy were to improve the effectiveness of R&D funds, the definition of R&D priorities, the application of research results and the use of knowledge. Further, the small proportion of companies participating in innovation activities should be increased. Vision of the programme was to create new knowledge, to transfer internationally accessible knowledge for the public good and for economic consumption, and to increase capabilities for mastering technological advances as the main source of national competitiveness and social and human progress. The programme also emphasizes the importance of stimulating joint efforts between the research and business sectors, and stronger initiatives for joint R&D projects between science and business in Slovenia (Ministry of Higher Education, Science and Technology, 2005). The *National Research and Development Programme for the 2006-2010 Period* was successful in raising the number of publications, but failed to increase the number of patents or innovation output of SMEs (Bucar, 2013). The current global crisis also showed that Slovenia has a number of structural weaknesses. It appeared that the country is too dependent on low technology industries and traditional services, which limit the competitiveness of the economy. To establish a responsive research and innovation system, the government adopted the *Research and Innovation Strategy of Slovenia 2011-2020*. The programme should help to improve the transfer of knowledge from the research to the business sector, cooperation in R&D, public funding of R&D and the level of innovation in Slovenia (National Assembly of the Republic of Slovenia, 2010).

Public funding for research and development in the business sector is almost provided exclusively for natural sciences and technical sciences. The funding system for research activities is characterized by a relatively high number of different instruments. That leads to fragmentation and lowers effectiveness of invested funds. The *Research and Innovation Strategy of Slovenia 2011-2020* determined that funds for research and development activities should be increased to enhance frontier research, encouraging projects in cooperation with the innovative economy and enhance investment into research and development activities in the business sector. Further, diversification of sources of funds for research and innovative activities should be increased and provide the environment for development of donor activities as private financing source of growing importance (National Assembly of the Republic of Slovenia, 2010).

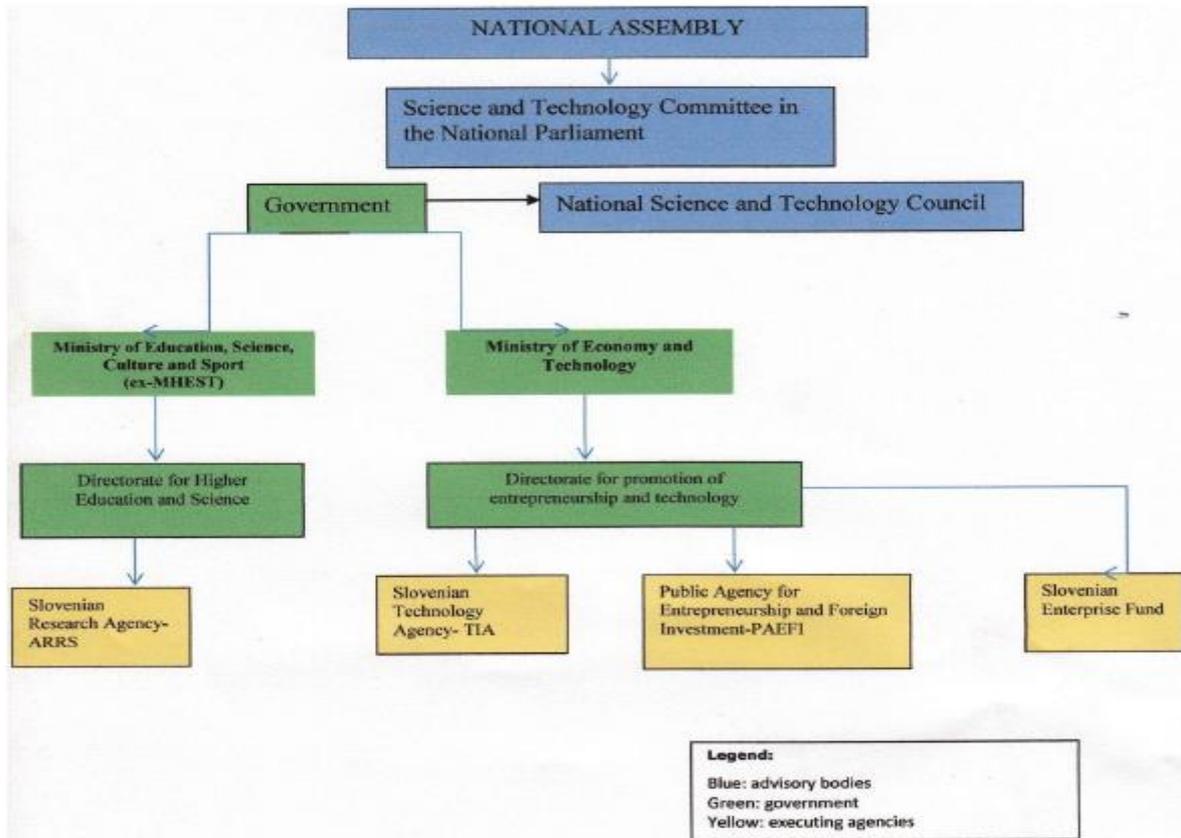
Government strategies and public funding documents contain no explicit mentioning of Key Enabling Technologies. The Slovenian government defined research priorities in its *National Research and Development Programme for the 2006-2010 Period*, as information and communication technologies, advanced (new) synthetic metal and non-metal materials and nanotechnologies, complex systems and innovative technologies, technologies for sustainable development and health, and life-sciences, which include Key Enabling Technologies. Targeted research and technology fields of the *National Research and Development Programme for the 2006-2010* are for instance biotechnology, environment, health, ICT, industrial production, nanosciences and nanotechnologies (erawatch, 2013i). The *Research and Innovation Strategy of Slovenia 2011-2020* does not include specific sectors which should be targeted. Instead, it defines a way of formulating and evaluating fields of specialisation and concludes that the defined fields of specialisation should be funded with extended resources (National Assembly of the Republic of Slovenia, 2010).

1.1. Country specific innovation system with emphasis on KET

The Slovenian research system shows that the National Assembly is the top legislative body and its two Committees, the Committee for Education, Science, Culture, Sport and Youth and the Committee for Economy, were in charge of discussing legal and policy documents related to R&D policy. The elections of 2011 were responsible for changes in the political landscape regarding R&D policy. The Ministry of Higher Education, Science and Technology was merged with the Ministry of Education and Sport and with the Ministry of Culture into the Ministry of Education, Science, Culture and Sport (MESCS). Together with the Ministry for Economic Development and Technology (MEDT), the MESCS is now responsible for the preparation of policy documents in the R&D sector, for the implementation of R&D policy (e.g. the National Research and Development programme), the public R&D budget and international cooperation in the field of R&D. The National Science and Technology Council is an advisory body for the government in the R&D sector. Two special public agencies have been established for the execution of R&D and innovation policy. The Slovenian Research Agency (ARRS)

is responsible for the execution of public research financing, for the professional and independent selection respectively evaluation process of projects and programmes, and the monitoring of research programmes and projects implementation. The Slovenian Technology Agency (TIA) is responsible for programmes promoting technology development and for business R&D co-financing. Another important agency is the Public Agency for Entrepreneurship and Foreign Investment, which provides resources from the Ministry of Economy and Technology. The agency supports the running of intermediary institutions as technology parks and university incubators and start-ups in innovation environment (Bucar, 2013). The Slovene Enterprise Fund (SEF) was established to improve the access to financial resources for SMEs and SME start-ups (Slovene Enterprise Fund, 2013). Figure 1 gives an overview of the Slovenian research system.

Figure 1: Structure of the Slovenian research system



Source: (Bucar, 2013)

The Slovenian Research Agency (ARRS) is an independent public funding organization which performs tasks relating to the National Research and Development Programme and European Research Area. It is closely related to the Ministry of Education, Science, Culture and Sport (MESCS) in terms of financial support for its programmes and for its basic policy orientation (erawatch, 2013a). As the ARRS, the Slovenian Technology Agency (TIA) is an independent public agency. Its main activities are grant programmes aimed at technology development and foster cooperation of R&D institutions and universities with industry (erawatch, 2013b). SPIRIT Slovenia, the Entrepreneurship, Innovation, Development, Investment and Tourism Public Agency of the Republic of Slovenia, is a new institution, which exists since 2013. The institution is an umbrella agency which unites three important agencies: the Public Agency of the Republic of Slovenia for Entrepreneurship and Foreign Investments (JAPTI), the Slovenian Tourist Board (STB) and the Public Agency for Technological Development of the Republic of Slovenia (TIA) (SPIRIT Slovenia, 2013). Aim of the new agency is to promote the Slovenian economy and its business development, innovations, technological development, foreign investment and the internationalization of Slovenian companies (erawatch, 2013h).

1.2. Organisation of mKETs policy

Neither the *National Research and Development Programme for the 2006-2010 Period* nor the *Research and Innovation Strategy of Slovenia 2011-2020* make explicit references to Key Enabling Technologies (KETs). But the *Research Infrastructure Roadmap*, which is a complement to the *Research and Innovation Strategy of Slovenia 2011-2020*, lists ten priority areas which include advanced materials, nanotechnology and biotechnology (Bucar, 2013). As already mentioned in the last section, the responsible institutions for policy making regarding Key Enabling Technologies are the Ministry for Education, Science, Culture and Sport (MESCS) and the Ministry for Economic Development and Technology (MEDT). While the MESCS is dealing mainly with R&D, the MEDT focuses on the field of technology (erawatch, 2013c).

One of the most important policy measures for linking research in business units and public research organisations are the Centres of Excellence and the Competence Centres. Since 2012, the Ministry of Economic Development and Technology is responsible for Centres of Excellence and Competence Centres. It took this task over from the Ministry of Higher Education, Science and Technology after restructuring of the government (erawatch, 2013d). The aim of Centres of Excellence is to promote the concentration of knowledge at priority technological areas and horizontal linking along the entire chain of knowledge development, which should be realized by strategic partnerships between the private sector and the academic sector. This cooperation should lead to more effective transfer of knowledge and result in new products, services and processes, and new dynamic high-tech companies (Ministry of Higher Education, Science and Technology, 2012). The Competence Centres are a complementary measure to the Centres of Excellence and were established by the government in 2010. Competence Centres are research and development units which links partners from business and public research organisations. Aim of the centres is to strengthen the development capabilities in the field of new technologies and promote transfer of these new technologies, products and processes in the priority areas for technological development of Slovenia (erawatch, 2013d).

The main task for the Slovenian Research Agency (ASSR) is to provide a framework for scientific research and promote research cooperation (erawatch, 2013a). Relevant for Key Enabling Technologies are especially calls for applied projects from the ASSR. These calls are usually published each year and have no thematic focus. Selected research and technology fields are ICT, biotechnology, nanosciences and nanotechnologies, materials, energy and others. Aim of the projects is to create new knowledge that serves concrete users and is a means to stimulate cooperation and transfer of knowledge from research institutions to public administration or to the business sector (erawatch, 2013e).

The Slovenian Technology Agency (TIA), which promotes technological development and innovation, is also highly relevant for Key Enabling Technologies and multi-KETs (mKETs). The agency implements programmes and measures to promote competitiveness and technological development within the context of the National Research and Development Programme and the policies of the responsible ministry for technology. Further, an important task of the agency is to improve the transfer of knowledge between R&D institutions and industry. Those tasks should be reached by providing grants and loans, which are financed by the government (erawatch, 2013b). AATT – Alps Adriatic Technology Transfer is an exemplary project implemented by the TIA. The project started in 2010 and is realized in cooperation with the Carinthian Economic Promotion Fund (KWF) in Austria and E-Zavod in Slovenia. Aim of the project is to create and establish an institutional supply of knowledge transfer in Slovenia and Carinthia (Slovenian Technology Agency, 2013).

Support for Slovenian SME is especially provided by the Slovene Enterprise Fund (SEF). Instruments of the SEF are loans, guarantees, subsidies and other forms of financing. Its mission is to provide small and medium companies with financial sources through the whole life cycle: the seed stage, the start-up stage, the development stage and the growth stage (Slovene Enterprise Fund, 2013).

Another KETs related programme is ARTEMIS (Advanced Research and Technology for Embedded Intelligence and Systems). ARTEMIS is an international funding initiative, where the governments of the participating countries fund projects in the sector of embedded systems (ARTEMIS, 2012a).

Slovenia also has important institutions and platforms regarding KETs and multi-KETs. The Jozef Stefan Institute is a public research institute and the leading Slovenian research organisation. The institute performs basic and applied research in relevant fields as physics, chemistry, biochemistry, electronics, information science, nuclear

technology, energy utilization and environmental science. The main target of the institute is to provide expert scientific and applied knowledge in the form of processes, products and consultancy (erawatch, 2013f).

NaMat, the Technology Platform for Advanced Engineering Materials and Technologies, has the objective of optimal involvement of industry and other stakeholders in the process of establishing priorities in the area of advanced materials and technologies and introduce sustainable development in the sector of advanced materials. As it covers all elements of the life cycle of advanced engineering materials and technologies, it is a highly relevant platform regarding multi-KETs (NaMat, 2013).

1.3. Main policies for Pilot lines

As already stated in the former section, Key Enabling Technologies, multi-KETs and pilot lines are not explicitly mentioned in the Slovenian policy documents. The main policy measures regarding pilot lines in the field of Key Enabling Technologies are the Centres of Excellence, Competence Centres and ARTEMIS.

The programme for Centres of Excellence started in 2004. Backgrounds for this measure were relatively low investments in R&D innovations which were caused by feeble cooperation between companies and knowledge institutions. This weakness in the transfer of knowledge led to insufficient investment in applied and development research and turned out as a great barrier for Slovenian competitiveness. Target of the programme is to enable a more effective transfer of knowledge and to encourage the development of new products, processes and services. This should be reached through higher cooperation between knowledge institutions and industry (Piciga, 2008). Centres of Excellence include all stages of knowledge development from basic research to development of commercial application. The policy measure is implemented through grants. It was funded by the Ministry of Higher Education, Science and Technology (MHEST) till 2012, since then it is financed by the Ministry of Economic Development and Technology (MEDT). Centres of Excellence are co-financed by the Structural funds (e.g. ERDF and ESF). The actual call is running from 2009 to 2013, a further call after 2013 can be expected. The overall budget for the actual call is € 84 million, the budget for the year 2011 was € 22 million. Centres of Excellence are thematically open, but in accordance with the *National Research and Development Programme*, five main areas were defined:

- Information and communication technologies,
- new synthetic metal, non-metal technologies and nanotechnologies,
- complex systems and innovation technologies,
- health and life sciences, and
- technologies for a sustainable economy (erawatch, 2013g).

The programme is open for all Slovenian companies and requires building a consortium of at least five partners. Three of them have to be business partners and two of them have to be research institutions (erawatch, 2013g). Relevant existing Centres of Excellence regarding multi-KETs are:

- The Centre of Excellence in Nanosciences and Nanotechnology (CE NS and NT),
- The Centre of Excellence for Biosensors, Instrumentation and Process Control (CEBIC),
- The Centre of Excellence for Integrated Approaches in Chemistry and Biology of Proteins (CIPKeBiP),
- The Centre of Excellence for Low-Carbon Technologies (CoE LCT),
- Centre of Excellence Advanced Non-Metal Materials with Technologies of the Future (CE NAMASTE),
- Centre of Excellence for Polymer Materials and Technologies (CE PoliMaT),
- Centre of Excellence Space: Science and Technology (CE Space.si), and
- NMR Centre of Excellence for Studies in Biotechnology, Pharmacy and Physics of Matter (CE EN-FIST) (Ministry of Higher Education, Science and Technology, 2012).

Selection criteria announced in the public call were scientific and technological excellence of the proposal and quality of the partnership, relevance for the implementation of the strategic goals set in the Resolution on the

National Research and Development Programme and the Operational Programme for Strengthening of the Regional Development Potentials in 2007-2013, quality of the proposed operation, and qualification of the consortium (erawatch, 2013g).

Competence Centres are a complementary measure to the Centres of Excellence. It is also implemented through grants and is open for all Slovenian companies. The programme was established by the government at the end of 2010. Till 2012, the programme was funded by the Ministry of Higher Education, Science and Technology (MHEST). Since 2012 it is funded by the Ministry of Economic Development and Technology (MEDT). As Centres of Excellence, Competence Centres are co-financed by the Structural funds (e.g. ERDF and ESF). The actual call for Competence centres started in 2010 and ends in 2014. The overall budget for the measure is € 45.285 million for the period 2010 to 2014. Competence Centres are defined as research and development entities, which link business and public research institutions. Their primary task is to strengthen the development capabilities in the field of new technologies and promote transfer of these new technologies, products and processes. As meeting criteria, a Competence Centre has to be a cooperation between the business sector and public research institutions and it must be led by the business partner. The current call specifies that centres in the following areas will be supported:

- User platforms and interfaces (ICT),
- network systems and services (ICT),
- food and health (Life Sciences),
- biomedical technologies (Life Sciences),
- process technologies (Complex systems and innovative technologies),
- sustainable construction (Technologies for sustainable economy), and
- efficient use of energy (Technologies for sustainable economy) (erawatch, 2013d).

At the beginning of 2011, seven Competence Centres were approved by the government:

- Competence Centre for Advanced Control Technologies (CC ACT),
- Competence Centre – Advanced Systems for Efficient Use of Electrical Energy (CC SURE),
- Competence Centre Biomedical Engineering (CC BME),
- Competence Centre for Sustainable and Innovative Construction (CC SIC),
- Competence Centre for Biotechnological Development and Innovation (CC BDI),
- Competence Centre for Cloud-Assisted Services (CC CLASS), and
- Competence Centre Open Communications Platform for Integrated Services (CC OPCOMM) (Ministry of Higher Education, Science and Technology, 2012).

The selection criteria for Competence Centres were relevance of the planned activities with regards to the *Slovenian Development Strategy* and the *Operational Programme for Strengthening Regional Development Capacities*, technology excellence and developmental potential, quality of the proposed partnership, and quality of the proposed projects to be implemented within the Competence Centre (erawatch, 2013d).

Another important programme regarding Key Enabling Technologies and mKETs is ARTEMIS. ARTEMIS is a private-public-partnership initiative (PPP) within the Seventh EU Framework Programme. It is a funding initiative in the sector of “Advanced Research and Technology for Embedded Intelligence and Systems”. The programme supports market-oriented research, which develops prototypes and demonstrators with domain-spanning applicability. ARTEMIS focuses on downstream-oriented research and technological development with a strong market drive (ARTEMIS, 2012b). The total budget for all ARTEMIS member states in the 2012 call was € 138.730 million and the share for Slovenian applicants was € 0.75 million. National funding for the 2012 call was provided by the Ministry of Higher Education, Science and Technology (MHEST). Projects have usually a maximum duration of three years. No funding was available for Slovenia in the 2013 call of the ARTEMIS programme. The call is open for companies with headquarters in Slovenia (ARTEMIS, 2012a). Projects should have clearly defined and sharply focused objectives and approach, additionally all projects should have proper

balance of application focus vs. generic technology development. Eight thematical subprogrammes were defined for ARTEMIS:

- Methods and Processes for Safety-relevant Embedded Systems,
- Person-centric Health Management,
- Smart Environment and Scalable Digital Services,
- Efficient Manufacturing and Logistics,
- Computing Environments for Embedded Systems,
- Security, Privacy and Dependability,
- Embedded Technology for Sustainable Urban Life, and
- Human-centric Design of Embedded Systems.

The three focal points which underlie these subprogrammes are Reference Design and Architecture, Seamless Connectivity and Middleware, and Design Methods and Tools (ARTEMIS, 2012b).

2. Business perspective

2.1. *Implementation of multi-KETs pilot lines*

No mKETs related pilot actions could be identified in course of the field work. mKETs related activities are mainly driven by industry in Slovenia but actions are currently still focused at applied research and not on pilot and demonstration activities. In fact there is evidence that collaboration and knowledge sharing often takes place in the first stages without the involvement of any type of public initiatives. In the interviews it was mentioned that firms often organize in informal or formal networks in order to share projects and R&D related activities. The competence centre for advanced control technologies has been for example put forward by the self-organised technology network for control technologies in cooperation with the Institut Jozef Stefan (i.e. the leading nation RTO).

In parallel it has to be pointed out that the science sector currently does not drive any pilot actions or collaborative R&D activities. In fact, universities are not interested in industry projects. This problem is a long lasting a major issue in Slovenia and stems back from old times of the Republic of Yugoslavia when 'science was for scientists' and applied research took place in labs that belonged to the state-owned industries. Unfortunately the university culture and institutional framework conditions do not encourage collaboration between research and enterprises. This is a large issue as a relatively high proportion of engineers and researchers are working at the universities or state institutions. In the automotive industry in Slovenia this is an issue, but the strong value chain and network means that the industry has created strong linkages with individuals at universities, not faculties, but this does not cover all research areas.

Access to finance for the most critical and high risk part of the experimental research and commercialization is recognized as an important gap. Research and innovation policy has been putting in last couple of years strong emphasis on development of efficient financial mechanisms to complement research (grant) funding with the accessible loan or equity financing opportunities.

Financial engineering was introduced as new financial instrument in 2009. The Holding fund was established, managed by the Public Small Business Fund and €35 million from the ERDF Operational Program invested to stimulate development of the venture capital market in Slovenia. The Holding fund is investing in private, venture capital and seed capital funds, operating in the country to increase the overall size of the equity financing for innovative companies in early stages of development.

Additional to that financial engineering instruments are also developed to improve access to loan financing for industrial research and commercialisation. €100 mill public funds have been invested in 2010-2011 to stimulate private financial institutions to support R&D and innovation projects with special guarantee and interest rate subsidies. Initiative has high leverage effect; all together there are €300 mill additional funds available on the market.

Access to funding is considered by big companies with more than 250 employees (not fulfilling the EU criteria for SME) as a major obstacle for putting forward industry science co-operations and pilot actions. They see themselves in an unfavourable position as many of their foreign competitors in overseas have very large R&D departments (some of them with more than 1,000 employees in R&D departments) and no such limitations for public funding of RDI activities. The major issue that is pressing the companies is that there is a funding gap for companies to grow: Some of the companies have participated in the European Framework Programmes (FP's) and this has helped the companies with new ideas, but not in terms of growing their business and to commercialise the research. This has large complications for sustaining the value chain in the leading industry sectors in Slovenia such as automotive, as there are no car manufacturers, only suppliers. The results of the FP's are often far away from the market and for 'large' companies with for example 500 employees there are very limited funding opportunities to take the research results forward. Also, sector and technology focus on projects funded often change along with new funding periods.

Another issue pointed out as a barrier is that the FPs often creates good relations with companies in other Member States. However, further collaboration (going up the chain of technology readiness levels) funded by national funding schemes is often not possible, as many national funded projects do not allow foreign

companies to participate. This is a particular problem for smaller Member States like Slovenia and creates a lack of critical mass. Centers of Excellence and Competence Centres thus devoted particular importance to this issue. While partners from other countries are eligible in Centers of Excellence, costs of R&D services are eligible regardless of the country of origin. One European Programme was pointed out as very positive. Factories of the Future, an FP7 programme of Public-Private Partnership included in the Commission's recovery package was seen as having a positive impact towards industrial deployment with more focus on industry needs and faster time to market.

Access to qualified personnel is another factor hampering the development of pilot actions. In order to engage in R&D activities it is vital for the companies to have access to engineers, but in Slovenia this is extremely difficult for firms to hire such people. A high proportion of engineers and researchers are choosing to work at universities or other state institutions due to higher wages (starting wage is lower in the enterprise sector) and job stability. Currently universities are not much interested in cooperating with industry in the training of future engineers and researcher; attempts by enterprises to engage a university faculty in a joint course failed, as the faculties were not interested. As a result of the lack of engineers in Slovenia larger firms have started to provide scholarships for young students every year.

2.2. Evaluation of KET policies/KET innovation eco-System

In Slovenia KET related policies are just in their initial stage. The realization of a successful KET policy is thus only possible, if necessary prerequisites are ensured within the national policy framework. With the Competence Centre programme first important steps have been set into the direction of a KET based RDI policy framework; the smart specialisation strategy that is currently under development will put even more emphasis on this issue. While industry is ready to cooperate and to put forward pilot actions, it is public policy that must now set the proper framework for future joint actions. There are several approaches mentioned by interview partners to set the stage for a KETs based policy and to increase the effectiveness of direct or indirect policy support.

The first one could be the design of stable condition in the KETs specific innovation system with the introduction of **sustainable funding mechanisms** that **combine** national funding, EU funding and private sector finance. This means a tripartite financing approach based on combined funding mechanisms involving industry, Commission and national authorities (member states and local governments), if this is required by the high costs of the KETs RDI projects, and put in place the appropriate programme management and mechanisms to allow the combination of EU funding (Horizon 2020, structural funds, etc.). Instruments should be modified or created to allow European funding for efficient cross border co-operation. Member states and regions should consider complementary budgets and regional development plans which enable regions to spend structural funds for KETs and innovation.

The second one follows a knowledge based view and forces **building, strengthening and retaining KETs skills**. Slovenia should promote individual excellence in technologically focused engineering, research and innovation, and establish the appropriate framework conditions through the ESF regulation in order to support KETs skills capacity building at national and regional level. Specific focus should be given to an increasing need of highly skilled engineers with the ability for interdisciplinary work. Also trained engineers should be encouraged more strongly to work (at least temporarily) with industry – this could be achieved with an improved scheme issued by public authorities.

The third relevant one stressed a **joint political approach to foster key technologies beyond traditional sectoral boundaries**. In Slovenia, such a joint approach of fostering of key enabling technologies is being currently developed in the framework of the crafting of the smart specialisation strategy. The existing economic sectors provide the foundation for smart specialization. However, as stated by the European Commission, the traditional view of the once homogenous and independent national industrial sectors is not the adequate basis for development policy anymore. In the updated Communication on the industrial policy the Commission sets six priorities of development that are not related to the industrial sectors, but the technology-related challenges. In line with this, the Slovenian industrial policy on the basis of the following challenges: climate and energy, sustainable mobility, food and human health and the potential for the key

enabling technologies, sets the following priority technological areas: environmental technology, sustainable mobility technology, biotechnology, nanotechnology, advanced material, micro and nano-electronics, advanced manufacturing and processing technologies, as well as the key industrial sectors.

3. Conclusions

In course of the fieldwork no KETs or mKETs related pilot lines have been identified. The national innovation system of Slovenia is on the one hand characterized by weak industry science links (the above mentioned programmes are targeted at this policy challenge), on the other hand those big enterprises that do have RTDI activities (e.g. ICT, pharmaceuticals) distribute their extramural RTDI investments on a global market. As a consequence existing pilot actions like the TECOS Centre for Toolmaking in Celje are aiming at testing and demonstration activities that are performed on a medium technology level thus being far away from the level of KETs/mKETs pilot actions.

3.1. Summary of policy perspective

Slovenia lost a great share of R&D during the restructuring in the early 1990's and since then a large amount of public funding has been earmarked to re-establish a strong R&D base in Slovenia. The aim of industrial innovation policy in Slovenia has therefore first of all been to strengthen to R&D base within the key sectors and technologies of national importance. Several initiatives were launched in order to increase R&D and uptake of R&D in companies. Alas, technology networks were formed using a top-down approach and funding was limited both in terms of money and time. This ongoing problem has been addressed in the Annual Innovation Policy Trends and Appraisal Report on Slovenia from 2006 'Funding has often been insufficient and irregular and several institutions spend much of their energy on survival instead of on carrying out the tasks they were established for'.

Up to now the major focus of RDI policy activities has not been directed towards Key enabling technologies. Neither the *National Research and Development Programme for the 2006-2010 Period* nor the *Research and Innovation Strategy of Slovenia 2011-2020* make explicit references to Key Enabling Technologies (KETs). But the *Research Infrastructure Roadmap*, which is a complement to the *Research and Innovation Strategy of Slovenia 2011-2020*, lists ten priority areas which include advanced materials, nanotechnology and biotechnology (Bucar, 2013). Pilot lines in the field of Key Enabling Technologies are implicitly addressed with policy measures such as the Centres of Excellence, Competence Centres and ARTEMIS. In general it has to be noted that the RDI policy framework has been in Slovenia rather unstable in the past decade with major changes in priorities, programmes and governance after each election to national parliament.

3.2. Summary of business perspective

In Slovenia, the main drivers initiating multi-KETs pilot actions are clearly the industry representatives – (in particular through inter-firm networks) – albeit public funding is the key source and prerequisite of financing for such actions. Pilot actions are realised in close cooperation with national RTOs and universities. The already existing pilot lines are shared facilities. In order to provide a true link between R&D and manufacturing, there is strong evidence that the existing pilot lines are strictly linked to an industrial strategy.

Slovenia has up to now only limited experiences in creating pilot lines on the level of KETs; here biotechnologies and advanced manufacturing are main thematic specialisations. Test beds and pilot projects are more common in medium technology applications such as tool making but it should be noted, that these respective pilot actions and demonstrator projects have been publicly co-funded.

3.3. Recommendations to support pilot lines

Firstly the industry science co-operations in the national innovation system need to be encouraged more strongly. As the results of the interviews but also the empirical evidence shows Slovene research institutions do co-operate only in a poor intensity with national enterprises. Firms that are doing R&D and innovation projects often look for scientific partners abroad. Thus mechanisms need to be established to make both universities

and enterprises to engage in projects on a national level. There are several options to do this: one option could be here to envisage longer funding periods for programmes such as the competence centre programme which are addressing demonstrator projects. The current funding period of three years is by far too short also in comparison to other comparable programmes in other EU countries. A second option could be change from institutional funding to universities and RTOs to a more performance oriented form of public financing. Currently universities do not have any strong incentive to engage in co-operative applied research.

Secondly mKETs need to be addressed explicitly in the national RDI policy framework. Such a new approach will require a systemic policy concept that needs adequate coordination at national and regional level and between different policy domains. In Slovenia, such a joint approach dealing with the systemic nature of key enabling technologies is currently generally missing. With the ongoing development of the new Smart Specialisation strategy are attempts underway to prioritise KETs in the national policy framework and to develop systemic funding concepts around these technology themes. In particular the new strategy aims to promote networking between the public research and education sector and the economy, to promote development activities and technological investments in companies, to promote non-technological innovation, to encourage employing researchers and developers in businesses and to encourage mobility of highly skilled people.

Thirdly KETs related skills need to be developed and supported. Specific focus should be given to an increasing need of highly skilled engineers with the ability for interdisciplinary work.

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4.2. Interviews

The following persons were interviewed for this country study:

Name	Function	Organisation	Industry/policy
Peter Stanovnik	Scientific Advisor – co-author of the national smart specialisation strategy	IER	Policy
Spela Stress	Head of Technology Transfer Office	Institut Jozef Stephan	Research
Zoran Marinsek	Director	Competence Centre for Advanced Central Technologies	Industry
Bostjan Udovic	Scientific Advisor	University Ljubljana	Policy

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Strauss & Partners, Roland Strauss
Spark, Marc de Vries
Noblestreet, Arnoud Goudsmit