



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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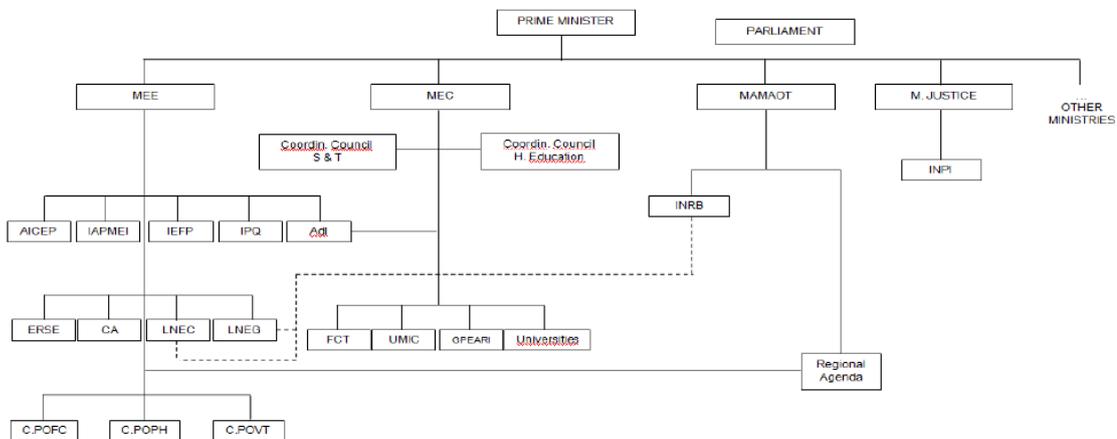
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1. Policy perspective

1.1. Country specific innovation system with emphasis on KET

The continued investment in the development of advanced human resources and scientific research has allowed Portuguese science to mature and converge with the most advanced research systems. However, Low level of qualifications is often regarded as a major hampering factor for economic development, with only 15% of the adult population tertiary-qualified in 2010. Additionally, as it is recognised by the recently published Strategy for growth, employment and business development (2013-2020), there has been an insufficient articulation and joint research among companies and organizations in the national research and technology system and limited applied research activity addresses business interest and demand. The fact that the country has lacked a technologically sophisticated business sector¹ has contributed to an insufficient participation of the business sector in driving national research priorities. Despite these problems the structural composition of the economy has changed to a certain extent, with some medium-tech activities emerging since the 1990s, and also a rising of knowledge-intensive business service. Machinery specialized for particular industries, road vehicles and plastics in non-primary forms are the high-tech and medium-tech industries with most positive variation in their contribution to the national trade balance. Business enterprise investment in R&D grew significantly (nearly quadrupled in 2000-2011) and product or process innovations in SMEs are at good level, having increased substantially over the last decade (EC 2013). But still, (1) commercializing Portuguese S&T in global markets to create these new jobs and regional wealth across Portugal and (2) retaining the country's educated talent by developing high value jobs and careers remain a challenge (UTEN PORTUGAL, 2013). The Ministry for the Economy and Employment (MEE) and the Ministry for Education and Research are the most relevant ones in innovation policy making, as it is shown in the figure below.

Figure 1. Organogram of the structure of policymaking



Notes to Exhibit 1

AdI - Innovation Agency; AICEP - Agency for Investment and Foreign Trade (AICEP Portugal Global); CA - Competition Authority; C. POFC - Management Authority of Competitiveness Factors Operational Programme; C. POPH - Management Authority of Human Potential Operational Programme; C. POVT - Management Authority of Territorial Valorisation Operational Programme; ERSE - Energy Regulating Entity FCT - Science and Technology Foundation; GPEARI - Planning, Statistics and International Relations Office of the Ministry for Education and Science; IAPMEI - Institute for Support to Small and Medium Sized Enterprises and Investment; IEFP - Institute for Employment and Professional Training; IPQ - Portuguese Standards Institute; INPI - National Institute for Industrial Property; LNEC - National Laboratory for Civil Engineering; LNEG - National Laboratory for Energy and Geology; MEE - Ministry for the Economy and Employment; MEC - Ministry for Education and Research; MAMAOT - Ministry for Agriculture, Sea, Environment and Territory; UMIC - Agency for the Information Society.

Source: Pro-Inno Europe

¹ The top 10 of business R&D spenders (2,108 companies) concentrate almost half of the total 2009 Portuguese BERD (€1,303m). The other half is performed by the other 2.098 companies that declare to have performed, financed or contracted R&D activities, which reveals a not very R&D intense business sector. The ranking is led by PT (the national telecom company), two banking entities (one of them is a subsidiary of a foreign bank), EDP (energy), BIAL (pharmaceuticals), Nokia Siemens Networks Portugal and Autoeuropa (a VW subsidiary).

The Ministry for Economy and Employment is in charge of the Competitiveness Factors Operational Programme – COMPETE. Both ministries embrace two key innovation policy implementing actors, namely the Fundação para a Ciência e a Tecnologia (FCT) and Agência de Inovação (ADI). FCT activities address mainly the needs of academic research, particularly at the universities and the associate laboratories. AdI, which is a joint venture of both ministries, mainly addresses the research needs of business firms and aims at stimulating the links between academia and industry. The research system is now mostly university based, shifting from the older state laboratory centred system. However, academic research is not only conducted by university departments and centres, but also by new institutions which have emerged during the last years with the legal status of non-profit organisations, with research mainly performed by university staff or research students. This landscape is complemented with other private non-profit research performing institutions, such as the Gulbenkian Foundation that has its own Gulbenkian Institute of Science, and more recently in 2004, the Champalimaud Foundation. The Network to support broadcasting of Intellectual Property (GAPI) and UTEN, the University Technology Enterprise Network, focused on the commercialization and internationalization of Portuguese Science and Technology (S&T).

Portuguese research and innovation policy has had over the recent decades a horizontal, broad spectrum nature. Despite the implementation of a number of recent initiatives addressing more targeted purposes, the fact is that the research landscape is dominated by generic, horizontal perspective with no explicit reference to Key Enabling Technologies and their role in the Portuguese economy. There are, however, signs that 'targeted and thematic funding' has been increasing in recent years (details in chapter 1.2.).

1.2. Organisation of mKETs policy

KETs or any similar term responding to the same aim are not explicitly mentioned by the Portuguese STI policy although there are signs of targeted thematic funding addressing various KETs, such as advanced materials, nanotechnologies, biotechnology or advanced manufacturing (linked to the ICT priority). Several facts might be referred to support such assertion:

- 'Partnerships for the Future of Portugal' (agreements with several US Universities and the Fraunhofer Gesellschaft) addresses well defined thematic areas, namely energy, advanced computation, security and health.
- The creation of the Iberian Nanotechnologies Laboratory (INL) in 2009 portrays a specific concern with this KET.
- During 2009-2012, part of the budget of every call launched under the OP-COMPETE (3.1 billion euro for 2007-2013) was allocated to the research priorities of Competitiveness and Technological Poles and Clusters (predefined in a specific long term research plan). The objective was to better allocate the available funds and help clusters to organise themselves. Clusters were also asked to validate whether the applicant projects would really fit the cluster priorities, so as to ensure that they were in line with the cluster strategy².
- Competitiveness and Technological Poles and clusters are being rationalised and redirected towards strategic objectives of more competitiveness in terms of increased exports and employment. The programme of the new government, which took office in mid 2011, suggests that investment in health and life sciences should be prioritized. Biotech, food, agriculture and fisheries, materials, environment and ICT are regarded as scientific areas to be further supported, so as to further strengthen the Portuguese innovation base. Launching of Scientific Thematic/ Priority Programmes under the Strategic Plan on Entrepreneurship and Innovation (+E+I) in December 2011 also shows targeted actions (EC 2013). Stronger sector focus and R&D priority setting is expected in the near future under the new programming period, in alignment with the on-going elaboration of Smart Specialisation Strategies.

² Clusters Policy is now under evaluation. The Portuguese management authorities decided to reassess the whole process after 4 years of operation.

Cooperation among those priority technologies are not either clearly addressed in any policy measure. However, Competitiveness and Technology Poles and clusters being rationalised and redirected towards strategic objectives indicate that priority technologies and their combined usefulness in various sectors could be addressed in the near future.

Transfer of S&T to the productive fabric has been incorporated as priority of the STI policy which is positive in terms of moving forward in the TRL scale in certain priority technologies. Promoting partnerships between research organizations and companies in order to address the traditional research and innovation policies divide and boost commercialization of research results is also at the forefront of the Competitiveness Factors OP COMPETE, with a specific instrument (“Projectos Mobilizadores I&DT-Empresas”) addressing that goal and funding demonstration activities. In fact, Portugal is regarded as having made a good use of Structural Funds, by combining the most usual set up of R&D infrastructures with strong company and innovation oriented measures. Additionally, The Global Accelerator Innovation Network (GAIN Network) will be also oriented to stimulate articulation among companies and organizations in the national science and technology system. That network will operate under open innovation thinking, promote collaborative projects under collaboration agreements and also address IPR issues. This will be combined with a revision and reinforcement of innovation incentive systems so as to stimulate the public-private funding, with the overall goal of incorporating (1) potential economic impact and (2) ability to mobilize private funds as decision making to publicly support R&D projects.

Additionally, the Strategic Plan on Entrepreneurship and Innovation (+E+I), embraces a wide set of measures aimed at making the business environment more conducive to innovation: promotion of domestic and international knowledge flows, competition reform, easier new firm entry through entrepreneurship, use of public contracts to promote innovation, promote the sourcing of innovative products, solutions and services by large Portuguese firms, attract R&D investments by multinational companies, accompanied by dedicated financial instruments (e.g. attract venture capital, creation of Portugal Ventures, which puts together all the former public venture capital instruments). Public support to business R&D and innovation is mostly indirect through tax incentives, in combination with direct funding through grants, contracts and loans. But still, raising the innovative capacity of the business sector will also require continued efforts to close the education gap. Hence, some reforms are planned in the education system so as to address one of the major bottlenecks of economic development. Innovation incentive system is aimed at supporting firms in scaling up their technologies by bringing the prototype to the market, build a new plant, build/improve a production line, etc.

Although no reference is made to KETs or pilot lines yet, in the recently published Strategy for growth, employment and business development 2013-2020, KETs are expected to be clearly mentioned and addressed by the next Operational Programmes (2014-2020) both at national and regional level which are under preparation. In terms of pilot lines, pilot lines will be addressed (maybe under the name of demonstration and dissemination activities) in the RIS3 strategies that are under preparation. Very likely, the current funding programmes and instruments to support demonstration activities and pilot lines will be maintained and reinforced in the next programming period.

1.3. Main policies for Pilot lines

Excellence and internationalization of the research system have been the main goals pursued by the research policy, reinforced by 'Commitment to Science', a policy document issued in 2006. More recently, the transfer of S&T to the productive fabric has been incorporated as priority of the science policy. The recent shift of the “Partnership for the future” initiative to entrepreneurship and innovation (EC, 2013) and the strengthening of **University Technology Enterprise Network (UTEN)**, combined with financial instruments to accompany the transfer process as well as to promote technology-based entrepreneurship, are some of the most recent signs of technology transfer being a priority:

- In 2006, the Portuguese government established a set of collaboration agreements with US universities, called “Partnerships for the Future” programme. Initially, this initiative involved three

programmes, with the Massachusetts Institute of Technology (MIT-PT), Carnegie-Mellon University (CMU-PT) and the University of Austin, Texas (UTA-PT). More recently programmes with Fraunhofer-Gesellschaft and Harvard Medical School has been incorporated, as well as an ambitious cooperation program in Nanotechnologies with Spain. The total amount allocated to this initiative for 2007-2011 was € 166.5 million.

- The UTEN was established in 2007, under the leadership of the FCT, INPI, and the IC² Institute at The University of Texas at Austin, to foster knowledge transfer between universities and industry, with the goal of increasing the economic impact of academic research. It enhances training and network building, on an international scale, of Portugal's technology transfer managers and staff, and technology entrepreneurs. UTEN has been continually enhanced, to provide much-needed training in technology transfer and commercialization, together with increased access to international networks, in order to increase capacity building that would (1) Strengthen Portuguese academic-industry linkages, (2) Increase technology-based entrepreneurship and (3) and accelerate firm growth nationally and globally. UTEN programs and activities include International Internships, Specialized Training and Networking, Technology Commercialization, Observation and Assessment, and Institutional Building. Currently, UTEN involves over 40 national university and research institutions and had an important role in creating a national network of technology transfer offices, training technology transfer professionals and bringing the issue of knowledge transfer to the forefront of universities' strategies. UTEN contributed to the incubation of Portuguese companies in international markets, offered on-site training to technology transfer professionals and developed an international business plan competition.

Promoting partnerships between research organizations and companies in order to address the traditional research and innovation policies divide and boost commercialization of research results is also at the forefront of the **Competitiveness Factors OP COMPETE**, which articulates this goal through various instruments.

- Specific "Mobilizing Projects for Technological Development"³ are supported in this context (in accordance with State Aid rules for R&D). They focus on knowledge transfer between research organizations and companies and the valorization of R&D in the companies. Demonstration activities under this kind of projects could be assimilated to pilot lines.
- Separate tool oriented to demonstration projects. These projects are oriented to validate and demonstrate that a specific technology coming out from a specific R&D process works and can be useful for several players in the market. As the main objective of those projects deal with showing that those technologies are worthwhile, applicable to a specific industry so as to increase its competitiveness, results have to be disclosed. However, firms have not shown interest in this tool. The reason behind that may deal with IPR issues (impossibility to fully appropriate the results of those projects), as well as lower funding rates. In addition, since standard R&D projects under COMPETE usually cover the Industrial Research stage and Pre Competitive Research (including demonstration) stage, a specific tool just for the demonstration stage is not usually attractive.

It is worth mentioning that COMPETE aims to cover all the innovation life cycle and support all type of companies through a diverse set of schemes. One of those is aimed at supporting firms in scaling up their technologies (Innovation incentive System) by bringing the prototype to the market, building a new plant, build/improve a production line, etc. When it comes to the Innovation Stage (not R&D), the maximum funding rates have to take into account both the funding through Risk Capital plus the financial grants under the Innovation Incentive System. The schemes change throughout the innovation cycle. During the investment stage, the companies do not get grants, but interest free loans. EU convergence funds (a vast part of the entire country) are used to support innovative investments projects (e.g. set up a new production line that can be used for commercialization purposes). Companies that apply for a project have to commit with specific goals in the long term. In general, three years after the investment is completed those goals are revised (turnover, value added, exports, etc.). If this firm achieves those goals the interest free loan can be transformed into a grant (up to 70% of the loan). It is a way of awarding the quality of the project and making sure that whenever

³ Projectos Mobilizadores I&DT-Empresas

COMPETE gives an incentive to these firms, they are achieving certain objectives that are in line with policy goals.

Additionally, some of the **Competitiveness and Technological Poles and Other Clusters** are relevant to KETs⁴ and built around the following objectives:

- Addressing market oriented challenges of the future
- Increase international competitiveness of products and technologies
- Development of structural projects aimed at the development of new products and solutions, qualification of traditional industries and generation of new future-oriented business
- Development of RTD projects that will lead to increasing the added value of national products and their exports; simultaneously, this investment will promote a higher level of cooperation among the institutions of the National Innovation System.

Public procurement is also being lately promoted as an important tool to drive and stimulate innovation, but it is still not very developed.

⁴ E.g. Competitiveness and Technological Pole - Engineering and Tooling; Competitiveness and Technological Pole - Mobility Industries; Competitiveness and Technological Pole - Refining, Petrochemical and Industrial Chemical Industries; PRODUTECH – Production Technologies Centre; Competitiveness and Technological Pole – Energy; Competitiveness and Technological Pole for Health - Health Cluster Portugal

2. Business perspective

2.1. Implementation of multi-KETs pilot lines

Technology and team in charge of bringing technology to the market are regarded as main success factors in the implementation of pilot activities. The importance of combining scientific and technical capacities with organisation capacities and business notions are highlighted for the success of the pilot line. Additionally, clear goals in terms of the technology that is being tested are regarded as a major success factor in the implementation of pilot activities. Many companies and pilot activities fail as they try to test or demonstrate many technologies at the same time.

Pilot activities work unevenly depending on their location or relationship with the company and they should be looked at and supported in different ways:

- **Pilot lines outside the company** work under a controlled environment, but could be assimilated to a real production line, despite not being a line which produces on a regular basis. They are useful to test and demonstrate new technologies because of taking place in a controlled environment (not feasible in a real production line), as well as for training purposes. Involvement of companies that will test their products/processes in those installations and location in areas where there is an important business base related to that field (physical proximity to end users) are mentioned as success factors. Financial liability is one of the main barriers highlighted by the interviewee. Funding takes place for the creation of the pilot line, but when the project/funding finalises they face difficulties to cover the significant running costs, especially to keep them updated. It is necessary to ensure that there exists a business model behind it to support those running costs (charge companies that undertake the demonstration activities in the installation, organisation of charged training activities, etc. complemented by annual support from public authorities). The Technocampus EMC² in the Nantes Region is regarded as a good example of pilot line with a business model behind it (companies like Airbus are using those installations) operating in the field of composite technologies for Aerospace, Automotive and other industrial sectors.
- In the case of **pilot lines inside the company** or real production line, business interest is ensured as they use it for their own production. However, one of the barriers/difficulties is how to get the initial funding. Supporting these initiatives means supporting specific companies which is difficult to handle in terms of market distortion and state aid. Support to pilot lines within specific companies becomes even more unfeasible in the European funding context. Demonstration activities are more difficult in this kind of pilot lines, as this means opening the company to others.

Interesting initiatives are found in terms of shared facilities, such as the Fablab EDP or the Iberian Nanotechnology Laboratory (INL):

- The main goals of the Fablab EDP are to reinforce the promotion of innovation and creative culture in the EDP Group, interacting with society, leveraging entrepreneurship and to encourage participatory citizenship. The Fablab EDP provides unique resources than can be used on a free charge basis (just paying for the materials) to develop projects and exploit new ideas, which can lead into business opportunities.
- The Iberian Nanotechnology Laboratory (IBL), fully operational since 2011, provides 22,000 m² of laboratory space and state-of-the-art equipment for various research areas. Cleanroom processes and laboratory equipment are available for external users. (1) External users coming to INL with approved collaborative projects (FCT, CSIC, EU, companies, university/research centre-INL protocols, etc.) get temporary user status at INL and perform/participate in the measurements, processes, research specified in the project always in collaboration with the project representative at INL. INL costs are internally charged to the research project. (2) External users requesting particular work/service or

equipment use outside any collaborative framework must supply a brief description of the work/service required and send it to the proper equipment/process contact person. If work/service is approved and executed, INL will invoice the ordering entity for the work done. Interested parties can check equipment and process availability at INL website.

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

The Portuguese innovation funding schemes are mainly oriented to SMEs. However, increasing restrictions to tax credits, caused by the current economic situation to a large extent, are negatively impacting on the innovation activity of companies, particularly SMEs. On the other hand, large companies normally face difficulties to get public funds and participate in public innovation funding schemes, particularly in demonstration projects funded by national authorities, and innovation policy makers are sometimes regarded as not having a sufficiently positive attitude towards the participation of large companies in those schemes. However, part of the Portuguese Innovation eco-system considers that the Portuguese innovation model performs better if large companies are involved (together with SMEs and other actors) as in most cases large companies are more qualified to make an effective use of public funds.

Complexity and rigidity of rules in the application process is hampering the participation of companies in innovation funding schemes. Additionally, the decision making model in innovation funding schemes is regarded as being insufficiently driven by technical advances and business opportunities offered by the applicants and motivated by other political factors.

3. Conclusions

3.1. Summary of policy perspective

Portugal has made a good use of Structural Funds, by combining the most usual set up of R&D infrastructures with strong company and innovation oriented measures. Although no clear priorities in terms of sectors or technologies are found in the policy papers, there are signs of targeted thematic funding addressing various KETs, such as advanced materials, nanotechnologies, biotechnology or advanced manufacturing (linked to the ICT priority). Key Enabling Technologies are expected to be explicitly addressed in the next round of policy papers, under the next programming period (2014-2020).

3.2. Summary of business perspective

Technology, team and setting clear goals are regarded as main success factors in the implementation of pilot activities. Pilot activities work unevenly depending on if they are located outside the company (under a controlled environment) or inside the company (real production line) and they should be looked at and supported in different ways. Interesting shared facilities are found both in the private (Fablab EDP) and public side (Iberian Nanotechnology Laboratory). Due to difficulties in accessing public funds, large companies are normally initiating, leading and funding their own pilot activities, in collaboration with other companies and actors (R&D).

3.3. Recommendations to support pilot lines

- Rigidity in the application process be softened and efficiency of the R&D and innovation support system should be measured also taking into consideration the cost that meeting all the application rules brings to companies.
- Stimulate corporate venture capital funds
- Policy makers should thoroughly evaluate the convenience of better addressing large companies in their innovation funding schemes and look for adequate instruments to articulate collaboration among large companies, SMEs and other actors and bring benefits to the entire Portuguese innovation and economic activity.
- Discourse about pilot lines should focus not only on new (end) products, but also on the development and demonstration of the production technology required to produce that product.
- Public funding could be used as an argument to convince beneficiaries to open their installations/pilot lines to others (normally difficult because of IPR issues, etc.), so as to give something back to the society in return for the public funding received.
- Attention should be now placed on how to make a good use and increase efficiency of existing facilities (such as the Iberian Nanotechnology Laboratory) so as to get return on investment made in the last years, instead of building up new facilities.
- Looking at how pilot lines could be supported by policy instruments, and referring mainly to the European context, a distinction between industry driven research projects and installation of a pilot line/complete production line is needed. Industry-driven research projects (especially European ones) should include demonstration activities with part of the budget dedicated to that, so as to give the projects the possibility to demonstrate and disseminate the results of the project (precompetitive prototypes in the EC terminology). The installation of a pilot line or complete production line is a complete different issue. The more you move towards the market, the optimisation of the European research programmes becomes more difficult, mainly because of:

- The more you go to the market the less the companies are willing to collaborate with others
- The more you go to the market the more money is needed (ten times more money than for other research activities). Because of budget constraints, EC could just support a few pilot lines and would be forced to making choices in terms of sectors to be supported, which is quite unfair in the European context.
- The more you go to the market the issues of market distortion and state aid become more serious. Installing a pilot line in one particular place, does not benefit Europe as a whole, but one particular region, while when you are developing a European research project many countries/regions are benefited.
- Setting up/building up pilot lines (infrastructure) should be funded either by private money, loans by the EIB, or national/regional funds (not necessarily Structural Funds), and not by European research programmes. Research activities that produce the technologies for those lines, research or demonstration activities that can be conducted in those lines could be supported by European research programmes (complementarity among policy levels). Smart specialisation strategy is a good tool to make progress in this direction so as to ensure that pilot lines make sense in terms of connection with regional economic activity.

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4.2. Interviews

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