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Valorisation of research results in the Mediterranean region

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Abstract. The efficient use of the existing research capabilities in the public sector to support the economic and social development in the Mediterranean Partner Countries (MPCs) is a key challenge. Valorisation of research, a fashionable topic, can strongly contribute provided that the research objectives and results are close to the strategic needs and prospects of firms. As the innovation policies in MPCs are increasingly dealing with valorisation, the article describes some of the measures and instruments created, namely technology transfer units, underlining the importance of analysing valorisation under a large focus which considers the conditions of public research and industry as well as the linkages between them.

Keywords. Valorisation – Technology transfer – Research - Cooperation – Intellectual property – Innovative enterprise.

Valorisation des résultats de la recherche en Méditerranée

Résumé. L'utilisation efficace des capacités de recherche du secteur public afin de soutenir le développement économique et social dans les pays MED représente un défi de toute première importance. La valorisation de la recherche, un sujet à la mode, peut apporter une contribution significative étant donné que les objectifs et les résultats de la recherche sont proches des besoins stratégiques et des perspectives des entreprises. Vu que les politiques sur l'innovation dans les pays MED sont de plus en plus centrées sur les questions liées à la valorisation, cet article décrit un certain nombre de mesures et instruments qui ont été mis en place tels les bureaux de transfert de technologie, en soulignant l'importance qu'on doit accorder à l'analyse de la valorisation dans une optique plus large qui considère l'état de la recherche publique et de l'industrie et les liens qui existent entre les deux.

Mots-clés. Valorisation – Transfert de technologie – Recherche – Coopération – Propriété intellectuelle – Entreprise innovante.

I – Introduction

For over a decade, the Mediterranean Partner Countries (MPCs) have developed complex research and innovation policies including initiatives for the valorisation of the results of research. The EMIS workgroup summarizes in this paper its vision on the current situation of those valorisation policies and efforts as well as on the institutional frame and research environment. These views are supported by the opinions of qualified experts from academia, industry and public institutions, gathered during a field work promoted by the EIB and performed in cooperation with ANIMA and several MIRA partners.

The creation of innovative dynamics in the region requires on one side the existence of a highly demanding industry and society and, on the other, research and academic institutions with the appropriate capabilities to provide suitable solutions. The public innovation and research policies play an important role in removing barriers and creating the conditions for those economic and research actors to interact and cooperate. Moreover, the creation of a Euro-Mediterranean Innovation Space (EMIS) should contribute to enhancing this innovative dynamics in MPCs through cooperation policies facilitating the actors of innovation in the region to exchange and strongly interact with EU firms and researchers.

The important differences that can be found between the EU and the MPC research, as shown by basic indicators, are coming out of the nature of economic structures, academic institutions and the articulation provided by research innovation policies. Although the figures for R&D expenditure in the region have increased during the last decade, with the exception of Tunisia, they are at levels distant from those of the EU, showing that public expenditures in research are not yet a priority. As for the private sector, its engagement in research and innovation remains at extremely low levels in most of the countries and this is also the case for cooperation with universities.

	Algeria	Egypt	Jordan	Lebanon	Morocco	Tunisia	EU-27
Total R&D Expenditure (GDP %)	0.40 (2010, est.)	0.21 (2009)	0.42 (2008)	0.30 (2006)	0.73 (2010)	1.10 (2009)	2.01 (2009)
Private R&D Expend. as Total % (est.)	<0.10	10	3	n.a.	22.7	14.1 (2005)	54.1

Source: UNESCO, 2011

Presently, some valid attempts to encourage companies to change can be appreciated with the opening, still quantitatively limited, of public research programmes to businesses, measures addressing incorporation of graduates and researchers into industry in Algeria, Egypt, Jordan, or the study of tax incentives to raise R&D private efforts in Algeria and Morocco. Nevertheless, the fact that most of the industry is made up of companies with limited skills and a very low technological intensity presents a significant challenge which once again outlines the importance of framing innovation policies with strong economic and educational policies.

The factors explaining the slow innovation and research development in MPCs, such as the dominant role of traditional industries, low development of research in universities or lack of resources for research and innovation have been shared by most of the countries in the area in recent times. Even when there are countries in the region, where the existence of natural resources could allow strong innovation policies, they did not reach a radically different situation. We have therefore to focus on policies dealing with structural issues when looking for the best suited approaches for innovation and economic development. A good example of those issues is provided by the weak interaction between the countries in the area and the numerous barriers—very often not explicit—to MPC cooperation that hinder efficient economic and innovation exchanges and strategies.

II – Technology needs for innovation

The absence of regular innovation surveys does not help have a sufficient and updated understanding of the technology needs of the MPC industry, therefore it relies on the figures for R&D business expenditure that show a low spontaneous demand of knowledge. Only a few large companies are reported to have in-house research capacities and the potential to lead cooperation projects or to request contract research, mainly like OCP (Office Chérifien des Phosphates) in Morocco, Sonade in Tunisia, Sonatrach or Cevital in Algeria. As for the international research collaboration, especially with European partners, it is still modest since the Mediterranean countries are rarely seen from abroad as technology partners.

The implementation of measures to promote the identification of technology needs and strategies in the industry as a key input to define research objectives in universities and research institutions and to become the basis for innovation and business development appears to be an urgent need in the MPCs. It is the creation of proximity links (not only geographical, but also organizational and cultural) between firms and providers of abilities and knowledge, as the universities and research institutions should be. This would allow the industry to advance not only in modernization of

plants and management systems, which is a basic need, but in the creation of new products and services for an upgraded competition in the national and international arena.

The creation of advanced industrial areas or technology platforms (cities of innovation, clusters, technology parks) already under development in many of the MPCs will help deal with the issue of industry needs for innovation and will also allow the creation of opportunities for new start-ups; however, the efficient use of existing resources in universities and research organizations will require a closer consideration of current regulations of the public research sector to make them suitable to leverage the firms technology potential.

III – Research resources and outcomes

Most of the MPC universities were created after the sixties with an exclusive initial focus on education. Only after the definition of the first public policies and investments in the nineties, they started to address research as their second function, generally without consideration of likely downstream applications. Presently, the public universities are to cope with the challenge of research upgrading in a situation of overload, inappropriate funding structure and ageing research facilities; this helps explain the weakness of scientific outcomes and the limited quality of the scientific training received by students. Besides, research fields and topics are quite often selected in the universities according to spontaneous approaches from researchers, far from national or market-oriented priorities, while the laboratory infrastructure and equipment are maintained lacking suitably skilled staff. This view is to be completed with the consideration of the public regulations and existing statutes in the universities closely focused towards education while mobilisation of researchers and instruments for cooperation with industry are quite generally not being considered. As for the most recent wave of private universities in MPCs, with a few exceptions, they lack the vocation and resources for technology R&D, as research is usually a second priority only at reach of their teachers-researchers when public facilities are available.

Adequacy of funding mechanisms, educational programmes adapted to the demands and needs of the labour market, as well as regulations to promote teachers competences and research form part of the government measures required to level the universities with the development needs of the MPCs. In the last times, though not everywhere, movements in the governance of universities occur towards implementing improvements in priorities definition, internal evaluation methods, monitoring of projects and areas of research in line with the democratization of management. Also, during the last decade the evolution of the legal frame of the universities is allowing initiatives to create or enhance links of universities with the industrial environment and to commercial exploitation of the research results.

The research or technology centres established in the eighties and nineties were frequently based on a linear view of the innovation process with insufficient attention to the creation of liaison mechanisms with the users and business community. This approach has been reoriented in recent times, involving private actors and companies, as is the case with the creation of new research centres in Egypt and Morocco (Mascir); they have a strong challenge ahead to show their efficiency in keeping close to the application. Meanwhile, research centres addressing national priorities in sectors like health or agriculture have been quite consistent with their objectives from start.

Other scientific infrastructures are timidly orienting their strategies to support academia and industry cooperation, as is the case of the CNRST laboratories in Rabat allowing easier access of universities and private users to their facilities. The growing need for resources to maintain research laboratories at a level of excellence recommends the development of common multilateral strategies involving centres from different countries, an issue already discussed during the Arab summit in 2010.

The availability of human resources for research in the region is a key element when the number of researchers per inhabitant in the region is below the most advanced countries. As exceptions, both Tunisia and Jordan have figures above many EU countries. The quality of the research teams in universities is deeply affected by the recruitment approaches, strongly conditioned by endogamous practices which give priority to graduates from the same institution and by the financial resources available for training and mobility assuring the return. In the last decades, a high number of university graduates from Egypt, Morocco and Algeria continue their studies abroad, mainly in the EU, where the most skilled obtain highly qualified jobs in business or research making difficult the search for comparative alternatives back home. Also ambitious policies to attract talent from abroad are being formulated with modest or no results for the moment.

When research started to be considered as one of the main functions of the universities, the number of publications became the main (often the only) criteria for quality evaluation. As a result, there was in the last decade a high growth in the number of publications in the region even when the differences between countries are important: Egypt has the highest number, while in relation to the population, Tunisia and Jordan outperform the world average of 147 publications per million inhabitants.

However, the research results show a very low orientation to industry needs if the patents are considered as indicator. The number of patents filed and registered confirm a lack of culture of intellectual property (IP) as compared to countries of similar size; being apparently the good news, some international patents are registered outside the region, mainly in the USPTO (US Patent and Trademark Office) and the European Patent Office (EPO).

	Algeria	Egypt	Jordan	Morocco	Tunisia
Patent applications, non residents (2007)	765	1452 (2009)	446 (2009)	856 (2010)	n.a.
Patent applications, residents (2007)	84	490 (2009)	60 (2009)	151 (2010)	n.a.
Average USPTO annual number of patents registered (2002-2006)	0.4	5.6	1.4	0.8	0.6

Sources: WIPO: *World Intellectual Property Indicators*. www.wipo.int/econ_stat; USPTO, <http://www.uspto.gov>

For most of the countries the number of patents is not yet considered as a measure of researchers' activity, thereby preventing them from a more focused approach looking for application and closer to the economy needs. The development of the culture of intellectual property, built on technical training and support to researchers as well as on increased dissemination and visibility of research results, should be enhanced to help create an efficient basis for technology transfer.

IV – Cooperation in research

Currently, public policies and programmes supporting university-industry cooperation, using public funds are timidly starting to appear in most of the MPCs. The promotion of applied research cooperation should be completed considering first the kind of projects to be developed, actually focused on well-defined and specific objectives of the firms which are to benefit from the research results.

Some of the main barriers to launch cooperation projects as a way to valorise knowledge come currently from the regulatory frame for career development existing in many institutions that creates difficulties for the motivation of researchers. Therefore, the definition of researcher's statutes facilitating the careers and mobility of researchers, together with the creation of incentives and strict codes of conduct will strongly help upgrade the research capabilities.

Moreover, promoting international research cooperation has an outstanding importance not only to contribute to the mastering of emerging technologies but also to facilitate the comparison with the state of the art.

International research cooperation in MPCs, which is supported by EU and bilateral programs offers opportunities for innovation and transfer of knowledge to firms in the region; however, these opportunities are still scarcely used: as an example, by the end of 2011, in the 168 FP7 projects involving MPC partners - mainly from Egypt, Morocco and Tunisia -, the participation of firms was only 10% of the total showing the need to address the sectors and firms with innovative potential as to increase their interest in innovation through cooperation. These results also underline the importance of reconsidering the existing rules of participation in international programmes such as the Framework Programme.

V – Valorisation of research in the MPCs

The “creation of economic and social value from knowledge and scientific capabilities” can be produced by a variety of channels: joint projects, patents license, business creation or training of specialists. The consideration of knowledge transfer as an actual role of the universities (the “third function”, after education and research) was introduced in most of the MPCs only in the last decade, and still has a long way ahead to set up regulations on the role of the universities, the researchers’ statute or the creation of professionalized capacities helping with industry liaison, RDT financing, IP management, contracts negotiation and business creation and development.

Those measures quite often include the creation of liaison or technology transfer offices (TTO) as well as other structures (clusters, technology parks, technical centres, incubators) able to provide the required expertise to both researchers and industry or final users.

Valorisation has to build as far as possible on research results that were produced looking forward to giving response to actual problems or innovation needs; otherwise the “marketability” of the academic knowledge will find barriers very difficult to overcome. The role of liaison with industries and final users as to help researchers to identify topics appears at the forefront of the TTO functions.

Most countries in the region have been defining valorisation policies during the last decade, which included the creation of units in universities and research centres together with other structures of support to industry cooperation and innovation. The implementation of those policies, following quite often models already developed in other countries since the late eighties, usually needs long periods of time to achieve a sustainable impact, as they are closely related to the whole process of knowledge production and innovation, and are also conditioned by regulatory and organizational factors in the academic environment. Here follows a short review of the valorisation policies and measures to implement support structures in the Mediterranean countries.

Since the nineties valorisation has joined the innovation policy schemes in **Algeria**, where specific measures have been proposed in research centres in order to create links to industry and to look for application of the existing capabilities. In 2008 a valorisation department was created to reinforce the policies of the Ministry of Education and Research - initially developed by the ANVREDET (Agence Nationale de Valorisation des Résultats de la Recherche et du Développement Technologique), an agency for dissemination of the results of research and an IP agency (INAPI).

The support to valorisation interfaces in universities appeared in the agenda after 2008 as they are requested to implement liaison offices promoting knowledge transfer to industry further than the supply of skilled graduates. Some universities set up valorisation units usually with the help of part-time researchers, who mainly addressed the negotiation of research contracts and IP issues,

as is the case of the Houari Boumediene University (USTHB). Other universities, such as those of Blida, Tlemcen, Constantine, Bejaia, Jijel, Oran and USTO are also in the process of developing their own units quite often conditioned for the availability of resources. This approach in public education is having a parallel effort in the business side where innovation and technology transfer centres (CITT) are planned, with the first one already at work in Tlemcen.

Regarding the existing public research and technology institutions, both the creation of valorisation units and the creation of technical subsidiaries are making easier for them to close the gap with final users and the industry since some of them such as CDTA (Centre de Développement des Technologies Avancées) or CDER (Centre de Développement des Energies Renouvelables) have annual experts in charge of valorisation, while others as the UDTs are currently formalizing valorisation units. The transfer of technologies developed in the research centres is being efficiently supported by specific subsidiaries – Saticom (a subsidiary of CDTA), ER2 (CDER) or PITT (UDTs) - created to adapt the technical solutions to the needs of the users or to new products covering all the stages of the innovation process.

Programmes for applied research collaboration funding in **Egypt** include more and more bringing together academia and industry in their objectives. That is the case of STDF - Science and Technology Development Fund, and RDI - Research, Development and Innovation Programme (financed by the EU), ITIDA Fellowship for IT and the IMC - Industrial Modernization Centre (which supports the stage of proof of concept). However, the specific issue of creation of technology transfer offices in universities and other structures to facilitate innovation such as incubators are slowly developing, mainly starting from the universities themselves. Thus, four universities (Helwan, Cairo, Asyut and the American University in Cairo) supported by the Tempus project (EU) created their TTO in 2010, while other universities followed: Kafrelsheikh, Ain Shams, Beni Suef and Egypt-Japan University of Science and Technology. These ones, in collaboration with the University of Alexandria, - which has a large TTO since 2009 - are working in the configuration of a national TT network (ENIT) with additional support from USAID. Technology transfer channels and institutions include also in Egypt the Invention and Innovation Development Agency (IIDA), helping to access the market and the Technology and Innovation Centres promoted by the Ministry of Industry.

The National Research Centre (NRC, the largest research institution in Egypt, with 14 thematic research areas) has been based, since its creation, on a different cooperation model with industry, in close relationship with industry associations and the Federation of Egyptian Industries as to facilitate the implementation of contract research projects. To this end, NRC created in 2002 a Business and Investors Office (BISO) which upgraded its capacity in IP and valorisation services to NRC researchers after 2011.

In **Jordan**, the application of a 1% tax on the benefits of the public companies is aimed to turn the business attention to innovation while helping increase the funding of research; additionally, incorporation of university experts into industry through the Faculty to Factory programme is efficiently contributing to the transfer of knowledge to industry. In more concrete terms, a wide network of technology transfer offices in academia and industry is being developed in the frame of the EU-financed SRTD programme with a wide geographic coverage.

This innovative initiative has supported the creation of eleven TTO since 2009 in both academic and industry environments (Jerash Private University, Jordan University of Science and Technology, Mut'ah University, University of Jordan Yarmouk University, NCARE; Al Urdonia Lil EBDA - JIC North, Amman Chamber of Industry, Jordan Enterprise Development Corporation, Jordan Industrial Estates Corporation and King Abdullah II Design and Development Bureau) through the National Programme for Technology Transfer. The creation of this national TTO network with common goals and cooperation mechanisms counts with the professional coordination from the Intellectual Property Commercialization Office (IPCO, a part of El Hassan Business Park).

Looking towards international cooperation in technology transfer, IPCO is currently exchanging experiences in the field with other institutions such as Lebanon's CNRS.

Since 2003 **Morocco** has created a number of valorisation units in the universities (fifteen) and research institutions (eleven) under an international cooperation program with France, aimed to provide the researchers with the necessary support to launch joint projects with industry and new innovative start-ups. Those units, developed in parallel with an incubators programme (RMIE), need further empowerment to cope with the challenges set by industry development in the country.

Meanwhile other instruments for industry-university cooperation have been launched in the last few years such as the public-private Mascir Foundation for research in priority fields (biotechnology, nanotechnology, microelectronics), industry clusters (microelectronics, digital industries, mechatronics, fishing industry) and Cities of Innovation (Fez, Rabat, Marrakech and Casablanca) under the Moroccan Innovation programme.

The National Plan for Research and Innovation and Valorisation Programme (VRR) in **Tunisia** has been active since the nineties aiming to increase university-industry cooperation and launching an ambitious programme of technoparks (seven have been created since then). From 2011 the PASRI programme has initiated with the cooperation of the EU and the WIPO the creation of 7 technology transfer offices (BuTT) to build upon experiences developed at the technoparks (e.g. Borj Cedria technopark hiring independent brokers to create and commercialise a technology portfolio) and Tunisian universities (Tunis - El Manar, 7th November, Carthage, Gabes, Gafsa, Jendouba, Sousse) which designed their liaison offices with industry under a Tempus project four years ago.

VI – Valorisation services

As it has been shown, valorisation activities in the Mediterranean countries started in the nineties, but only in the last decade universities and research institutions became aware of the convenience of building professionalised support interfaces, giving pace to the above-commented policies and initiatives. In order to attain a more detailed vision of the valorisation approaches and services, a questionnaire and interviews were addressed to 24 research institutions leading the ERA-WIDE projects approved by the EC in 2010-11.

	Algeria	Egypt	Jordan	Morocco	Palestine	Syria	Tunisia	Total
Institutions surveyed	2	5	6	3	4	1	3	24

Almost half of the institutions declared to be managing valorisation of research results from presidency-related departments (only one of them had a specific unit) while other departments such as those of external relations, marketing, dissemination, or central laboratories were charged with industry liaison tasks. This proximity to the institution heads suggests that valorisation issues are still having a low degree of development and autonomy.

In line with it, hiring specialized professionals is not common, and the researchers themselves are at the forefront of the day-to-day liaison and valorisation work. The technology transfer units or responsible people usually support the researchers with horizontal services: information, training, workshops organization, while those services that involve greater specialization, such as IP management, search of research projects financing or support to spin-offs quite often remain with no suitable support.

Summarizing, it can be said that valorisation is usually allocated as a complementary function to units in charge of other responsibilities in the academic or research institutions, and since professionals in IP management, technology watch and specialized fields are rare. Those

functions are to be usually performed either by the researchers themselves or other management people lacking the required qualification, who quite often require external support (patent agents, consultants, etc.).

These findings are coherent with the general opinions on valorisation and technology transfer also gathered in the survey showing that in research institutions: (1) research-business links are usually created through personal contacts; (2) transfer of patented knowledge is unusual as a means of co-operation with industry; (3) technology transfer units and services still play a marginal role in the creation of links with industry (Fig. 1).

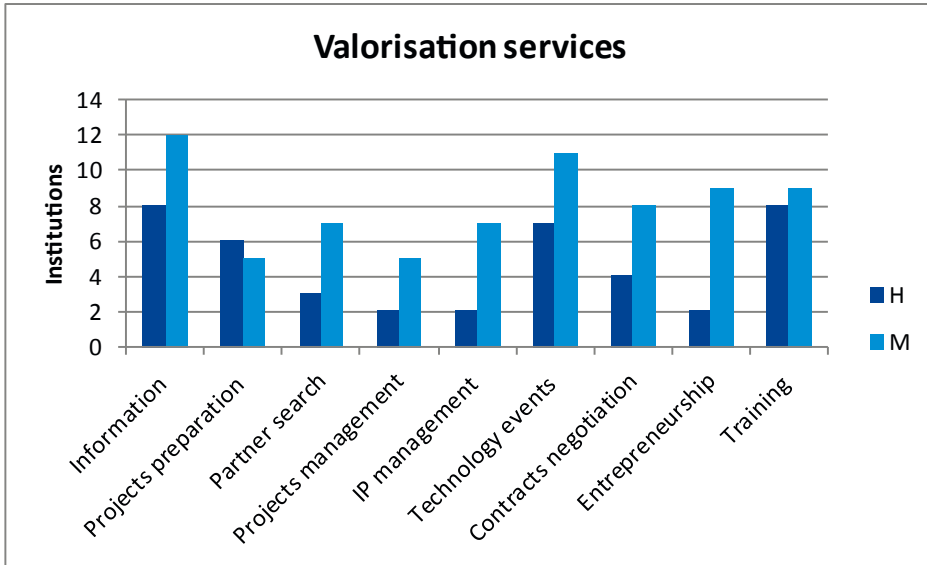


Figure 1. Results of the survey on valorisation and technology transfer in research institutions
H= High intensity; M = medium intensity
Source: MIRA (2011)

VII – Networking of valorisation interfaces

By its own nature the flow of knowledge has no borders and sets a challenge to facilitators in the creation of efficient channels for technology transfer both in their countries and internationally.

From the firstly created Technology Transfer Offices in Morocco to the most recent initiatives in Jordan, Egypt, Algeria or Tunisia, building capabilities, performing joint activities and sharing expertise through interlinking them appear clearly in the forefront of the valorisation policies. The experiences of European networks, both national (e.g., Italy’s Nerval, France’s Curie, Spain’s RedOtri) or international (e.g. Proton, EEN) show some of the benefits that can be drawn from networking cooperation. In this line, five public universities in Egypt agreed to create a nationwide network (ENIT) to debate on sustainability models and to exchange experts. The response of the universities professors and researchers has been very receptive to a model which, even when caring about the experiences from other countries, is to be drawn according to national issues and challenges.

Another initiative is the network of the Jordan Higher Council of Science and Technology (HCST) and Jordan Enterprise Development Cooperation (JEDCO) aimed to supply eleven university and business TTOs with a professional coordination that has to cope with the specific cultures of the involved organizations and to look for the best ways of respecting the institutional independence while getting more and more involved in sharing tech transfer activities.

The creation of linkages among technology transfer units and national networks in the Mediterranean area will help open new perspectives not only to valorisation but more important to research cooperation, as shows the experience of the 1995-created Enterprise Europe Network (EEN), in which members from Morocco, Tunisia or Egypt are currently taking part.

VIII – Final Comments

Valorisation of research results is facing similar challenges in most of the Mediterranean Partner Countries. A main one is the strengthening of links between researchers and firms allowing to orient and improve the quality of applied research performed in universities and research centres. Those links can also play a key role in the creation of favourable conditions for innovation in industry and to promote the allocation of private resources to research which in return will help to overcome weaknesses of the industry and to improve its competitiveness.

On the industry side, the changes in the strategies of the firms are more and more conditioned by the competition in open markets to invest in product development and to innovate. The identification of the technology needs linked to the objectives of the firms appears therefore as a critical issue for industry that is followed by the measures to guarantee the accessibility to technology, through capacities in the country or through international alliances. It is here where the public research sector should focus its attention to become a strategic agent.

Additionally MPCs show the need of a powerful policy of innovation to implement strong measures aimed to upgrade and modernise industry in terms of skills, equipment, information and quality management, to increase the number of firms able to compete in local and external markets. Knowledge and technology available in universities and research institutions are to contribute to this endeavour, providing skilled graduates and the capabilities to deal with the technical problems and innovation challenges. On the research side, the public institutions are to deal with the issues related to the quality and motivation of researchers for cooperation with industry. This means that the public standards and regulations of the careers have to consider the possibilities of a stronger commitment of researchers active in applied research, with higher possibilities of getting involved in the exploitation of the results through joint projects with industry, patents licensing or creation of innovative start-ups.

Public regulations and institutions are also to deal with the introduction of intellectual property culture and with IP rights management (ownership, share of revenues, patent licenses) and with provisions for the mobility of researchers, a hard challenge when the internationalisation of research opens the labour market for researchers.

Innovation and research policies in MPC are currently deploying a wide arsenal of instruments – technology transfer interfaces, clusters, incubators, technoparks, technology platforms, etc. – which are to be tuned to the possibilities and requirements of the country's economy, after a sound consideration of the country's priorities in the different research and industry areas. The existing programmes are very often not addressing the research-industry cooperation needs in a fully satisfactory way, usually affected by governance barriers between the departments in charge.

In the international arena, certainly the use of the existing EU, bilateral and multilateral programmes offer wide opportunities of cooperation for MPC, helping keep close linkages and acquaintance of international markets, state-of-the-art and frontier technologies. Besides, what is actually missing is a deeper cooperation effort to create liaisons between the Mediterranean Partner Countries themselves, facilitating the creation of common platforms through technical and managerial exchanges with the critical mass in international forums and networks as to play a mutual benefit role in technology and research exchanges.

Valorisation and knowledge transfer from the public sector to industry will need a close consideration in the frame of the innovation policies, and will require specific measures for creation of support units or interfaces with the professional capacities to help researchers and firms cooperate in creating strong liaisons, raising R&D funds, managing intellectual property, negotiating technology contracts or helping to create and develop innovative enterprises.

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