Monitoring Research and Innovation Policies in the Mediterranean Region

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The article shows how new policy tools are designed in the Mediterranean countries for the monitoring of research and innovation. It relies on the results of a large European project, ESTIME, funded by the European Union that aimed at describing the state of research and technology policies and systems of partner countries in the Mediterranean. Other initiatives are also mentioned that aimed at gathering information on research and innovation systems in the Middle East and North African countries (MENA). The article presents the importance of the European Union as a reference for this monitoring activity. It also shows that the new tools, for example, innovation surveys, are a part of the policy process itself. Finally, it presents the main characteristics of public policies, their recent turn toward innovation and the effects that these policies have had on the institutions and actors promoting innovation which we propose to call the 'innovation world'. Two examples are presented in more detail, Tunisia and Morocco, since both countries have been actively promoting innovation policies and have developed innovation surveys.

Keywords: Research Policy; MENA countries; Innovation incentives; Tunisia; Morocco

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Introduction

Innovation policies and innovation activities in firms are, with some exceptions, little known in the context of Mediterranean and North African (MENA) countries. Still, innovation policies have been developed and sustained quite firmly in the last years by some governments, for example, in Algeria, Egypt, Turkey, Morocco and Tunisia. Other countries in the Mediterranean region have also promoted specific schemes and measures for innovation (Jordan, Lebanon, and, to a lesser degree, Syria). In the last ten years, this effort has benefited the so-called 'Barcelona process' (EU-Med cooperation) and the policies have often been supported by the cooperation between the EU and the Mediterranean countries. Even though the overall Barcelona process has not necessarily been very successful, research and technological developments have been a prolific area of cooperation and institutional developments. A large array of measures have also been devised that aim at industries catching-up and the funding of innovation activities in companies (Pasimeni et al. 2006).

Additionally, international organisations, bilateral donors and NGOs have participated in the need of the countries to transform their development models from low-cost into knowledge-based production: The EU, OECD, UNESCO, UNIDO and ALECSO are only a few examples of these. Finally, the World Bank has actively promoted policies in favour of knowledge and innovation, mainly through its KNA-MENA initiative (Reiffers and Aubert 2002).[1] A specific emphasis was put by funding agencies and governments in the development of techno-parks and industrial clusters (Saint Laurent 2005). This policy shift toward innovation (rather than solely research support) was basically done through measures promoting innovation in the public sector and contacts between the public sector and the productive companies in many forms: engineering networks, promotion of technology transfer units, fiscal measures, promotion of start-ups and venture-capital funding. Finally, at varied degrees, all the MENA countries were profoundly affected by the EU, which served as an example by its own promotion of innovation and instruments set up to measure it (such as the European Innovation Scoreboard).

This article revises recent developments in the follow-up of research and innovation policies in the case of Tunisia and Morocco as derived from the ESTIME project.[2] The first part briefly states the discussions in

the region on the follow-up of the research system's performance and of innovation activities. It then introduces two main surveys, in Morocco and Tunisia, which were designed to gather information on the enterprises, a necessary information input for policy making and analysis of the innovation activities. Some of the main tendencies of the policy making decisions will be introduced for these two countries. Finally, it formulates a proposal on where the focus of the policy monitoring should be aimed.

Nonetheless, this article does not introduce in detail a description of the research and innovation policies in any of the MENA region countries. These policies have been largely diffused in publicly available documents (which can be all found in the country reports of the ESTIME project and are mentioned in the article). Moreover, most of the material describing policy measures is short lived and rapidly outdated. We focus on longer trends, observed since at least the beginning of this new century. Monitoring of policies, included under the vocable 'evidence-based policy making', is by itself such a long trend.

The article is mainly based on the results of the ESTIME project which has been, among other things, instrumental in collecting information systematically on the policies around the Mediterranean partner countries of the EU (Arvanitis 2006). But other projects also have tried to fulfil the need for information in the MENA region such as ASBIMED and Medibtikar and, more recently, the Mediterranean Innovation and Research Coordination Action (MIRA).[3]

Medibtikar has been setting up a network to promote a systematic collection of information specifically related to innovation and the design of a 'Euro-Med scoreboard of innovation' (an initiative labelled Network for Evidence-Based Innovation Policy [NEBIP] in the MEDA countries).[4] MIRA is a large platform joining policy makers and the European Commission for the observation, analysis and promotion of shared science and technology policies in the MENA region. MIRA is much more than a project: It is the widest policy-making forum that has been devised so far between EU and its neighbouring countries. MIRA is also included under the 'Union for the Mediterranean' (UfM), a political process triggered under the French Presidency of the European Union in July 2008,[5] that has been devised at a higher state level, to include all the Mediterranean countries (with the exception of Lybia who is a 'permanent observer' in the UfM) in devising common policies for the region. This political

process has resulted in a conglomerate of initiatives.[6] Moreover, because of its nature of collection of projects, UfM has issued priorities that were already a part of the Barcelona process, or on-going initiatives.[7] MIRA is the case: in becoming a part of the UfM process, MIRA offers still another policy discussion forum for the Euro-Mediterranean policy.

As we will show in the article, the monitoring of research and innovation policies, such as the one that is reflected in the observatory of science and technology cooperation proposed the MIRA project, or the setting up of a Euro-Mediterranean Innovation Space (EMIS) group (also inside MIRA) are not purely intellectual tasks. These on-going initiatives are closely linked to policy-making processes. The article will try to offer sufficient background information to disentangle both the knowledge of the research and innovations systems and the growing 'observation' apparatus that is being built-up.

The Tools for Monitoring Innovation: Indicators in the MENA Countries

Why insist on the monitoring of policies? There is a clear need to identify specific tools that would be an adequate follow-up of research and innovation policies. This has been expressed by many reports (see all background documents for the ESTIME project, of which policy reports were written by policy people). Secondly, instruments to promote innovation are numerous and new. Some learning in their use needs to take place; since innovation policies are more complex than the support given to research institutions, these tools should be of help in providing evidence for policy makers. The observations of innovation actors should moreover provide comparisons and help identify what directions should be taken in the future. Thirdly, innovation involves a growing number of new actors that could be grouped under the heading of 'innovation world'. This comprises all actors that act in the promotion of innovation. The multiplicity of these new actors in terms of locations, institutions, types and activities, as well as the varying incentives and drivers to innovation need a specific analysis of the innovation world. These actors, moreover, are governing the innovation process as well as the official state authorities. The governance of this whole innovation system is far from being as straightforward as is usually implied by policy statements (Arvanitis et al. 2010).

The European Reference Framework

If we examine more specifically the issue of evidence production for policy in the MENA region, we still find a very uneven situation among countries and among institutions. Some efforts have been made to provide policy makers with innovation-related indicators. This difficult task, which needs both a methodological discussion (because innovation is context-specific) and a significant investment in skills, is ongoing in the region and has been mainly pushed by the European Union and the partnership of MENA countries with the EU. On the whole, surveys, a systematic compilation of indicators and provision of up-to-date and meaningful reports on the 'state-of-the-art' are still lagging behind in many MENA countries (for many other indicators, see the ESTIME final report). Apart from the pressure of the EU which goes hand-in-hand with the setting-up of joint research programmes with EU funding, others have had a hard time in completing data on any of the dimensions of the research and innovation process. None of the OECD, UNESCO or World Bank experiences have been successful so far in providing the necessary expertise in the countries themselves. Rather, what is usually done are specific projects that select, compile and provide a set of indicators.

Specific projects, funded by the EU, such as Medibtikar, ESTIME, ASBIMED, had a regional scope and have designed methodologies to give an incentive to policy makers in the countries to produce up-to-date data.

Medibtikar was a project funded by the EuropAid Fund of the EU to promote innovation in the region. Among its activities it proposed, for example, to provide a Mediterranean Innovation Scoreboard (MedIS). This scoreboard aimed at illustrating the development model of the MEDA countries, which are in a process of transition from 'resource-based' and 'low-labour cost' economies, with significant trade protection, into economies that wish to be incorporated in the global competition race for the knowledge economy. The indicators were supposed to be 'EU-compatible', that is, pave the way to compare with Europe (and in particular, the European innovation benchmark tool, the European Innovation Scoreboard [EIS]). Although now the economies of the twenty-seven EU member states and the ten MEDA countries are hardly comparable, it is expected that at a later stage, MEDA and EU benchmarks would evolve parallelly.

This ambitious goal proved a good boost in an effort to adopt a list of MedIS indicators, adopted unanimously at various seminars that brought together experts from the region.[8] Nonetheless, completing the list of indicators with actual numbers proved quite disappointing in the sense that, despite extensive search, the availability of indicators was very limited.

The Mediterranean Innovation Scoreboard (MedIS) exercise started, based on the idea of replicating the European Innovation Scoreboard (EIS) and comparing the MEDA countries' innovation performance among themselves and with that of the European scoreboard.

ESTIME and ASBIMED were both funded by the International Cooperation Fund of Framework Programme 6 and had a different ambition. ESTIME had the mandate to gather all information available to draw a state-of-the-art research and technology structure of the main Arab partner countries of the EU. The project was designed to build a local capability in selecting and using science and innovation indicators. Teams in each country were identified and provided studies on specific topics. Official authorities devised local surveys to fulfil this demand for up-to-date information.

The ESTIME project produced a complete statistical and institutional analysis of seven countries, bibliometric analysis at the institutional and macro levels on seven countries (excepting Palestine), reviews of science and technology policies on six countries (not including Syria and Egypt), analysis of research activities based on interviews and CVs of researchers, analysis of innovation surveys in Tunisia and Morocco and a review of innovation policies in all the countries (except Egypt). To date it is the only project that has been able to cover such a span of activities. It should be underlined that in each country a massive effort has been undertaken to obtain information and to build a collaborative network of researchers, including at least fifty researchers or government officials.

On the whole, ESTIME was efficient in fulfilling most of its objectives but since its scope in time was limited, it could not sustain the network of teams and persons engaged in the project on a longer period; neither was that goal among its initial objectives.

ASBIMED was answering a question posed by the EU and its Mediterranean partners: What cooperation exists between the Med partners and EU countries other than through the EU funding mechanisms? The project provided information about the existing networks of bilateral cooperation and the main areas covered by this cooperation. It showed that

significant flows of bilateral cooperation between Mediterranean partner countries of the EU and EU member states exist, that in most cases they are completely independent, not coordinated nor coherent with the thematic priorities set either within the Euro-Mediterranean Partnership agreements, or within the Framework Programme.[9] It is worth mentioning here that the bilateral cooperation activity is generally driven by academic research, with a low involvement of technological and industrial topics. Maghreb countries, as expected, show strong links with French institutions, but there is a tendency towards a greater involvement of Spanish, Italian and Greek cooperation with them. Egypt shows a lower interest and involvement in bilateral cooperation with EU countries, probably due to its sufficiently high cooperation with the US. Globally, it is worth remembering that the entirety of this bilateral cooperation is quite low, not higher than the EU international cooperation (INCO) devoted to the Mediterranean countries.

In these projects, promoted in the framework of a Euro-Mediterranean policy for research, the aim is not to provide comparative work with some EU standard: It is rather to provide inputs for further policy making either locally or at the European level.

MIRA is an on-going activity, a large International Cooperation Network (INCONET) that is the main platform of cooperation of policy-level authorities on both sides of the Mediterranean. It includes many policy activities, such as the observation, analysis and reflection on indicators, the promotion of funding and dissemination of information on research and technology; it also acts as the secretariat of the 'Monitoring Committee'. It also includes a specific activity labelled 'Euro-Mediterranean Innovation Space' or EMIS.[10]

MIRA adopted a rather different methodology on indicators than that adopted by the other projects mentioned here. It urged policy makers and policy analysts to provide a minimum list of indicators and explain how and why each country should provide these data. The assumption is that since progress in gathering information is rather slow but effective, each country should be able to fit into a minimal set of general indicators on inputs and processes along the following lines.[11] This on-going activity is related to the discussions that take place inside a Euro-Mediterranean policy arena, namely, the 'Monitoring Committee for the Euro-Mediterranean Cooperation in Research, Technology and Demonstration'.

The 'Monitoring Committee' was set up by the European Council as part of the Euro-Mediterranean Partnership (1995). Its task is to promote

the development of a Euro-Mediterranean Space for Science and Technology, and thereby to support the sustainable development of the whole region in view of the creation of an 'area of shared prosperity' (Barcelona Declaration, Economic and Financial Partnership's goal). It has to monitor the scientific, technological and to a lesser point innovation activities in Euro-Mediterranean cooperation. Very much linked to the European Commission, the MoCo has been closely associated with the definition of priorities of international cooperation in science through the successive Framework Programmes (FP) for science and technology. In FP5 (1999–2002) and FP6 (2003–06), the participation of third countries in the main activities was gradually opened, including access to funding. However, the success of this initiative was very limited and most of the international cooperation activity in FP6 took place through specific international cooperation activities (INCO). For the first time, beginning under FP7, all thematic programmes as well as the international fellowships (Marie Curie programme) are open to non-European countries and INCO's direction inside the European Commission is limited to encouraging participation in the thematic priorities of the FP and monitoring specific institutional initiatives.

As can be seen, in the case of the EU-Mediterranean cooperation, institutional initiatives are structured politically and express needs and promote orientations in specific programmes. Projects such as ASBIMED, ESTIME and MIRA were all asked for and approved by the 'Monitoring Committee'.

The Wider World: World Bank and World Economic Forum

Other international institutions were involved in the effort to gather relevant information on research and innovation, as for example, the UNESCO Institute of Statistics (UIS) in Montreal, although in principle all countries are supposed to be regularly reporting to the UNESCO Institute of Statistics in Montreal. UIS has implemented a series of workshops to create a stimulus for better data collection, which has not been really followed by great additional inputs to the data. Some indicators can possibly be compiled from existing statistical sources. But experience reveals that this is rarely the case, except maybe education demographic data. Nonetheless, the attitude and activities in the MENA countries is showing a certain change in this state. Indicators do not seem so far away as a

target for a policy-oriented programme. Moreover, qualified personnel seem to have taken command in government offices and in charge of the policies (Tsipouri 2008).

There exist other initiatives that do not depend upon the European Union or UNESCO. Mainly two of them have had some importance: the initiative of the World Bank on the knowledge economy in MENA and the Competitive Index developed by the World Economic Forum. Although representing different methodologies, these two initiatives present rankings of countries. The whole concept of an index is comparative per se, since it produces a ranking for each variable and an overall ranking that is a weighted combination of variables. A possible critique of these indexes is that, as Paul Krugman puts it, companies compete, not countries. Nonetheless, the indexes say something—not so clearly as might appear at first hand—about the institutional (or 'competitive') environment in each country.

The World Bank Institute has developed a series of indicators around the concept of the knowledge economy for the MENA region (Reiffers and Aubert 2002). The measurement is based on four pillars: economic environment and competitivity, education, a system of innovation composed of enterprises, universities, and information infrastructure. A complex system of indices has been created that permits measuring each dimension and combining them into one unique indicator. The system permits making on-line comparisons between regions and countries.[12] The whole set of variables is based on the same kind of figures that one can painstakingly gather in international organisations, in particular the World Bank's internal statistical database and local national sources. Some of these figures come from the World Economic Forum (like intellectual property rights ranking, intensity of competition, research collaboration between banks, spending on R&D, availability of venture capital, firm-level absorption capability of technology, and others related to the education background). Most figures are thus at a somewhat high degree of aggregation, something inevitable since figures at the sectoral level or the firm level would need to rely on innovation surveys.

The World Economic Forum Competitive index does not concern all countries but only a selected number and is based on an opinion survey directed to business leaders around the world. Promoters of the index claim to have addressed it to more than 11,000 persons. Some variables of the index are based on international organisations' reports. Appendix 1

reproduces the results concerning the Arab countries which are partners of the EU in the MENA region. As can be seen from this appendix, with the help provided by classifying each variable in four quartiles, the MENA countries have a varied profile. One common and reassuring aspect is that availability of engineers and scientists in these countries is supposed to be rather good; it speaks of the fact that the main orientation of the S&T system in these countries is on training rather than research or innovation. The quality of universities and higher schools is supposedly rather good or medium, and most variables related to human resources and universities are in the middle ranges. Rather interestingly, as was confirmed by innovation surveys, the capacity to absorb technology is rather good in companies; what seems not so good, through this analysis, is the innovation capability and the R&D effort. It is precisely in this aspect that the innovation surveys shed a new light.

The Innovation Surveys as Part of the Policy Process

Innovation surveys are probably the more recent effort to fill the gap left open by economic statistical data. As such, innovation surveys have been generalised as the Community Innovation Surveys (CIS) in Europe. To be more precise, CIS, initially developed in the 1990s, followed a series of efforts in many countries that sought to measure innovative activity based upon the theoretical perspectives exposed in the books of Nelson and Winter, Chris Freeman and Nathan Rosenberg.[13] The evolutionary economics framework thus found a way and was finally formalised in the *Oslo Manual* under the sponsorship of OECD. To say it succinctly, innovation surveys grew hand-in-hand with the evolutionary economics framework, thus matching a policy need with academic developments.[14]

In the MENA countries, none of this happened at that same time. First came a strong re-appraisal of science and technology policies and economic policies, mainly at the end of the 1990s. Additionally, the strong impulse from the EU, in what was called the Barcelona process, promoted a reflection on innovation policies. It should be added that the innovation policies were usually the domain of intervention of ministries of higher education or science and technology while industrial policies were under the influence of some industrial, commerce or economic ministries. Thus the preoccupation of the higher state officials in the science and

Box 1
Innovation Surveys

Main Topics

- Main sources of information
- R&D and engineering activities
- Providers and markets
- Collaborations with technical partners
- R&D and innovation expenditures
- Manpower in R&D and innovation activities
- Factors motivating or hampering innovation
- Government support and knowledge of support schemes by companies
- data on techno-parks, in the case of Tunisia, since this has been a priority

technology branch of the executive was rather little interested in the innovation or technological part of their policies.

As mentioned earlier, two countries developed specific innovation measures in such a number that it can be labelled innovation policies, although the label was not explicitly used until very recently. Tunisia and Morocco, both for the same fundamental reason, were tagged as 'globalisation's effects on the economy'. But both countries drew different directions:

- Tunisia, quite early put a large emphasis on SMEs[15] and on new technologies, as well as a parallel review and reform of the academic research institutions, and the promotion of the technical research centres and industrial and technology clusters (under the figure of 'techno-parks').
- Morocco embarked on a revision of its research policy and higher education structure. It multiplied universities and tried to stabilise a large incoming population of researchers, mainly from France, a large brain gain that began with the enthronisation of King Mohamed VI and its new alliance government. Morocco, as part of this political modernisation and democratisation, sought to promote some civil society institutions, education and science. This large movement gave birth to a nationwide initiative among which was the evaluation of the research capabilities of the country, the reformation of higher education and the reforms to the economic policy. It also promoted newly introduced concepts such as networks of engineering, industrial clusters and the promotion of SMEs.

As a part of these changes, both countries initiated an interest in innovation survey because of lack of adequate information (See Box 1). In Morocco, in 1999, a first survey was mainly interested in R&D activities in companies. It was done by the Ministry of Industry and Commerce, which has a strong statistical and surveying capability and has been doing many industrial surveys. At that time, it had a complete survey in the metal-mechanics and machine-tools sector as well as a large economic survey on productivity factors. The 1999 survey was mainly interested in R&D activities. After this first survey, it appeared clearly that there was a need for a better coverage of the items that characterise innovation activities in companies. In 2005, an innovation survey was designed and run by the industrial association 'R&D Maroc'[16], on the demand of the Ministry of Higher Education, Research and Technology. This second survey was probably more exhaustive in its questions and closer to the Oslo Manual guidelines. Both surveys were drawn on a statistically significant sample (see Box 2).

In Tunisia, the 2005 survey had not only the purpose of measuring the innovation activity of firms but was also aimed at creating a systematic database of innovative enterprises. As such, the survey tried to

Box 2
The Morocco R&D Surveys

1999 Survey	*2005 Survey*
Number of responding enterprises: 1,939 Response rate: 80 per cent Reference year: 1998	Number of responding enterprises: 1,001 Response rate: 50 per cent Reference years: 2002–04
Criteria for sampling: • The volume of investment in the last five years • Size as measured by employment; very small enterprises were not included • Export sales • Representativity in terms of geographical and sectoral distribution	Criteria for sampling: • Representativity in terms of geographical and sectoral distribution • Minimum required size of enterprises • Reference to the 1999 survey listing
Operator: Division of Studies, Ministry of Industry and Commerce, Morocco.	Operator: R&D Maroc, Morocco.

be exhaustive rather than to draw a statistically significant sample (see Box 3). A new survey has been completed recently (2009) and is in process of being analysed.

Box 3
The Tunisian Innovation Survey

Number of responding enterprises: 586
Response rate: 79 per cent
Reference years: 2002–04
Criteria for sampling:

- Minimum size of enterprise, more than 10 employees
- Manufacturing companies with high value-added products
- Presence in the main statistical listings (API [Agence de Promotion des Industries], INS [Institut National des Statistiques], BMN [Bureau de Mise à Niveau],…).
- Representativity in terms of geographical and sectoral distribution

Operator: Ministry for Scientific Research, Technology and Development of Competencies.

As can be seen in both the countries, innovation surveys appeared not so much from an academic interest combined with a policy need. They appeared as a policy need and as a response to the political and economic relations with the EU.

Nevertheless, some academic work has been triggered after these surveys were done, since this new abundance of data offers many possibilities for exploration. For the time being most work is done on the determinants of innovative activity in Tunisia (M'Henni 2006) and Morocco (Assad 2007; R&D Maroc and Assad 2007). Additional work has been done in the comparison of the surveys in Morocco (Maghrabi 2006), trying to identify types of innovative firms (R&D Maroc and Assad 2007) and in the analysis of the linkages between the R&D activity and the main drivers of innovation in Tunisia (Ayadi et al. 2007; Gabsi et al. 2008). Most of this work has been done either under the ESTIME project or related to the activities of the entities that are responsible for the innovation surveys (Ministry MRSTDC in Tunisia and R&D Maroc in Morocco).

Economic relations are an integral part of the European Neighbourhood Policy that sets the framework for EU-Med relations, and the rhetoric that was adopted was that of promoting competitive economies. Innovation

policies and innovation surveys were thus one of the answers these two countries offered to the EU partnership.[17]

Policies from Research to Innovation in the Region

Historical Variety

Research and innovation activities in the Middle Eastern and Maghreb countries are the product of a rather diverse historical background. To begin with, it is interesting to note that in all policy documents, innovation is linked to research. Research, because of its historic past, is mainly related to higher education.

Lebanon, Syria and Egypt have had the oldest teaching and academic institutions: The Syrian Protestant College was the first university in the region, established in 1866, by American protestant missionaries and became the American University of Beirut in 1920; the Catholic Jesuits founded the Université Saint-Joseph in Beirut in 1875. The American University of Cairo was funded by Americans in 1919 under the British-ruled Protectorate and can be considered the first established university.[18] The University of Damascus was funded in 1903, under Ottoman rule. Public universities are rather rare in the Middle Eastern countries where private higher education is the rule rather than the exception. The complex history of the late nineteenth and early twentieth century in the region left little room for the establishment of public universities. The large Cairo University was funded in 1925, after independence (1922). The Lebanese University is the first, and unique, public university in Lebanon and was funded in 1953 in an effort to democratise higher education.[19] Most public universities in the Middle Eastern countries, as well as in Egypt, were the product of a strong policy to train highly qualified personnel linked to the State and its 'developmental' orientation.

In the Maghreb countries, only Algeria had a university under French colonial rule, the University of Algiers funded in 1909. It was after independence, in 1959, that Tunisia funded its first university in Tunis and Morocco in Rabat funded the Mohamed V. University. Under French rule some research institutes existed: The Institut de Carthage (Tunisia) in 1893, mainly in anthropology, and the Laboratoire d'Hygiène was funded in Morocco in 1914 as well as the first Institut Pasteur in Tangiers and one in Casablanca some years later. Other professional technical institutions

were funded but mainly for the French technical personnel and keeping 'Muslims', as Maghreb inhabitants were called , far away from them (Arvanitis 2007; Waast 2002).

Thus, even though the colonial past has not affected all the countries in the same way, a fact is common to all: Public research institutions and large universities are the product of independence, not of 'colonial science', and they all relate to a political process that has been geared by the formation of the young independent states. The colonial rule itself has affected the institutionalisation of science very little, contrary to what happened in Asia, or Latin America. At the time of independence, practically all institutions needed to be created or re-created. In the very few cases where such institutes existed before independence (in the three French-speaking countries mainly in agriculture and anthropology), they have had a hard time reconverting to the missions of an independent state. Thus most, if not all, research institutions are not only the product of post-colonial history but also of a political national project (Kleiche 2003; Siino 2003, 2005; Waast 2002).

Research Systems Mainly Geared toward Public Research

This historical precedent explains why the institutional setting of research policies is mainly in the hands of the government and geared towards the public sector. But this takes different and varied forms and it is difficult to make generalisations on the countries of the Mediterranean and North Africa (MENA). As a way to synthesise the science and technology policies we produced Table 1 based on various case studies and country reports.[20]

Maghreb countries have a wide set of research institutions, which are usually solidly grounded, and research is asked to participate in the modernisation of the country. Tunisia, Morocco and, to a lesser degree, Algeria have seen a growth of research budgets aiming the 1 per cent of GDP target (Table 2). Since two decades, although these countries have seen turbulence and some political turmoil (civil war in Algeria and irregular support in Morocco), the general trend has been one of professionalisation and of consolidation of academic and research institutions.

Tunisia has created a national evaluation system of its laboratories, research teams and projects, organised on a national level, with a periodical review of activities (usually every four years). Morocco engaged in a

Table 1
Principal Characteristics of National Research Systems

Country	*Ministry of research (and higher education)*	*Coordination and funding agencies*	*Other funding mechanisms*	*Documents defining research policy*	*Types of governance of S&T*	*Budget R&D/ GDP – ca. 2006 (%)*
Algeria	Yes	ANDRU ANDRS ANVREDET, etc.	PNR National programmes of RTD	National Plan (1998)—Law 98/11	Centralised	0.25
Morocco	Two general directions in the Ministry of Education	CNRST CPIRSDT	Various funding programmes	Vision 2025 (2006)	Centralised	0.8
Tunisia	Yes	HCSRT	Various funding programmes	National Plans Law 96/2006 (1996) S&T Strategy 2010	Centralised	1.0
Egypt	Yes	Many	Various funding programmes by Ministries	No	Centralised	0.2
Lebanon	No	CNRS	Funding for research in some universities	STIP (2006)	Decentralised	0.22
Jordan	No	HCST	Various sponsors	(2005) S&T Strategy 2006–2013	Decentralised	0.34
Syria	Yes	HCSR	Funding for research in some universities	NA	Decentralised	0.12

Source: Various data sources, ESTIME project. See Arvanitis, final report. See also article in ST&S by Waast (Research in Arab Countries), this issue. (This table is a revised version of the source table).

Table 2
Estimated Figures on Expenditures on R&D as a Percentage of GDP

Country	*1998*	*2001*	*2004*
Algeria	0.16	0.27	0.21
Egypt	0.20	0.19	–
Jordan	0.38	–	0.34 (2003)
Lebanon		–	0.22 (2006)
Morocco	0.32	0.71	0.80
Palestine	–	–	–
Syria	–	–	–
Tunisia	0.43	0.53	1.00

Source: Country reports, ESTIME. Most figures from national sources.

profound revision of its system, and a call for the creation of academic research entities inside the universities is ongoing. Algeria since 1999 has created a national law on research which launched a five-year plan to develop research based on national programmes, managed at the national level, and including all those research units interested in the topic of the research programme on a voluntary basis.

Jordan and Lebanon are apparently witnessing a rather less direct role for the state. The financial contribution of the state has been low. Scientific production is limited to some well-known universities (American University of Beirut, St Joseph and Lebanese University in Lebanon; Aleppo and Damascus Universities in Syria; Jordan University, Jordan University of Science and Technology (JUST), Yarmouk University in Jordan) that still maintain their dominance in a burgeoning environment of newly created academic institutions.

Egypt, a case by itself, embarked on a slow but massive reform of its research system to face the overcrowding of its universities and is trying to evolve from a centralised system of large public research institutes to a more flexible institutional framework. The reform is poorly documented but has been very actively executed; the novelty of the situation makes any attempt of evaluating the possible changes impossible at that point.

Research in all these countries has depended upon the dialectic between the state, some large institutions devoted to research activities, mainly universities, and individual researchers. The state, in practically all the cases, has been promoting 'research for growth' or 'research for development', which in most cases coincides with the objective assigned to higher education of providing the state with highly trained professionals (engineers, doctors, high administrative cadres). Research was thus

summoned to be applied and in some cases specific research institutes that were created were oriented towards a mission (agriculture, health, technical development). Universities, for many well-known reasons, have tried to promote research but the main driving force has been the incredible growth of the demand for training of more students. It was thus difficult to prioritise research and the research teams in universities have always appeared as if by miracle. The main driving force has rather been individual researchers, in particular in the academic setting. They have had an immense role in shaping the system, mainly as well-trained personnel, mostly in foreign countries (in Europe and more rarely in the US and Canada). These people have rapidly secured high positions in the political and academic structures and they have had sufficient prestige to strongly influence policies and orientations. All these forces behind the promotion of innovation have been rather at odds with the promotion of innovation, setting what we labelled a real governance issue (Arvanitis et al. 2010).

International scientific collaborations have been fuelling the research system, to a varying degree that still cannot be evaluated as such.[21] To begin with, the research systems in all these countries do not depend in terms of inputs on the funding provided from external funds, since most research is funded by domestic public budgets. Gaillard & Gaillard show for example in their survey of the research laboratories that the influence of international scientific collaborations has been very profound and in ways that go far beyond the state. Again this influence has been very different in the various countries. For most Maghreb countries, their historical linkage to France was initially very strong and it modelled the research collaborations. Morocco had the strongest ties in research collaborations with France and Europe. Other foreign funding sources have appeared to be rather marginal (Kleiche and Waast 2008). Tunisia has followed a similar path but somehow a more diversified number of collaborations mainly in biomedical sciences.[22]

Recently, mainly in Machreq countries, NGOs and international organisations have had a decisive influence by promoting service-oriented research as well as research run under the mode of expertise (Hanafi 2007). But researchers are always moving beyond the barriers imposed by institutions, moving in and out of their academic positions, playing often the role of experts and occupying and leaving at times official positions. This relative fluid move of highly trained personnel has not only been shaping

the systems but also allowed the institutional difficulties, the rigidities of political decisions and bureaucratisation to be surpassed. If we put aside this individual fluidity,[23] universities have been quite isolated from the rest of the economy and efforts made to institutionally link them to enterprises have usually had little success. Individuals once again have played a significant role in that they engage in active relations with specific enterprises. But more institutionalised relations between academia and the companies seem difficult to sustain. Nonetheless, it should be noted that the major concern of policy makers in the region has been towards promoting applied research, technological development and innovation.

In effect, the lack of integration of public research units with companies has been repeatedly mentioned in all policy documents to be the main issue in the setting up of an innovation policy in the Mediterranean.[24] By reading the policy documents and interviewing policy officials, 'innovation' is understood as a way to promote the integration of academia with companies. What lies behind this objective are concerns other than scientific ones, such as economic, demographic and social concerns: increasing unemployment that affects the students with higher diplomas, brain drain, growing weight of a rapidly increasing population of students, modernisation of enterprises, attraction of foreign investment, development of non-traditional and new economic sectors such as services and new agro-industries and instrumentation of a strategy aimed at depending less on low labour costs and natural resources and more on knowledge. Tunisia and Morocco are excellent examples of these overall similar strategies.

The Turn of Policies towards Innovation in Tunisia and Morocco

Amidst a discourse worldwide promoting innovation and the 'national systems of innovation', the countries we are reviewing here adopted policies that were devoted to 'innovation' with ease. Even though it is still premature to talk about the setting-up of an innovation 'system', policies dedicated to innovation were quite numerous and varied.

Some Trends on Research and Innovation Policy in Tunisia[25]

Tunisia is an example of a country that has given particular emphasis on the reorientation of the research system towards economic activities as well as the consolidation of its research units at the national level. This is a policy that took place when, in recent years, economic growth was robust,

with significant increases in per capita incomes. However, Tunisia is considered as a middle-low income country, with slow employment growth, low labour productivity and weak competitiveness. The challenge is to expand the country's growth potential and improve productivity, and boost employment and quality of life. The main economic sectors of Tunisia—agriculture, tourism, textiles and clothing, machinery and electronic components—are under pressure from lower-wage competitors vying for market share. Raising productivity and innovation in these sectors is crucial for maintaining competitiveness and attracting the foreign direct investment (FDI) needed to continue the modernisation process.

Tunisia's R&D intensity, at 1.07 per cent of GDP in 2006, is quite low by OECD or EU standards, although it exceeds that of Portugal, Turkey, Poland and Mexico, and is the highest in the MENA region.[26] Funding from abroad is abundant and comes mainly from the European Framework Programme for Research and Technological Development. Public research organisations and research structures in universities are the main actors of the innovation system, absorbing more than 80 per cent of government funding for R&D and performing 67 per cent of R&D. Of course, human resources are a key challenge. Currently, there are 4.52 researchers per 1,000 persons total employment (2006) and 11.2 per cent of all university graduates have degrees in science and engineering (in the range of twenty–twenty-nine years). More generally, one-third of the population aged between eighteen and twenty-four had attained tertiary education in 2006. Many Tunisian doctoral students go abroad for advanced training. According to the ESTIME project (2006), Tunisia accounted for 0.8 per cent of the world's scientific articles in 2004, up from 0.49 per cent in 1999, but is absent from the list of countries having triadic patents in 2006. The figures are relatively problematic as compared to the effort deployed by the state.

The aim of Tunisian policies in the last two decades has been to emphasise new enterprise development or new business creation. Although there is no formal mechanism for coordinating an innovation policy, the Higher Council for Scientific Research and Technology (HCSRT) has intended to be the coordination instrument of industry-oriented initiatives. Official plans acknowledge the need to support innovation.[27] Linkages with the private sector have been formalised and maintained through the years on the basis of agreements involving the appropriate ministry and the national federation of industries (UTICA). These agreements have never

resulted in concrete actions and thus the input from the private sector to the innovation agenda remains weak.

Four different programmes were promoted by the ministries or secretariats of state since the 1990s to enhance linkages between research and business:

- In 1992, the government established a financial instrument to encourage research results to production (known as VRR from its French initials Valorisation des Résultats de Recherche). The Ministry ensures funding for projects that aim partnerships between research structures and socio-economic actors such as technical centres, private companies and professional groups through the development of innovative products or processes. Until 2005, sixty-one projects benefited with more than six million TND funding.[28]
- A Premium for Investment for Research & Development (PIRD) was created by the decree no. 94–536 in 1994. It supports original work necessary for the development of new products or processes, the implementation of prototypes and their technical experiments or in the field experimentation. The premium also helps companies to acquire scientific equipment necessary for their R&D projects.[29] During the period 1995–2005, premiums were granted to only forty-three projects submitted by forty companies.

Federative research programmes (FRP) were initiated in 2003 to address development issues putting together all stakeholders (research teams, universities, industries and public institutions). These programmes are financed through multi-annual agreements, which define the projects' structures, objectives and expected results, human and material resources to be mobilised as well as follow-up and evaluation procedures. FRP are given accord-ing to national priorities identified in consultation with the different stakeholders of the concerned sector (water, energy, biotechnology, ICT, etc.).

- Finally, the National Programme of Research and Innovation was created in 2003 to respond to the needs of Tunisian industry by developing their technological innovation and improving their competitiveness through applied research. Projects are carried out in collaboration between research structures, industrial enterprises and technical centres. In 2004, nine projects were selected involving

fifteen research teams, fourteen companies and five technical centres. The second call for proposals launched during 2005 involved seven technical centres.

And even if the Tunisian research and innovation 'system' is considered as one of the most structured in the region, numerous weaknesses are still lowering its development. It is worth noting that an intense effort to discuss these issues openly is reflected in debates at the national level.[30]

Some Trends on Research and Innovation Policy in Morocco[31]

Another good example of a policy, mainly pushed by the state, towards innovation has been that of Morocco. The country embarked on a large reform of the university system in 1997. At that time, there was a strong expansion of universities as well as a worrying growth of unemployment of PhDs (this was 31 per cent for university diplomas in 1997). That triggered the reform which included a reform of the status of researchers. Researchers were recognised at least legally. At the same time, a series of measures to encourage technological diffusion, technological networks and large thematic research networks (quality, vegetal biotechnology, sea sciences, high-energy physics, space technologies) was undertaken.

The decisional structure of the science and technology policy was profoundly marked by the sub-secretariat to research (1998), which finally became a Ministry in 2002. It was dissolved in 2004 and since then a direction of science and a direction of technology have been living in parallel inside a larger Ministry of Education, Higher Education and Research. This instability of the decisional and coordination level of research has been probably counterbalanced by a strong commitment to research and innovation that can be heard of not only at the top of the Kingdom, in the Ministry of Education, but also in the other components of the government.

Various funds have been created since 1996 in this process that are oriented towards research institutions and, to a lesser extent, towards enterprises. Exceptional funding was authorised for research in the Five Year plans 2000–04, and Action Plan 2004–07. Human resources did not grow in the same proportion, although the student population has been growing steadily. In 2004, Morocco numbered more than 10,600 teachers in universities, 3,976 in high engineering and public schools (mainly engineering schools, 'écoles normales' and the like) and 2,900 researchers in institutions dedicated to research. Postgraduate levels in

universities (Masters and PhD) account for more than 19,000 students, of which around 8,000 are PhD students. Outside the public sector, scientists and engineers were estimated to be around 2,800, working in some 200 R&D departments.

Publications have grown steadily as a response to this massive change of the institutional setting. SCI reports a growth from a low 300 articles in 1993 to more than 700 articles in 2003. The growth has attained a plateau since then and is growing anew but more slowly. This growth was not boosted by any massive growth of human resources but by change of structures. A slowing down of production is not only the result of the change of the status of professors–researchers (a popular explanation) but also because of the instability that has been surrounding the function of research.

The small private R&D universe is probably much larger today and growing quickly. The survey on R&D and innovation of 'R&D Maroc' shows that 41 per cent of the enterprises are innovating somehow and 27 per cent of the enterprises declare having an R&D department. Importantly, R&D grew: Around 9 per cent of the enterprises in 2000 declared performing R&D against 23 per cent in 2005. Expenses for R&D grew from 1.3 per cent to 1.6 per cent of sales. Interestingly, the growth is mainly due to medium-sized enterprises, not large ones (neither, of course, small ones).

The last few years have also been an active period in the creation of structures dedicated to promoting technology and innovation, which also translates the expressed will of orienting the research system toward innovation 'and the needs of the country'. The Ministry of Commerce (ex-MICMANE) has supported in many ways university technology transfer units and technical networks, the incubation of new companies, the mobilisation of new funding schemes and fiscal support measures and measures of information diffusion. The Ministry of Research and its dependencies in charge of research have managed a series of measures that are mainly oriented towards support to innovation: the creation of 'Pôles de competences', outreach structures of the universities also supported by the Ministry of Industry and research–technological networks, where business opportunities can find technical support and adequate human resources in engineering and sciences. As a relatively new effort for Morocco, we should also mention the technology platforms around some heavy equipment and new programmes of research with socio-economic

objectives. Also, a systematic effort has been made to promote specific funding for technological development. The office of patents (Office Marocain de la Propriété Industrielle et Commerciale [OMPIC]) has also developed a strategy called 'Stratégie 2010'. Measures oriented towards large companies tend to support a more proactive vision of patents as a source of strategic information. Measures toward SMEs are basically structured around studies on the technical level of the companies. OMPIC is still not accepted as an important actor: In the innovation survey 44.2 per cent of the enterprises did not know of OMPIC and 70.7 per cent had never used its services.

Finally, as in Tunisia, Morocco has developed an exercise in foresight as a consequence of the second national gathering on science in March 2006 where policy issues where discussed openly. A 'Vision of scientific and technological development in 2025' has been produced that sets priorities in research and examines strengths and weaknesses. This policy exercise followed an important and quasi-exhaustive evaluation of science that took place in 2002. The evaluation exercise that took place in all fields of science, combining Moroccan and European experts successfully, identified areas of opportunities and structural and organisational issues that need to be solved.[32] Among its main recommendations were the necessity to identify clear strategic priorities, to develop tools that permit identifying the most effective actors of the research system and the future objectives, and to implement the identification of research laboratories with a specific label and a specific budgetary procedure.

As we can see from this brief overview, Morocco has developed a range of support tools for research and technology and in a very few years has experienced a large variety of tools, most of which aim at diffusing knowledge, at linking universities and enterprises, and providing incentives to enterprises wishing to upgrade and include more R&D and knowledge components in their processes.

Networks as the Basics of Innovation Policies

Although different in the nature of the policy initiatives, Morocco and Tunisia show a common turn towards innovation in their S&T policies. Most of the measures try to link research, science and universities to the productive sector. Policy documents insist upon the need for more contacts between academia and the productive sector. This is neither specific to the two countries or MENA. But as we said, MENA countries entered

this innovation policy orientation rather later than other countries and have been focusing on some particular part without an overall national innovation strategy.

The first visible initiative in most cases was the promotion of techno-parks. Tunisia was a fore runner in the region with the El Ghazala techno-pole in Tunis, mainly oriented toward new information and communication technologies. Morocco set up its techno-park in Casablanca, Egypt its Smart Village close to Cairo and in Lebanon the University of St Joseph created the Berytech. These are remarkable in their orientation toward new information technologies, focussing on rather small start-ups and are relating some training facility (university or engineering school) with enterprises. These techno-poles or techno-parks have been successful in housing many new small technology-oriented companies. Nonetheless, some assessments tend to doubt the efficiency of the linkage between universities and the universities or engineering schools and departments included in the techno-parks (Mezouaghi 2006).

Additionally, we can mention a series of frequently mentioned policies in the promotion of innovation policies around the Mediterranean:

- Technology transfer units in universities and engineering schools
- Funding issues including venture capital, credit schemes, etc.
- Engineering networks
- Promotion of intermediate technical centres
- Business associations related to innovation and technological development.

It would be fastidious to detail all the measures that have been taken in order to sustain these orientations.[33] Suffice to mention that in the last five years, Tunisia and Morocco, as well as all countries around the Mediterranean, have developed a wealth of instruments and measures with the main aim of connecting businesses with public research centres and universities. Thus innovation has been very much related, in policy terms, to the development of techno-economic and engineering networks. Networks are mentioned as such in the policy documents, as an efficient means for promoting technology to businesses.

It might be necessary to insist on the fact that this emphasis on techno-economic networks is not the only possible means for innovation policies. Other possible orientations could have been the development of businesses with a strong (public) investment component,[34] a preferential policy

towards international investors,[35] or the development of strong public technical centres. The 'network' orientation has certainly the advantage of flexible arrangements. It is also strongly inspired by innovation policy concepts developed in France and more generally in Europe. It has finally the additional characteristic of challenging the public research sector by asking it to establish linkages to the economy but without putting in danger the institutional and political position of academic institutions.

These policies aimed at promoting networks are too new to have received an impact evaluation. They merit our attention not only because they are new but also because they are creating a whole set of new institutions and promoting new players in the game. Basically, what is at stake is the creation of a whole set of new actors in between firms and public authorities.

In between Firms and Policies: The Innovation World

Innovation activities in Morocco and Tunisia are low but rather surprisingly higher than was expected and growing (please refer to the innovation surveys discussed earlier). In Morocco, between 1999 and 2004, the percentage of enterprises active in R&D evolved rapidly, from 9 per cent (1999) to 23 per cent (2004). Twenty-seven per cent of the industrial enterprises had an R&D unit. Expenditures in R&D also grew from 1.3 to 1.6 per cent of sales. The most remarkable change in this period was the appearance of middle-sized enterprises. In 1999, there were 29 per cent firms that declared that they were engaged in R&D and innovation activity, while in 2004 this percentage grew to 42 per cent. In Tunisia, from the 586 companies who replied to the innovation survey (practically an exhaustive survey of innovative and R&D-intensive companies), 248 carried out research and development activities in the period 2002–04, a percentage similar to Morocco (42.3 per cent). It should be noted that only 27.6 per cent carried out R&D activities on a regular basis. And 92 enterprises (15.6 per cent) had a dedicated R&D budget. In Morocco, 35 per cent of the companies declared having continuous innovation and R&D activity. So the figures were low but rather higher than expected. The quite detailed comparison of 1999 to 2004 survey in Morocco brought out the remarkable result that middle-sized companies are now a major player in R&D (Maghrabi 2006).

What is mainly characterising these activities is that innovation and R&D is an activity rarely formalised in the companies, either because

it is not identified as such or because there is no specific organisational unit that is in charge of innovative activities. This fundamental feature, not specific to these two countries,[36] has also been confirmed through case studies and qualitative surveys in Morocco at least (Mellakh 2007). The qualitative survey showed a varied array of organisational forms that deal with technology within each company. Many projects that are innovative are realised by the production units or the commercialisation personnel. Some companies consider innovation as an essential item of their strategy and consider the company as an innovation by itself. Many consider innovation as important but are not investing either in R&D or in innovative projects. In most cases, the innovation comes from market needs and linkages with foreign, but more often from national clients. Of course, this depends greatly upon the economic sectors and the industrial dynamic.

But not only does the quantity of innovation-related activities augment in these countries, most impressive is the yet unevenly documented growth of what we have called the 'innovation world' (Arvanitis 2005). By this concept we want to qualify all the institutions, especially intermediate-level organisations, which have been created to respond to the technological activities of firms such as public bodies devoted to the management of engineering networks, fiscal and credit incentives, promotion of units of technology transfers, and the like. Many associations of engineers, scientists, business people, research centres, born of either private or public initiatives have appeared. A remarkable example is 'R&D Maroc' in Morocco, a quasi-NGO that groups managers from R&D units from all over the country. A number of consultancy firms have appeared that manage technological innovation and cater for economic and technological information to industry. Most of these are engineering consultancy firms in specific fields (building, public works, environment) or sectors (energy, environment, ICT industry, electronics industry, telecommunications). Along the way, some venture capital firms have appeared as financers of projects for creation of new companies, or projects linked to technology development, as well as companies managing portfolios of companies and venture capital enterprises (financial participation in new technology companies). Technological networks, as already mentioned, have been actively promoted in all countries. Older industrial districts, not be confused with techno-parks, have been the object of attention of industrial and commercial policies favouring their consolidation. Finally, regulatory

institutions have also been consolidated that manage patents, ISO standards, quality standards, standards linked to the promotion of local brands (local rural products and specific products), environmental standards, and so on.

All these institutions and actors are usually included under the heading of the national innovation system. We do not use the concept here since we have strong evidence that linkages are rather loose in between these actors. Most actors are related on a bilateral scheme between the state and each of these actors. Moreover, a national innovation system would be rather centred on innovation activities either in traditional or new firms, whereas, as we insist earlier, most activities in the public sphere and public policies are mainly concerned with linking the academia to the productive sector. Finally, what we want to underline here with the word 'innovation world' is the growth of new actors, a world by itself, not a system of closely connected and interdependent agents, as is implied in the word 'system'.

The actual situation described earlier, arising from the results of innovation surveys and this growth of the innovation world, indicate a paradox. On one hand, there is growth of innovation activities, basically in firms that were not interested in this activity some years earlier while simultaneously we find a growth of the innovation world; on the other hand, innovation surveys indicate a low level of interest of the firms in public support to innovation. Many reasons are mentioned by companies in the surveys, but mainly two arise: bad knowledge of support schemes, and little involvement in them and little previous experience. This low use of public support is a common feature in the two countries. Up to a certain point it is a difficult issue that cannot be answered by some simple relations between a single variable and some response to it. In fact, there are three aspects that need to be taken into account when discussing this dimension: direct support to firms through the incentive schemes; the nature of the technological environment of the firms that is supported by the state; and the functioning of the research system.

But finally, one has to mention that after a closer look at the types of enterprises in these countries a rather large heterogeneity of firms emerges. Not only do they vary in relation to size but also have varied types of responses to the challenges posed by stronger competition and the strategies that would allow them to overcome the new difficulties. It is thus natural that the firms do not react in the same way to public support.

It should be noted that on the whole new support schemes that were introduced in innovation policies in Morocco or Tunisia were unknown to a vast majority of the enterprises. The enterprises respond to a better knowledge of the support measures depending on the sectors, rather than the size, and the ability to design innovation projects and realise R&D. This ability to use public support is in fact related to the general technological capabilities of firms.

In the same vein, although the innovation surveys show a growth of R&D and innovation activities in firms, at the national level the countries seem to have some difficulty in orienting their research system towards innovation. The risk here is that the public research system and the innovation potential deployed by enterprises do not converge. The state will play—and already does play—an important regulatory role as it funds most of this innovation world through specific technological programmes, incentive schemes and institutional arrangements that aim at creating more linkages. The state also provides technology directly through its technical centres and mission-oriented research; these centres seem to constitute a permanent source of reference for the companies (Hsaini 2007; Mellakh 2007). These aspects are difficult to seize solely through the questionnaires in the innovation surveys. They would call for a better framework for policy evaluation.[37]

Conclusion

Our article relied on the presentation of efforts in monitoring the research systems in the Mediterranean region and providing some background information on the research systems and policies. We used the examples of Tunisia and Morocco, since these two countries have developed policy analysis tools, including innovation surveys. We did not enter into a more in-depth examination of methodological issues in the design and exploitation of the innovation survey questionnaires, but they permit us to identify some common features in the firms' behaviour in the region (Assad et al. 2008; Ayadi et al. 2007). We focused on the relation of firms with the public sphere and we insisted on the creation of an innovation world, composed of many new actors, firms, consultants, networks, techno-parks and other institutions that are bred by both the market and the policies. We also insisted that to begin an evaluation of the innovation policy it is necessary to go well beyond the macro-indicators provided by

a country-level analysis. The innovation surveys permit us to go down to the sector level and firm level and as such are better tools than macro country rankings. We also insisted on the fact that the policy has been very much oriented to creating networks, a feature that is crucial to innovation but was probably over-stated and needs to be re-evaluated. The role of the state has been downgraded by the discourse on competitiveness: With the financial crisis the role of the state tends to be reintroduced as that of a regulator. We believe that in the case of innovation there is a strong symbiosis of policy and firms, and the only possibility of providing fertile ground for innovation is that the symbiosis be fed and nurtured from both sides. Part of the negative assessment of the Barcelona process, as far as the economy is concerned,[38] relies very much on the absence of an analysis of these institutional arrangements where the state and the firms interact and where the role of the state goes far beyond regulation or providing financial support (or custom protection of trade and market protection—a usual but unnamed tool of policy!).[39]

Further investigations should be pursued by developing specific questionnaires that both satisfy international standards (in particular the Community Innovation Survey format and the Oslo Manual) and local specificities (by giving more space to items largely related to technological learning, relations to foreign firms and specificities of the local industries). Widespread preference for performing technological innovation activities on the basis of informal organisational structures, the specificities of SMEs, the preference for exogenous (international) sourcing by large companies, the on-going consolidation of R&D units inside companies and the overwhelming difficulties in acquiring capital goods that lead to the neglect of suitable measures to compensate for human resources limitations are only among the few issues that merit particular attention.

A transversal analysis is also necessary that would permit an accumulation of observations from MENA countries, Latin America and Europe. Moreover, if policy recommendations are to be drawn, based upon the evidence provided by the innovation indicators, discussions of these results by the policy makers are more than necessary. Some of the ongoing projects, such as the MIRA project, aim at coordinating this effort between scholarly analysis and policy making. Additionally, the MIRA Observatory on Cooperation should permit coordinating the measurement of research output and the wider uses of research.

Appendix 1
Opinions from Business Executives (World Economic Forum, Competitivity Report, 2008–09)

	Brain drain (Rank/134)	*Company spending on R&D (Rank/134)*	*Quality of scientific research institutions (Rank/134)*	*University–industry research collaboration (Rank/134)*	*Local availability of specialised research & training services (Rank/134)*	*Firm-level technology absorption (Rank/134)*	*FDI and technology transfer (Rank/134)*	*Capacity for innovation (Rank/134)*	*Quality of management schools (Rank/134)*	*Availability of scientists and engineers (Rank/134)*
Maghreb and North Africa										
Algeria	123	116	108	124	111	128	132	133	117	41
Morocco	77	69	94	99	69	70	72	87	63	68
Tunisia	48	38	42	35	28	34	27	38	17	10
Egypt	129	57	96	79	92	63	55	85	116	47
Near East										
Jordan	90	79	51	60	53	35	56	66	45	39
Syrian Arab Republic	113	115	89	100	95	87	110	117	95	40
Gulf										
Bahrain	23	82	100	101	72	36	34	118	85	72
Kuwait	9	93	54	73	64	28	106	94	89	62
United Arab Emirates	2	50	74	58	44	14	15	74	46	75
Qatar	3	35	30	25	45	40	11	60	35	53
Oman	32	44	59	39	79	82	78	49	97	95

1° quart	**2° quart**	**3° quart**	**4° quart**

NOTES

1. KNA-MENA is the Knowledge Network Agency for the Middle East and North Africa region, created in 2004 by the World Bank in Marseille, France, with the aim of developing tools for the analysis of the knowledge economy in the Mediterranean region.
2. ESTIME: Evaluation of Science, Technology and Innovation capabilities in the Mediterranean countries. It concerned seven countries, all Arab: Algeria, Egypt, Jordan, Lebanon, Morocco, Syria and Tunisia. (Arvanitis 2007). See final report at http://www.estime.ird.fr.
3. Mediterranean Innovation and Research Coordination Action (MIRA) available at http://www.medibtikar.eu.
4. The MEDA countries are Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Syria, the Palestinian Authority, Tunisia and Turkey.
5. Official documents may be found on the EC website at http://ec.europa.eu/external_relations/euromed/index_en.htm, accessed January 2009.
6. A description of the initiatives in the Mediterranean since the Barcelona process is in a report by M. Delgado (2008).
7. The 'new' priorities are the de-pollution of the Mediterranean Sea; the establishment of maritime and land highways; civil protection initiatives to combat natural and manmade disasters; a Mediterranean solar energy plan; the inauguration of the Euro-Mediterranean University in Slovenia; and the Mediterranean Business Development Initiative focusing on micro, small and medium-sized enterprises.
8. Details of the Amman workshop are available at http://www.medibtikar.eu/-Workshop-on-R-D-and-Innovation-.html, accessed January 2009, and of the Tunis workshop at http://www.medibtikar.eu/Tunis-workshop.html, accessed January 2009.
9. Framework programmes (FP) are, since 1984, the main tool for funding research within the EU; Since FP6 (2003–06), international cooperation with non-member states of the EU has been opened to practically all countries. The on-going FP7 (2007–13). (For an assessment of the European Union cooperation policy, see European Commission and ERA Expert Group 2008).
10. The name EMIS was proposed by one of the authors of this article (RA) at the joint ESTIME-ASBIMED Barcelona meeting (October 2005).
11. All documents of this activity are located in the Work Package 2 of the MIRA project, available at www.miraproject.eu.
12. For details, see info.worldbank.org/etools/kam, accessed June 2007.
13. In the developing world, Latin America pioneered this kind of innovation analysis since 1987–88 in Venezuela (Pirela et al. 1991, 1993).
14. This also explains the vivacity of the Globelics network that gathers scholars in economics from around the world, who have been trained and work with an evolutionary economics reference.
15. Programme de promotion et de mise à niveau de l'industrie (Programme for the promotion and upgradation of industry).
16. 'R&D Maroc' is an interesting case of an association gathering companies with strong R&D capabilities. It has many activities towards the promotion of innovation in the country: an innovation fair, a prize to innovative companies and publications on

innovation. It also serves as an intermediate organisation for relaying some innovation-related activities of the state.

17. Something similar could be said of the Turkish innovation survey, which is closely related (and nearly integrated) into the European Innovation Scoreboard. Contrary to Turkey, Morocco and Tunisia innovation surveys are not integrated into the EIS.
18. Al-Azhar University, funded as a madrassa around 970 AD, became a degree-granting institution only after 1961, when non-religious disiciplines were introduced.
19. See 'Science and Technology in Lebanon: A University Driven Activity' by Gaillard, in this issue. See also J. Kabbanji {2010 #4988} for a short history of the main universities in Lebanon.
20. A full list of these reports is given in the final report of the ESTIME project (Arvanitis 2007). For details see http://www.estime.ird.fr.
21. Figures on the European Union research framework programmes show a rather low participation of Arab countries. See bibliometric leaflets on the ESTIME website as well as the 'Arab Knoweldge Report 2009', Chapter 5.
22. Details on these collaborations can be got from M'Henni (2007).
23. It should be noted that this is not a specificity of MENA countries. Hebe Vessuri and her co-authors in a series of case studies in universities of Latin America have very much insisted on the differences of the individual and the institutional's role. In China a similar phenomenon has been noted. In Europe the policy to link universities to private sector companies has also been a high priority and always diagnosed a similar difference between what individual professors do and what the institutions are promoting in terms of technology transfers from the university to the private sector. In the US, the issue has also been high on the agenda and it took a long time before technological platforms became incubators for new companies. The issue has always been presented as a lack of common language between the university and the companies but the individual fluidity between those sectors proves it is not the case.
24. (ESCWA, 2001, 2005 and 2007). See also Country Reports, ESTIME.
25. Details on the policies in Tunisia can be found in M'Henni et al. (2007).
26. The government's objective is GERD of 1.25 per cent of GDP by 2009, of which 19 per cent would be funded by the business sector.
27. Several specific plans for S&T since the Ninth National Development Plan (presently, it is the Eleventh National Development Plan that is running, covering the period 2007–11).
28. In 2005, one Tunisian Dinar was approx €0.65. Currently it is €0.55.
29. The PIRD grants up to 50 per cent of the project costs with a maximum of 25,000 TND for studies and up to 100,000 TND for the implementation of prototypes and their technical experiment or for carrying out ground experimentations and acquisition of scientific material.
30. Such as the 'The national days for scientific research and technological innovation', organised in November 2007. They included more than 1,000 research in two series of round tables and meetings. Theses were the second series of 'National Days'. The first ones were organised in July 1991.
31. Details and data of this part can be found in the ESTIME document by Kleiche et al. (2007). *La recherche scientifique au Maroc*. Rabat: Background document for ESTIME project. MRSFC, available at www.estime.ird.fr.

32. The results of the exercise were presented in a large seminar in Rabat (Kleiche and Waast 2008).
33. See the main part of the synthesis ESTIME report on Morocco (Kleiche et al. 2007) and the background report of Tunisia, volume III (M'Henni et al. 2007).
34. Morocco has also tried this option, for example, in the development plans of Tangiers.
35. This is an option suggested very strongly by the Economic Plan of Morocco called 'Emergence' launched in 2006, based on an analysis that was asked for by the Moroccan Government from McKinsey consultants.
36. As has been shown repeatedly in Latin America (Katz, 1976; Pirela et al. 1993; Villavicencio and Arvanitis 1994; Villavicencio et al. 1995; Arvanitis and Villavicencio 1998, 2000; Dutrénit and Vera-Cruz 2000; Mercado 2002) and in many analysis of firms activities in Asia (Mathews 1999; Lall 2000; Lee and Lim 2001; Hobday 2002; Arvanitis et al. 2006; Zhao 2006).
37. The EMIS workgroup of the MIRA project is dedicated among other things to the analysis of these new actors of the innovation world.
38. See, for example, Moisseron (2005) who compares the regional integration of the MENA region with Europe to the probably more successful case of East European countries with Europe. This author relies heavily on a comparison between Egypt and Poland and to our knowledge is one of the very rare attempts made to evaluate the economic partnership of Europe and its neighbouring countries.
39. Nelson (2008) calls these institutional arrangements 'social technology'. For a review of how trade policies affected industrial development see Amsden (2001).

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