Monitoring Research and Innovation Policies in the Mediterranean Region

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Innovation policies in the context of North-Africa: new trends in Morroco and Tunisia

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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 (MEDA) countries. Still there are innovation policies that have been developed and sustained by the governments, for example, of Algeria, Egypt, 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 of 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 development have been a prolific area of co-operation and institutional developments. A large array of measures have also been devised that aim at the catching-up of industries and the funding of innovation activities in companies (Pasimeni, Boisard, Arvanitis and Rodríguez, 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, the OECD, UNESCO, UNIDO and ALECSO are only a few examples to name. Finally, the World Bank has actively promoted the policies in favour of 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 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 will revise recent developments in the innovation policies in the case of Tunisia and Morocco as derived from the ESTIME project[2], which, among other things, has been instrumental in collecting systematically the policies around the Mediterranean partners of the EU (Arvanitis, 2006). Other projects try to fulfil the need for information in the MENA region such as Medibitikar or the Mediterranean Innovation and research coordination Action (MIRA). MIRA is setting-up a collective network for the observation of science and

[1] KNA-MENA is the (Knowledge Network Agency for the Middle East & North Africa Region created in 2004 by the World Bank in Marseille in 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 countries: Algeria, Egypt, Jordan, Lebanon, Morocco, Syria and Tunisia. See final report on the web for a presentation of main results: Arvanitis (2007).

technology in the MENA region and Medibtikar is setting-up a network that will collect information specifically related to innovation (see the Network for Evidence-Based Innovation Policy (NEBIP) in the MEDA countries; it was created in the framework of large EU-funded project during the second year of Medibtikar).

After a view of the transformation of the research systems in MENA countries, we will examine the indicators and focus on the example of Tunisia and Morocco, since these two countries have developed a systematic policy toward research as well as innovation surveys.

Research and innovation systems in the MEDA countries

MEDA R&D systems mainly geared toward public research

It is difficult to make generalizations on the countries of the Mediterranean and North-Africa (MEDA). As a way to synthesise the science and technology policies we produced the following table based upon various case studies and country reports.[3]

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 Gouvernance 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	No (in the course of creation)	Decentralised	0,12

[3] A full list of these reports is contained in the final report of the ESTIME project. estime (Arvanitis, 2007) See web site: http://www.estime.ird.fr/

Sources : Various data sources, ESTIME project. See Arvanitis, final report. See also article in ST&S by Waast, this issue.

Maghreb countries have relatively recent research institutions, which are usually solidly grounded and research is asked to participate to the modernization of the country. Tunisia, Morocco (and, to a lesser degree, Algeria) have seen a growth of the research budgets in order to attain the 1% of GDP. Since two decades, although these countries have seen turbulence and some political turmoil (civil war in Algeria, irregular support in Morocco), the general trend has been one of profesionnalisation, and of consolidation of institutions. Tunisia has created a national evaluation system of its laboratories, research teams and projects, organized on a national level and with periodical review of activities. Morocco engaged in a profound revision of its system. Algeria since 1999 created a national law on research which launched many specific research programmes.

Machreq countries are witnessing a rather less intense role for the State (with the notable exception of Syria) and research has taken place often in private universities. 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 of Science and Technology, Jordan and Yarmouk Universities in Jordan) that still maintain their dominance in a burgeoning environment of newly created academic institutions. Egypt, a case by itself, has also seen a growth of its student population and has been embarked in a slow but massive reform of its research system, which was entirely oriented towards large public research institutes and now evolves in a more flexible institutional framework.

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 latter have had an immense role in shaping the system, and in particular because they have had training in foreign countries and at their initiative, they strongly influence policies and orientations. International scientific collaborations have been fuelling the research system, in ways that go far beyond the State. Recently, mainly in Machreq countries, NGOs and international organizations have had a decisive influence by promoting service-oriented research, as well as research run under the mode of expertise. 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, occupying and leaving at times official positions. This relative fluid move of highly trained personnel has been not only shaping the systems; it also permitted to surpass the institutional difficulties, the rigidities of political decisions and bureaucratization. If we put aside this individual fluidity[4], 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 institutionalized

[4] 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 in Latin America have very much insisted on the differences of the individual role and the institutional. In China a similar phenomenon has been noted. In Europe the policy to link universities to private sector companies has been also a high priority and always diagnosed a similar difference between what individual professor do and what the institutions are promoting in terms of technology transfers from the University to the private sector. In the USA, the issue has also been high in 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 its not the case.

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.

The turn towards innovation

The lack of integration of the public research units with the companies has been shown to be the main issue in the setting up of an innovation policy in the Mediterranean. It has taken a dramatic turn in the light of the increasing unemployment that affects the students with higher diplomas, brain-drain, and the growing weight of a rapidly increasing population of students.

Tunisia is a good example of a country that has given particular emphasis in the re-orientation of the research system toward economic activities.

In recent years, economic growth has been robust, with significant increases in per capita income. 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, so as to boost employment and quality of life.
As a catching-up and open economy, Tunisia's main economic sectors – 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 will be 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% of GDP in 2006, is quite low by OECD or EU standards, although it exceeds that of Portugal, Turkey, Poland and Mexico.
Funding from abroad is high, mainly from the Framework Programme for Research and Technological Development. Public research organisations and Universities' research structures are the main actors in the innovation system, absorbing more than 80% of government appropriations for R&D and performing 67% of R&D. The government's objective is GERD of 1.25% of GDP by 2009, of which 19% would be funded by the business sector.
Human resources are a key challenge. Currently there are 4.52 researchers per 1 000 total employment (2006) and 11.2% of all university graduates have degrees in science and engineering (range of age 20-29). More generally, one third of the population aged 18 to 24 had attained tertiary education in 2006. Many Tunisian Phds' students go abroad for advanced training.
According to Estime project (2006) Tunisia accounted for 0.8% of the world's scientific articles in 2004, up from 0.49% in 1999, and is absent from the list of countries having triadic patent in 2006. This is relatively problematic compared to the effort done.

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), have intended to produce some coordination of industry oriented initiatives. Official plans acknowledge the need to support innovation.[5] Links with the private sector have been formalised repeatedly down through the years on the basis of agreements

[5] Several specific plans for S&T since the 9th National Plan of Development (actually the 11th devlopment plan for the period 2007-2011 is in course)

involving the appropriate ministry and UTICA – the federation of industry. These agreements have never resulted in anything concrete and so the private sector input to the innovation agenda remains weak.

Four different programmes were promoted by the ministries or secretary of states since the nineties to inhance the linkages between research and business;
- Since 1992, the Government established the VRR, as a financial instrument to encourage Research Results Valorisation. The Ministry ensures funding for the projects aiming at reinforcing partnership between research structures and socio-economic actors such as Technical Centres, private Companies and professional groups through the setting up of innovative products or processes. Up to 2005, only 61 projects benefited of more than 6 Million TND funding.
- Created by the decree n°94-536 of march 10th 1994, Premium of Investment for Research & Development (PIRD) supports original studies necessary to the development of new products or processes, the implementation of prototypes and their technical experiments or the carrying out of ground experimentations. The premium helps also companies to acquire scientific equipments necessary to their R&D projects.
PIRD grants up to 50% 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 experiments or for carrying out ground experimentations and acquisition of scientific materials.
During the period of 1995 – 2005, premiums were granted to only 43 projects submitted by 40 companies.
- Federative Research programs have been initiated in 2003 in order to address development issues putting together all concerned stakeholders (research teams, universities, industries and public institutions). These programs are financed through multi-annual agreements, which define projects' structures, objectives and expected results, human and material resources to be mobilized as well as follow-up and evaluation procedures. The FRP tackles national priority themes identified in consultation with the different stakeholders of the concerned sector (water, energy, biotechnology, ICT, ...)
- The National Program 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, 9 projects have been selected involving 15 research teams, 14 companies and 5 technical centres. The second call for proposals launched during 2005 involved 7 technical centres.

After all these efforts to establish scientific and technological foundations, the decision-makers recently turned their eyes on the policy-making issues. They realized that they should have appropriate tools, measures and agencies in order to have effective policy-making process. That's why the 'National Observatory of Science and Technology' (NOST) and the National Agency of Research and Innovation (the so called APRI) were created respectively in 2006 and 2008. Their major role is to promote national S&T innovations by means of providing policy recommendations to government officials as well as policy makers, as the primary consulting agencies of national S&T policies.

Another good example of a voluntarist policy towards innovation has been that of Morocco. The country has been embarked in a large reform of the university system which was undertaken in 1997. At that time, there was a strong expansion of the universities as well as a worrying growth of unemployment of PhDs (it has been of 31% for university diplomas in 1997). That triggered the reform which included a reform of the status of researchers.

Researchers were recognized at least legally. At the same time, a series of measures to encourage technological diffusion, technological networks, 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 counter-balanced by a strong commitment to research and innovation that can be heard of at the top of the Kingdom, in the Ministry of Education but also in the other components of the government.

Various funding agencies have been created under the name of specific programmes: PARS and PROTARS have been addressed to the research institutions and the enterprises since1996. Exceptional funding was authorized for research inside the Five-Year plans 2000-2004, and action Plan 2004-2007.

The last years has also been an active period in the creation of structures dedicated to promote 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 (RDT, RGI), the incubation of new companies, the mobilisation of new funding schemes and fiscal support measures (the Moroccans have invented a new word "incitatifs fiscaux") and measures of information diffusion. The Ministry of research and its dependences in charge of research have managed a series of measures that are mainly oriented toward support to innovation (Pôles de compétences, outreach structures of the universities also supported by the Ministry of Industry and research-technological networks : RDT, RMIE, RGI). As a relatively new effort for Morocco we should also mention the technology platforms around some heavy equipment and new programs of research with socio-economic objectives (PARS, Pôles de compétences PROTARS I, II, III). 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 »). The measures oriented toward large companies tend to support a more pro-active vision of patents as a source of strategic information. The measures toward SMEs are basically structures around studies on the technical level of the companies. OMPIC is still not accepted as an important actor: in the innovation survey 44,2% of entreprises didn't know OMPIC and 70,7% had never used its services.

As far as S&T policy framework is concerned, Morocco has developed an exercise in prospective as a consequence of the second national gathering on science in March 2006. A Vision of scientific and technological development in 2025 has been produced. All large institutions have contributed to this reflection which includes measures in order to consolidate the national research system and a strategy for the future. It seems that advances are slower today on the front of policy, than they were in the early years of our century. On a brighter side, it should be mentioned that after the important and quasi-exhaustive evaluation of science that took place in 2002 Morocco enjoys a real consensus on the need for strategic evaluations. The exercise that took place in one year in all fields of science, combining Moroccan and European experts was a success in that it permitted to identify the effective actors of the research system and the future objectives. What is now necessary is to implement the identification of research laboratories with a specific label and a specific budgetary procedure, something that was discussed in detail in the ESTIME meeting of July 2006 (Algiers).

Morocco in very few years has experiences a large variety of tools in the promotion of innovation and technology. There is a need to evaluate these tools; there is also a need to promote a "world of innovation" that makes the diagnosis of the place technology and innovation occupies in the economy less public. In the same tonality, but for different reasons, Tunisia has also expressed the need to evaluate its policy. That may also explain why both countries have proceeded in realizing innovation surveys. On the last point it might be reminded that the exhaustive work done in Morocco between 2001 and 2003, which culminated in the presentation of the result of nation-wide evaluation exercise[6], has produced all these data, including the economic and innovation data. Similarly, Tunisia has been quite active in compiling the relevant to policy data and this effort is particularly interesting.[7]

Although different in the nature of the policy initiatives, Morocco and Tunisia show a common turn toward innovation in their S&T policies. Most of the measures try to link research, science, universities to 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 in some particular part without an overall national innovation strategy. Most often than not, it is the technoparks initiatives that was the first visible initiative. Tunisia was a forunner in the region with the El Ghazala technopole in Tunis, mainly oriented towards new information and communication technologies. Morocco set-up its Technopark in Casablanca, Egyt its Smart Village close to Cairo and in Lebanon the University of Saint-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. But technoparks were not the only common feature in the innovation policies around the Mediterranean. We additionally can mention the following:

- Technology Transfer Units in universities and engineering schools
- Funding Issues including venture capital, credit schemes, etc…
- Engineering Networks
- Promotion of intermediate technical centers
- 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.[8] Suffice to mention that in the last five years both countries, 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 networks.

This orientation putting emphasis on techno-economic networks is not the only possible. Other possible orientations could have been the development of businesses with a strong (public) investment component,[9] a preferential policy towards international investors[10], or the development of strong pubic technical centres. The "network" orientation has certainly the advantage of flexible arrangements. It is also strongly inspired on innovation policy concepts

[6] The results of the exercise were presented in a large seminar in (Kleiche and Waast, 2008)

[7] To our knowledge only Jordan in Machreq has made a similar effort. See Country report on Jordan in the ESTIME website. We know that Egypt has also produced internal documents on its RTD system but not available publicly.

[8] See the main part of the synthesis ESTIME report on Morocco {Kleiche, 2007 #4695} and the background report of Tunisia , volume III {M'Henni, 2007 #4697}.

[9] Morocco has also tried this option, for example in the development plans of Tangiers.

[10] 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 by the Moroccan government to McKinsey consultants.

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 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 promote new players in the game.

The tools of the trade: innovation indicators and innovation surveys for the MENA countries

The European reference for innovation indicators

Some efforts have been made to provide policy-makers with innovation-related indicators. This is a difficult task, which needs both a methodological discussion (because innovation is context-specific) and needs a significant investment in skills, surveys and systematic compilation of indicators. On the whole, innovation indicators are still lagging behind in many MENA countries (as many other indicators, see ESTIME final report). It should be mentioned that the main effort in providing these indicators has been under the pressure of the EU and usually with EU funding. None of the OECD, UNESCO or World Bank experiences have bee successful so far in providing the necessary expertise in the countries themselves, Rather, what usually is done is specific projects that select, compile and provide a set of indicators. The project Medibtikar proposed for example to provide a Mediterranean Innovation Scoreboard (called MedIS). MedIS mentions also some methodological pre-requisites. The indicators, it is said, should be:

1. *Region-specific*, i.e respond to the development model of the MEDA countries, which are in a process of transition from "resource-based" and "low-labour cost" based economies, with significant trade protection to economies that wish to be incorporated in the global competition race for the knowledge economy.
2. *EU-compatible* i.e. pave the way to compare with Europe (and in particular the European innovation benchmark tool, namely the European Innovation Scoreboard - EIS). Although now the economies of the 27 member states and the 10 MEDA region countries are hardly comparable, it is expected that at a later stage, as envisaged by the Euro-Mediterranean Partnership (as defined in the Barcelona Declaration of 1995) the MEDA and EU benchmarks can evolve in parallel.

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.[11] 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. Other international institutions were involved in the effort, namely 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 in order to create a stimulus for better data collection, which has not been really

[11] Amman Workshop: http://www.medibtikar.eu/-Workshop-on-R-D-and-Innovation-.html
Tunis Workshop : http://www.medibtikar.eu/Tunis-workshop.html

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 the education input demographic data. Nonetheless, the attitude and activities in the MENA countries is showing a certain change in this state of matters. Indicators do not seem so far away as a target for a policy-oriented programme. Moreover qualified personnel seem now to take command in the government offices in charge of the policies (Tsipouri, 2008).

The Mediterranean Innovation Scoreboard (MedIS) exercise started based on the idea to replicate the European Innovation Scoreboard (EIS) and compare the MEDA countries' innovation performance among themselves and with that of the European scoreboard. Other projects, such as ESTIME or ASBIMED had a different ambition. ESTIME wanted to build a local capability in selecting and using science and innovation indicators. ASBIMED merely was answering a question posed by the EU and the Mediterranean partners of the EU: what co-operations exist other than with the EU between the Med partners and EU countries. In these projects, both 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 input for further policy-making either locally or at the European level.

The wider world: World Bank and World Economic Forum

There exist other initiatives which do not depend upon the European Union, as we have mentioned in the introduction. Mainly two of them have had an importance: the initiative of the World Bank on the knowledge economy in the 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 s 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 iindicators around the concept of Knowledge economy for the MENA region {Reiffers, 2002 #4032}.

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The World Economic Forum Competitive is index does not concern all countries but only a selected number and is based on an opinion survey to business leaders around the world, a survey (claimed to be addressed to more than 11.000 persons). Some variables of the index are based on the international organizations reports. Tables XA and XB reproduce results concerning the Arab countries which are partners of the EU in the MENA region.

Arab countries. Opinions from business executives (World Economic Forum, Competitivity Report, 2008-2009)

	Brain drain Rank/134	Compagny spending on R&D Rank/134	Quality of scientific research institutions Rank/134	University-industry research collaborationRank/134	Local availability of specialized 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										
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

As can be seen in this table, 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 rather supposed to be good; it speaks of the fact that the main orientation of the S&T system in these countries goes to 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 we will also confirm later in this article, the capacity to absorb technology is rather good in companies; what seems not so good 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 generalized through the Community Innovation Surveys (CIS). To be more precise the CIS, initially developed in the nineties, followed a series of efforts in many countries that sought to measure the innovative activity, based upon the theoretical perspectives exposed in the books of Nelson and Winter, Chris Freeman and Nathan Rosenberg.[12] The evolutionary economics framework thus found a way and was finally formalized in the *Oslo Manual* under the sponsorship of the OECD. To say it succinctly, the innovation surveys grew hand in hand with the evolutionary economics framework, thus matching a policy need with academic developments.[13]

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 nineties. 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 preoccupations of the higher state officials in the science and technology branch of the executive were rather little interested in the innovation or technological part of their policies.

As we said earlier, two countries developed specific innovation measures in such a number that it can be labelled an innovation policy, although the label was not explicitly using until very recently. Tunisia and Morocco, both for the same fundamental reason which was tagged ‘globalization’s effects on the economy’. But both countries drew different directions.

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[12] Among the first reviews of this effort in Latin America was the work one of us authors was engaged in, in 1987 in Venezuela: (Pirela, Rengifo, Arvanitis and Mercado, 1991) It was followed by an innovation survey run in 1988 in the chemical sector: (Pirela, Rengifo, Arvanitis and Mercado, 1993). It should be noted that the surveys were limited to the chemical sector because, although the research team tried to mobilise public interest in this endeavour, none of the official structures were, at that moment (1987-1991) interested in running such surveys. In Latin America, the earlier efforts to measure innovation were all born out of academic motivation and teams (like the early work of Jorge Katz or the technological learning team in CENDES in Caracas) and in some cases were funded by the sectoral industrial Chambers and Associations (like all the studies in the Chemical sector in Venezuela, Brazil, Mexico and Argentina).

[13] This also explains the vivacity of the Globelics network that gathers scholars in economics around the worls that have been trained and work with an evolutionary economics reference.

- Tunisia, quite early put a large emphasis on SMEs[14] 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 technoparks).
- Morocco, embarked in an revision of its research policy and higher education structure. It multiplied universities and tried to stabilize a large incoming population of researchers, mainly from France, a large brain-gain that began with the intronisation of King Mohamed VI and its new alliance government. Morocco, as part of this political modernization and democratization, sought to promote some civil society institutions, education and science. This large movement gave birth to nation-wide initiative among which 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 introduce concepts such as networks of engineering, industrial clusters, and the promotion of SMEs.

As part of these changes, both countries initiated an interest in innovation surveying because of a lack of adequate information. 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. It had completed. At that time, 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 the R&D activities. After this first survey, it appeared clearly that there was a need for a better coverage of the items that characterize innovation activities in companies (see box 1). In 2005, an innovation survey was designed and run by the industrial association "R&D Maroc"[15], 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 boxes 2 and 3 in following sections).
In Tunisia, the 2005 survey had not only the purpose of measuring the innovation activity of firm: it was also aimed at creating a systematic database of innovative enterprises. As such, the survey tried to be exhaustive rather than to draw a statistically significant sample.
(see box 4).

As can be seen, in both 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 works 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 has been done on the determinants of innovative activity in Tunisia (Mhenni, 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, Rahmouni and Yildizoglu, 2007; Gabsi, Mhenni and Koouba, 2008). Most of this works has been done either under the ESTIME project or related to the

[14] Programme de promotion et de mise à niveau de l'industrie.
[15] "R&D Maroc" is an interesting case of an association gathering companies with strong R&D capabilities. It has many activities toward the promotion of innovation in the country, an innovation fair, a prize to innovative companies and publications on innovation. It serves also as an intermediate organization for relaying some innovation-related activities of the State.

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 Neibourhood 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 countries offered to the EU partnership.

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 technoparks, in the case of Tunisia since this has a priority

Box 2 . The Morocco R&D survey 1999.

Number of responding enterprises : 1939
Response rate : 80%.
Reference year : 1998.
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.

Operator : Division of Studies, Ministry of Industry and Commerce, Morocco.

Box 3 . The Morocco innovation survey 2005.

Number of responding enterprises : 1001
Response rate : 50%.
Reference years : 2002-2004
Criteria for sampling :

- Representativity in terms of geographical and sectoral distribution.
- Minimum required size of enterprises
- Reference to the 1999 survey listing

Operator : R&D Maroc, Morocco.

Box 4 The Tunisian innovation survey .

Number of responding enterprises : 586
Response rate : 79%.
Reference years : 2002–2004
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

Box 5. Common questions in the Tunisia and Morocco innovation surveys

The common information gathered concerns;
A) – General information: geographical situation, sales, % exports, employees, industrial activity)
B) – R&D: R&D activities between 2002 and 2004; occasionally/regularly; patents; expenditures in R&D; personnel in the R&D unit; conventions, agreements and collaborations in R&D.
C) – Innovations: in products, in processes, sub-contracting / consultancies; main R&D and innovation activities;
D) – Incentives to R&D and innovation: do you know offers of the state? Have you benefited from state support? Do you think you would ask for this support?

Research and innovation policies and firms

Innovation activities in Morocco and Tunisia are low but rather surprisingly higher than was expected and growing (see references we mentioned just above). In Morocco, between 1999 and 2004, the percentage of enterprises active in R&D has evolved rapidly, from a portion of 9% (1999) to 23% (2004). 27% of the industrial enterprises had an R&D unit. Expenditures in R&D also grew from 1.3 to 1.6% of sales. The most remarkable change in this period has been the appearance of middle sized enterprises. In 1999, they were 29% declaring being engaged in an R&D and innovation activity, while in 2004, this percentage grew to 42%. In Tunisia, among 586 companies who replied the innovation survey (practically an exhaustive survey of innovative and R&D-intensive companies), 248 carried out research and development activities in the period 2002-2004, a percentage similar to Morocco (42.3%). It should be noted that only 27.6% carry out R&D activities on a regular basis. And 92 enterprises (15.6%) had a dedicated R&D budget. In Morocco, 35% of the companies declared having a 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 this remarkable result that middle-sized companies are now a major player in R&D.

What is mainly characterising these activities is that it is an activity rarely formalized in the companies, either because it is not identified as such, or because there is no specific organizational unit that is in charge of innovative activities. This fundamental feature, not specific to these two countries,[16] has been also confirmed through case studies and qualitative surveys in Morocco at least (Mellakh, 2007). The qualitative survey showed a varied array of organizational forms that deal with technology within each company. Many projects that are innovative are realized by the production units, or the commercialization personnel. Some companies consider innovation as an essential item of their strategy and consider the company is 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 the market needs and linkages with foreign, but more often from national clients. Of course this depends greatly upon the sectors and the industrial dynamic.

But not does only 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 organizations, which have been created in order to respond to the technological activities of firms:

a. **Public bodies for the promotion of industry, companies and entrepreneurs, public organizations that finance technological development**. Ministries and ministerial bodies that contribute to policy and agencies which do the financing, as well as state bodies that finance economic development (development banks), and organizations which set production standards and those that deal with patents and intellectual property.
b. **Intermediary organizations** like the associations of engineers, scientists, business people, research centres, born of either private or public initiatives for

[16] As has been shown repeatedly in Latin America (Katz, 1976; Pirela, Rengifo, Arvanitis et al., 1993; Villavicencio and Arvanitis, 1994; Villavicencio, Arvanitis and Minsberg, 1995; Arvanitis and Villavicencio, 1998; Arvanitis and Villavicencio, 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, Zhao, Qiu and Xu, 2006; Zhao, 2006).

the promotion of Research and Technological Development (like for example "R&D Maroc" in Morocco).

c. **Consultancy firms** that conduct work in demand for researching technological and economic information.
d. **Engineering consultancies in** specific fields (building, public works, environment) or sectors (energy, environment, ICT industry, electronics industry, telecommunications).
e. **Venture-capital firms**, either through development agencies or banks that act 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).
f. **Technological networks** like networks of companies, laboratories and engineering bodies.
g. **Industrial districts**, not be confused with technological networks, which are a direct product of industrial history (for example a manufacturing area specialized in textiles, clothing and so on).
h. **Standards setting institutions** which manage patents, ISO standards, quality standards, standards linked to the promotion of a local brand (local rural product, specific product), environmental standards, and so on.

Thus we find now a paradox. On one hand there is growth of innovation, basically in firms that were not interested in this activity some years before, and simultaneously we find a growth of the innovation world; on the other hand innovation surveys indicate a low level of interest of the firms with public support to innovation. Many reasons are mentioned by companies, but mainly two arise: bad knowledge of the support schemes, and little involvement in them, 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 cant 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: the direct support to firms through the incentive schemes; the nature of the technological environment of the firms that is supported by the state, and finally the functioning of the research system.

A closer look at the types of enterprises showed the heterogeneity of firms. Not only do they vary in relation to size; the also have varied types of responses to the challenges posed by stronger competition and the strategies that would allow 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 the vast majority of 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 realize R&D. This ability to use the public support is in fact related to the general technological capabilities of firms.

As we have stated above, Morocco have had the privileged situation of a country where a large nation-wide evaluation exercise of its research system took place. The exercise by itself is an interesting experience since it was quite unique.[17] It should also be reminded that there was a strong policy incentive for that: Morocco had to have the work done according to an agreement it had signed with the EU. It relied in a series of steps: a state of the art of research

[17] It was done under the supervision of Roland Waast from IRD between 2002 and 2003.

in the country; an *in situ* evaluation of a very large array of research teams by twenty European experts and national experts; finally, the presentation of the results and discussion at the national level. Many analytical instruments were used: the state of the art relied in historic analysis, economic surveying, bibliometric in-depth analysis, a survey by questionnaire to all research laboratories of the country (unfortunately the social science were not included in that evaluation exercise; they were specifically examined in a project that was directed by Prof. Cherkaoui some four years later). This unique survey to the 778 laboratories was answered by 496.[18]). In the book that gathers the experience, and the main expertise reports, R. Waast explains some of the ingredients of success: a very strong implication of the Ministry of Higher Education and Research; political willingness as acknowledged by very high-ranking officials and the constant effort of the sub-secretariat for research in promoting the exercise and its result;[19]
Scientific experts, active scientists themselves in European countries, tend always to make advice that oscillated between two extremes: on the one hand, they propose the integration of the national research teams in the international scientific community; on the other hand, they favour the exploitation of specific locational advantages and niche opportunities for specific research programmes (for example, they made a strong case for medicinal products, agricultural sciences, chemistry of natural substances). These two opposite positions are, to the saying of the experts, both compatible only if one could rely on *good* science. 'Good science' according to this view is the result of good functioning of academic institutions, the support of research careers and sound evaluation mechanisms. They usually fall short of advice on how to generate the demands, for example, of the industrial sector or the users of the agricultural sector. They also have some difficulty in proposing mechanisms that would allow for the good match between the science capabilities and the implementation of results. Of course, nobody asks experts to do the job that is usually that of policy-makers. But since their work has identified many possibilities for the future, what should have been the policy advice in those specific areas? In fact, answering this question would entail a work that goes far beyond the evaluation. Forecasting tools and SWOT analysis have been regularly proposed as a way to promote policy answers to these questions.

Experts also insisted on many structural problems: the duality of the research institutions – academic research institutions that work in the same areas as specialized research institutes— in certain areas (eg. agronomy and forestery), difficulties in the careers, mainly in medicine and biomedical sciences, the difficulties to seize the needs of users of research. In fact, we would like to insist here that the whole exercise, apart form its Moroccan peculiarities shows that the « needs of the country » are closely related to the research capabilities. The areas where a in-depth knowledge of the environment and resources is needed are also those where research fulfils a double aim: a public service for the State and a prospective work for the users. This previous knowledge that comes out from research is in fact a necessary conditions for research and its uses. And it also needs a constant growth of the research capabilities. That is where Morocco has had the difficulties. After a regular and spectacular growth of its research activities, science production[20] has reached a plateau. The causes of this slowdown are not yet fully understood, but it appears quite clearly that it related both to a generational problem as well as an institutional problem. The generational problem is largely insufficient

[18] The methodology as well as the results are presented by A.M. Gaillard and J. Gaillard in Kleiche and Waast.
[19] The person in charge of the sub-.secretariat, Dr. Omar Fassi Feru is now president of the Academy of Sciences Hassan II and he has implemented ideas gathered from his previous experience as for example the bibliometric follow-up of research at a national level, th creation of indicators for research, and the design of a clear policy.
[20] As measured by simple bibliometric indicators.

as an explanation of this slow growth (Waast and Rossi, 2008). On the contrary, it appears that the reasons go rather deeper: they relate to the unfulfilled institutional reform.

In the same vein, although the innovation survey shows a growth of R&D and innovation activities in firms, at the national level, the country seems to have some difficulty in orienting its research system towards innovation. The risk here is that the public research system and the innovation potential deployed by enterprises do not converge.

The case of Tunisia is rather different in the sense that the country experience an active policy toward the promotion of technology and innovation and in terms that were different from those used in the science system reform. The main objective of the policy has been technological development and up-grading of companies.
Tunisia established a network of technical support structures dedicated to specific industry sectors. It created a network of incubators facing challenges due to a weak project pipeline. The recent introduction of courses on 'innovation management' as part of industrial engineering degrees has been encouraged. Some may have unrealistic ambitions and over-estimate need for them to demonstrate success in terms of spinoff companies – pedagogical gaols may be more reasonable for now. Industry-academia links exist but must be developed both in kind and in intensity. Industry has started to express needs in terms of the sociotechnical skills, and post.graduated departments in universities and high engineering schools are not well equipped to respond to these issues. It seems that the activity of some very active and pioneering academics in this regard needs stronger institutional support. Also, a real policy towards venture capital was designed but the difficulties rose more on the part of the private sector which has been quite timidly responding to this support. The venture capital industry has started to mature: there is increasing specialisation and regionalisation. There is a focus on development capital, a low level of financing for seed-money and early stage ventures and basically there are 'business angels' investments. Venture capital experiences are still weak, they have to take into account the high cost of 'educating' company owners and unexpectedly high costs of supporting business services and occasional expertise. There is a growing need to provide support for the networking of VC professionals, occasions for mutual learning and a system for benchmarking performance of funds with a view to raising awareness among investors and entrepreneurs as well as developing the market for private equity in the region.
The technopoles in Tunisia as we mentioned above have been actively developed. It seems nonetheless that there some difficulty to engage in active innovations in many of the enterprises and connections between the engineering schools and departments and the companies are still very low.

The State playing an important regulatory role acts as an intermediary between the different actors in the system. Specific technological programs have been set-up where the State is the facilitator of both research and the promotion of innovation. Incentive schemes in the two countries, although apparently with a low impact, have created a knowledge base that is difficult to measure through the realization of innovation activities inside the firms. The creation of the technical centres in Tunisia, for example, have had a permanent role in up-grading the skills of the personnel in the firms, through various training programmes, access to technical information or promotion of ideas. The mere existence of these centres as well as the promotion of research activities in the public research institutes and universities has encouraged firms to develop activities integrated in R&D. Last, but not least, the State also contributes to financing structures that promote innovations; these centres seem to constitute

a permanent source of reference for the companies (Hsaini, 2007; Mellakh, 2007). These aspects are difficult to seize through the questionnaires of the innovation surveys.

Conclusion

Our presentation relied on the presentation of the research systems in Tunisia and Morocco as well as the results of innovation surveys realized in these two countries. We did not enter in the more in depth examination of methodological issues in the design and exploitation of the innovation survey questionnaires (Assad, Ben Saleh, Piron and Arvanitis, 2008). But it appears that some common features can be drawn from the first surveys.

Further investigations should be pursued by developing specific questionnaires that both satisfy the 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, the overwhelming difficulties in acquiring capital goods that lead to neglect 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 to accumulate observations form MENA countries, Latin America and Europe.

Moreover policy recommendations can be drawn, based upon the evidence provided by the innovation indicators, in as much an effort is given to the meaning of these results. The NEBIP network has the intention of coordinating this effort. Additionally, the MIRA Observatory on Cooperation should permit to focus on this crucial aspect of measuring the research output and the uses of research.

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