Evaluation of Scientific, Technology and Innovation capabilities in MEditerranean countries

Evaluation des Capacités Scientifiques Techniques et d'Innovation des Pays Méditerranéens

ESTIME : Towards science and technology evaluation in the Mediterranean Countries

FINAL REPORT

Rigas Arvanitis, coordinator

Sixth framework programme

Project n°INCO-CT-2004-510696. ESTIME: Evaluation of Scientific, Technology and Innovation capabilities in MEditerranean countries

Instrument: SSA

Thematic Priority: International Cooperation

Period covered: from 01.09.2004 to 31.08.2007

Date of preparation: 15.10.07 draft / 30/11/2007 final

Start date of project: 01.09.04 Duration: 36 months

This final report is based on the following synthesis reports of ESTIME project which are annexed to this document:

- *La recherche scientifique au Maroc, Rapport de synthèse,* IRD & MRSFC (Kleiche M., Laaziz I., Zebakh, S.), 2007
- *La recherche scientifique algérienne, Rapport de synthèse pour ESTIME*, IRD & CREAD (Ziour H, Ferfera Y. Benguerna, M. Arvanitis R, Boisard A-S.)
- *Scientific Research in Tunisia. A report based on research work conducted as part of the ESTIME project in Tunisia*. P. Renaud (ed.). IRD.
- *Evaluation of Scientific, Technology and Innovation Capabilities in Lebanon*, Gaillard, Jacques in collaboration with Jacques Kabbanji, Joseph Bechara and Mona Assaf, May 2007, 54 p.
- *Research in Jordan. Country Report.* 10/07/2007. Pénélope Larzillière (ed), Khaled Elshuraydeh (Secretary General HCST), Isam Mustafa (Project Manager), and Abdel Hakim al Huzban.
- *Scientific Research in Palestinian Territories, ESTIME core team synthesis report*. February-November 2007.
- OST - *Country information leaflets.* (updated versions, data up to 2004). All countries of the project.
- *Identification of innovation capacity in MEDA countries*, Arvanitis, R.May 2005.
- *Les sciences sociales dans les pays arabes : cadre pour une recherche*, on-line, ESTIME website, Ali El Kenz, 2005.
- *Bibliométrie sciences sociales au Maghreb*, Waast, Roland en collaboration avec Rossi, Pier Luigi et Fondation Abdul Azziz, 79 p.
- *Bibliométrie des sciences exactes et naturelles.* Waast, Roland, Rossi, Pier Luigi, mai 2007.
- *A propos des analyses conceptuelles dominantes du SPL : une présentation synthétique,* Hsaini, Abderraouf, Rapport à la demande du coordinateur de ESTIME, Laboratoire PEPSE (Grenoble).
- *Towards a Euro-Mediterranean Innovation Space: some lessons and policy queries*, Core team ASBIMED and ESTIME teams (Pasimeni P., Boisard, A-S., Arvanitis R. Rodríguez-Clemente, R.).

All of these synthesis reports are based upon the numerous background reports of the project (cited in final section of this document). We are profoundly indebted to the work accomplished by the more than eighty persons which collaborated somehow in this project. Nonetheless, the ideas and expressions used here are the sole responsibility of its author and neither the background material authors' nor the synthesis documents author's can be held responsible for the opinions expressed here. Some of our colleagues who have worked in the project may not see their names mentioned in this page; we apologize for this unfair treat which is only the product of a diverse and large project that needs to be summarized. Their names are cited in the *Final Activity Report* (third period) which was submitted to the European Commission, and their work is mentioned in the following pages.

Publishable executive summary

1 Project objectives

The **ESTIME** project (Evaluation of Scientific and Technological capabilities in MEditerranean countries) aims at the description of the scientific and technological capabilities in 8 research partners countries of the Mediterranean (Morocco, Tunisia, Algeria, Egypt, Lebanon, Syria, Jordan and Palestinian Territories).

The investigation concerns all of scientific activities, including the social and human sciences. It is funded by the European Union for a whole period of two years and a half (September 2004 to February 2007).

The project draws a synthetic vision on science and technology in these countries by proposing:

- A description of the research institutions, higher education institutions and science and technology policies ;
- A statistical overview based on bibliometric analysis of the scientific production (publications in all fields of science on a ten years period);
- An analysis of the dynamics of research activities in a choice of disciplines, based on interviews with laboratory and research personnel previously identified by the bibliometrics analysis;
- An analysis of the uses of science and scientific results (relations of research centres with enterprises, development of innovation projects, activities of R&D in enterprises, NGOs activities that work with public sector researchers);
- An analysis of the role of social sciences. They need a specific treatment because of methodological problems. World bibliographic databases cover poorly the production in these countries, specifically the non-occidental social sciences.

2 Contractors involved

The project is coordinated by the “Knowledge and Development” team of *Institut de la Recherche pour le Développement* (IRD). Bibliometric macro-indicators are managed by the *Observatoire des Sciences et Techniques* (OST). Most of the empirical research is being done in collaboration with research teams in the Mediterranean countries that participate in the design, analysis and interpretation of results. Researchers willing to participate have been identified in Algeria, Morocco, Tunisia, Lebanon, Jordan, Syria and Palestinian Territories (see list below in *List of participants*). Because of the type of funding (SSA) the project had no pre-defined set of participants in all countries. Nonetheless, all national authorities have been contacted for the institutional description.

3 Co-ordinator contact details

Rigas Arvanitis.

Institut de Recherche pour le Développement
UR 105 « Savoirs et Développement »
132, avenue Henry Varagnat
93143 Bondy Cedex
Tel: (33).1.48.02.56.14
Fax: (33).1.48.47.30.88
E-mail: rigas@option-service.fr rigas.arvanitis@ird.fr

4 Work performed in the project

Overview of activities achieved and results

The participation of each country is different in the project. Research teams have been identified everywhere but not on all subjects. National authorities or persons dedicated to science policy analysis have been contacted everywhere and all, except one, have answered favourably and participate to the project.

The project has been mainly gathering information in each country independently. Workshops showed a wealth of information that needs to be formatted, interpreted, presented and disseminated adequately. A serious intellectual effort was necessary also to be undertaken in order to interpret the data and compare the research and technology systems in all the countries.

Table 1. Thematic Areas Covered by ESTIME

	Institu-tional description	**Macro-biblio-metrics**	**Micro-biblio-metrics**	**Innovation & uses of research**	**Social sciences**
Morocco	*Yes*	*Yes*	*Yes*	*Yes **	*Yes*
Algeria	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Tunisia	*Yes*	*Yes*	*Yes*	*Yes **	*Yes (partially)*
Egypt	*No*	*Yes*	*No*	*No*	*Yes (partially)*
Jordan	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Lebanon	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Syria	*No*	*Yes*	*Yes*	*Yes (partially)*	*Yes*
Palestinian Tterritories	*Yes*	*No*	*No*	*Yes (partially)*	*Yes*

Note: * Morocco and Tunisia have also innovation surveys and R&D surveys in industry.

The project has produced:

- A complete statistical and institutional analysis of all countries of the project (excepting Egypt and Syria).
- A complete a bibliometric analysis at institutional level and macro level on seven countries (excepting Palestine);
- A comparison on macro and micro bibliometric data.
- A review of science and technology policies on six countries (does not include Syria and Egypt) ;

- An analysis of the dynamics of research activities based on interviews and CVs of researchers; this is an uncompleted task for reasons explained in the results,
- A secondary analysis of innovation surveys in at least two countries, Tunisia and Morocco;
- A review of innovation policies in all countries (except Egypt) : relations of research centres with enterprises, development of innovation projects, activities of R&D in enterprises, NGOs activities that work with public sector researchers;

The results on each of the above items are mainly contained in the country reports and strategic reports (see below).

It should be underlined that in each country a massive effort has been done to obtain information and to build a collaborative network of researchers. We can mention at least fifty researchers or government officials have been engaged in the project (see list below).

Bibliometrics

Macro-bibliometric indicators

- *Macro-bibliometric* indicators have been delivered with data until 2001 and published as information provisional leaflets by OST. OST has produced new leaflets with figures based on the Science citation index until year 2004. See: http://www.estime.ird.fr/article159.html.

Micro-bibliometric indicators at the level of institutions or cities

- *Microbibliometrics,* which are data on publications at the level of institutions and cities, are delivered on a case by case basis for each country (data up to 2005) by IRD. Analysis is also performed on the PASCAL database, a French multi-disciplinary database. Egypt and Palestinian territories have not been covered.

Specific Bibliometrics for the Social Sciences

- A contract of collaboration with "*Fondation Abdul Azziz*" has permitted to advance indicators for Maghreb countries in the social sciences. No equivalent database exists in other Arab countries.

- A contract with IFPO has permitted to put-up a database for Lebanon, Jordan and Syria based on a survey in the social sciences.

- The initially planned work in Egypt with the Faculty of Arts (Sociology) which has a bibliographic compendium of research in Egypt and the Arab world has been cancelled due to the difficulties in the negotiations with the Ministry of research of that country.

Fieldwork

Identification of research teams for field work

Research teams have been identified in different countries. Fieldwork has been going on in all countries. Nonetheless, all aspects considered initially could not be covered satisfactorily mainly because the identified teams were not sufficiently aware or could not be engaged in

specific tasks that involve a know-how they felt they didn't master sufficiently. *The central need here is surveying skills in qualitative research and reporting on surveys.*

Field work activity

This is the single most important activity of the project. Field work activity consisted mainly in interviewing researchers or research managers in the countries of the project. In all countries, such a work has been done. In some cases, delays have occurred. In Egypt, no interviewing has been done under the project in the natural and exact sciences. The project has received no answer from the Ministry of Research.

Workshops and meetings

- *Kick-off meeting* in Amman (April 25-26, 2005). A presentation of the project was offered to the MoCo *Ad hoc* committee in Amman meeting.
- Given the difficulty to organize large encounters, we opted for specific workshops instead of two large intermediate meetings as it was initially planned. In the period under review, we organized two meetings:
- A *social sciences workshop*, Paris Expert Meeting (28 November 2005)
- Joint ASBIMED-ESTIME meeting took place in Barcelona in October 2005. This meeting has been instrumental in advancing both projects. The resulting MIRA project was devised in this meeting.
- A *science policy meeting* : Evaluation workshop, Algiers (3 July 2006)
- *Innovation and uses of research* workshop, Casablanca in November 2006 (23 to 25 November);
- "*Dynamic of research*" field-work workshop in Beirut in December 2006 (7 to 9 December).
- *ESTIME Final Meeting* Hammamet, Tunisia 28-81 June 2007. Organized by ONST for ESTIME, and by IRD. Gathered the representatives of the national authorities and representatives of DG Research. The Meeting was inaugurated by the Minister of Research. A joint ESTIME-IRD training workshop for doctoral students took place at that same time (Atelier ATHENA). Doctoral students could also participate in the ESTIME meeting.

Web site

The web site is running since the beginning of the project: http://www.estime.ird.fr/

The web site contains material produced by the local teams and the coordination team: announcements, reports, etc. Some restricted reports are posted on a specific space and accessed by login/password. We proposed to maintain the website after the end of the project for publication of reports. The website is in Arabic, French, and English.

Future publications (intentions for use)

Most of the results are intermediate reports and working documents. A lot of information is still confidential since it concerns Curriculum vitae of interviewed persons. Most of the public results are available on the website: http://www.estime.ird.fr/

Several projects for publications are under discussion:

- As a result of the Evaluation Meeting, which was held in Algiers, during July 2006, a publication on *Evaluation methods and practice* in the region will be published in Algeria. The French version will take the form of a special issue

of the journal "*Les Cahiers du CREAD*". The English summary version will be published as part of the final report of the project.

- As a result of the study concerning innovation in Morocco & Tunisia, all the partners gathered several times to decide a publication on innovation and R&D in Maghreb countries. It will probably be published as a special issue of the economics journal "Critique Economique". *Critique Economique* is a well distributed journal of high standard. This project has not yet been confirmed. Alternatively *the International Journal on Technological Learning, Innovation and Development* (IJTLID) has proposed to host such a special issue.

More projects are under discussion:

- A book in Arabic (and one in French) will be published based upon the material that was presented in the Beirut workshop in December 2006.
- A book by Foundation Abdul Azziz will be published in February 2007 on social sciences production in Maghreb countries (publication in Casablanca in Arabic and French).
- A special issue of the journal *Science Technology & Society* has been discussed with the editors.

5 Main deliverable results obtained in the project

Not only do we have a diversity of participation patterns for each country and each team; vut we also have had a very large array of results.

MIRA : an INCONET devised as the pursuance of the monitoring and assessment activity

The ESTIME workplan had a work package (WP14) dedicated to writing a follow-up proposal for ESTIME based on the idea of creating a network of observatories in the Mediterranean region on Science and technology. The end result of this activity has been the writing of an INCONET proposal with the coordinator of ASBIMED. The proposal has been evaluated positively and its kick-off meeting is in January 2008.

In many countries initiatives have been taken in order to create observatories of science and technology. In the ESTIME countries, Tunisia (ONST), Jordan (inside HCST) and Lebanon (as part of CNRS activities) have been actively pursuing this task. Syria in the newly created Higher Commission for Scientific Research has been undertaking a survey of scientific research. Statistics on S&T are still not a routine activity in any of these countries and reporting to UNESCO's Institute of Statistics is still not common practice. ESCWA (from UN system) has planned a regional initiative in the Middle East (with main contribution from Lebanon and Jordan) in order to create such a network but the initiative has been interrupted.

The MIRA INCONET contains a work package specifically oriented toward creating a EU-Med countries observatory. The proposal states: "The observatory of S&T will be geared toward understanding the state of research and technological cooperation between the EU and the MPC. It will focus on the establishment of standard indicators for these purposes, to be used for the MoCo to support their recommendations. It will maintain a database on scientific production of the cooperation. It will engage in analysis of the dynamics of research system."

Reports (and intentions for use)

Details on work performed in each country would make this summary too long. Nonetheless, it should be underlined that in each country a massive effort has been done to obtain information and to build a collaborative network of researchers. All draft reports of the project have been discussed in the intermediate meetings (Casablanca & Beirut) and at the Final meeting (Tunisia). 10 reports were produced:

- 6 country reports:

Morocco
Algeria
Tunisia
Jordan
Lebanon
Syria (delayed after the project)
Palestinian Territories
No report for Egypt.

- 4 strategic reports:

National systems of research in Mediterranean countries
The production of science of Mediterranean countries; a bibliometric analysis
Innovation, technology and uses of science in Mediterranean countries
A panorama of social sciences in Mediterranean countries

6 Main recommendations of the project

The observatories on STI: Promote the monitoring and assessment activity

As it was indicated in the section above (see MIRA) there are many initiatives in order to create observatories of science and technology. Only Tunisia has created an observatory today, the ONST, directed by Dr. Hatem Mhenni. In all countries we found such initiatives (with the notable exception of Algeria). These initiatives should be encouraged:

- at the regional level, by joining effort with ESCWA, ALECSO and UNESCO;
- at the national level, by supporting the small teams that have been created in the specific institutions devoted to producing indicators of science and technology, as for example:

Jordan (inside HCST)
Lebanon (as part of CNRS activities – see the feasibility report by Laurence Esterle, former director of French OST)
Syria inside the newly created Higher Commission for Scientific Research
Palestinian territories in an independent organisation which is the PALAST
Morocco: probably inside CNRST and/or the Academy of Science

- inside the cooperation agreements with the EU, by promoting the experience gaining in European countries on observatories and S&T indicators/innovation indicators.
- by promoting more actively the efforts done by European academics on S/T indicators toward these countries (for example through networks of excellence already existing such as PRIME).
- by comparing the Med countries with similarly-sized countries (See the report prepared by J. Mouton and R. Waast) on a Meta-study of Science in intermediate size countries (Asia, Africa and Latin America)

Promote a Euro-Mediterranean Innovation Space (EMIS): Innovation surveys, mapping of technology transfer units, analysis of "bridging" institutions, innovation policy

Innovation surveys at the level of firms have also been identified as a need of all countries. ESTIME found that only Tunisia and Morocco have had this type of surveys at the level of firms. In some countries some teams plan to make this kind of surveys (for example CREAD in Algeria). The recently funded **Medibtikar** project (Europe Aid funding) could be the right place to begin with. It is strategically important to reinforce the collaboration of projects of DG RESEARCH and AID on this specific matter. Innovation surveys are not difficult to set-up if and only if a specific team is in charge of it in each country. Such an activity is strategic for Europe and the Med countries.

A larger understanding of innovation policies and structures should begin by identifying (and evaluating) these "middle-level" or "bridging" institutions that now seem to be created everywhere, along with regional innovation policies promoting technology parks, incubators and industrial clusters. In one country only ESTIME promoted a survey of technical centres that are dedicated to a specific industry (Tunisia). ESTIME has largely begun a mapping of all the technology transfer units in all countries of the project. By technology transfer, we mean uses of research from university to the productive sector. There is a clear need for this effort. Recently some countries (Jordan for example) have insisted in promoting "applied research" and reinforcing the structures that permit to have a close collaboration between research and enterprises

ESTIME has also encouraged "secondary" analysis of the data in Morocco and Tunisia. This activity is an "academic" activity that is necessary if one wants to interpret correctly the results. Comparison of R&D units in Med countries wth European or strongly industrialized countries is not straightforward: its needs specific metrics and specific analysis. A *Manual* should be written or at least adapted from the Oslo Manual which serves the purposes of the Community Innovation Surveys (CIS).

The institutions that appear to be in a position of supporting this type of analysis at a regional level in Maghreb: the foundation R&D Maroc in Morocco, CREAD in Algeria and the ONST in Tunisia. R&D Maroc and ONST additionally could also act at a regional level with the support of some international organization. In Egypt, project Medibtikar has also identified many participant institutions that could play this role. Finally, in Middle-Eastern countries, the effort coordinated by ESCWA is already rendering good results and would need to expand its analytical capacities by supporting specific projects on a more localized level.

It should be noted that the recommendations of the MED7 project in its Casablanca meeting specifically insisted that the EU should promote not only directly innovation projects but also a continuous monitoring and analysis of the innovation activities: it is the basic condition in creating a EURO-MEDITERRANEAN INNOVATION SPACE (EMIS). As part of MIRA project (see above) innovation activities will be replaced inside the discussions and strategic activities of the EU-MED cooperation activities in science and technology. But it is imperative to extend this activity to the innovation policies.

Promote evaluation tools and an evaluation culture

- Create a bibliometric database for the natural and exact sciences

It is common practice to use the *Science Citation Index* as reference tool for evaluation of mainstream science. ESTIME has shown that the bibliographies of researchers in the Arab countries are not satisfactorily covered by the international databases, for a range of reasons that are far from clear. The social practices of the researchers, the functioning of universities

and research institutions, the feeble importance of evaluation in their careers, the importance of non-English production, the specific areas of specialization (mainly engineering) all contribute to this bad coverage. It is absolutely necessary to cross-check various sources and there is only one way to do this: **create a common reference** tool that could be closely related to the SCI, and also develop specific tools that would encourage a larger production in the internationally recognized journals and a better image of locally published research. This work can be done by a small team and its benefit can rapidly outperform its costs. It needs to be supported by the authorities of the European Union and cannot be the sole result of a local and private initiative. An institution like the Observatoire des Sciences et Techniques (OST) and the network of European Scientometric teams (European Network of Indicators Producers ENID). (http://www.enid-europe.org/) could be the managers of such a cross-institutional platform.

- Create a documentary network for the social sciences

ESTIME has tried to evaluate the importance of research in the social sciences. No database has been found to be satisfactory except the very notable *Fondation Abdul Azziz* which has gathered all production in the social sciences in Maghreb countries. No equivalent exists in other countries. ESTIME has found in all countries a growing importance of the social sciences and about half the production (or little more in some countries) is in Arabic. There is no relevant database to make this evaluation. The evaluation of the work done in the social sciences is strategic for the future of Arab countries (see below). ESTIME created a real knowhow inside the Fondation Abdul Azziz and it should be necessary to prepare the future by supporting the continuous up-grading of this know-how.

- Promote prospective activities for future areas of scientific research

In all countries where research has been stabilized as a policy issue, ESTIME found there is a clear expression for prospective thinking on the future and areas of concern for research. Three countries have done an exercise in national priority setting: Jordan (Strategy plan 2006-2010), Lebanon (STIP) and Morocco (Vision 2025). Other countries have clearly expressed the need for such an exercise. MED7 permitted also to identify future areas of common concern between the North and South banks of the Mediterranean. A general framework has been envisioned for a common Euro-Mediterranean innovation space (EMIS) as part of the MED7 project.

A specific DG Research project, geared toward this need, has been INNFORMED which concerns Egypt, Jordan, Morocco and Tunisia: “INNFORMED will use Innovation Systems thinking and a Foresight approach to develop a structured Euro-Med dialogue in research and innovation, to embed innovation systems thinking in the region, to deepen and strengthen MEDA capabilities in RTDI related policy process design and implementation, and to develop success scenarios for turning current MEDA strengths and RTD investments into growth opportunities.” (from the project presentation).

- Prepare common disciplinary evaluations by cooperation of EU & Mediterranean experts

In the national policies about research, basic sciences have been largely left to their own. Most effort in the national plans has been on innovation and applied research and technological development, rarely on basic sciences (with the notable exception of Tunisia). The tools for evaluation of scientific disciplines (not individuals or projects) and the means and resources for research have been the central core of ESTIME, thus encompassing both applied and basic research. But the word “evaluation” has been misunderstood, either because of lack of previous experience, or because of fear of the results. We could clearly identify two exercises: an evaluation of means for research –what ESTIME was all about– and an evaluation of disciplinary strengths and opportunities. The experience of Morocco is

interesting in this last regard. Experts from the EU have been called to evaluate disciplines in connection with their Moroccan counterparts. This exercise is fruitful and permits to identify avenues for future research, specifically in basic sciences. It would be advisable to engage in similar exercises maybe on a more limited scale.

Reintegrate the social sciences in science and technology policy debates

ESTIME found that the social sciences have grown considerably in the last years and that no adequate reflection exists on the role that should be given to them. They also play a significant role in understanding the political, cultural, religious activities and roots of our world. Globalization has affected in many ways the Med countries and the technocratic promotion of research, science, technology, engineering, and education is insufficient. A real effort needs to be done to promote an understanding of the social structures that could host a more equitable world and more educated and informed populations. And, these are necessary steps before a knowledge-based society can emerge (see UNDP, Arab Human Development Reports 2003 & 2004).The post September-Eleven world is in need of a more careful intervention in the inner making of policy, that associates the diversity of opinions and positions in Europe's closest neighbouring societies.

Moreover, it appeared clearly from interviews in the social sciences, that an instrumental view of the uses of the social sciences (for example by adding a social science work package in health-related projects or in environmental projects) is clearly necessary but also insufficient. There is a need to create the economic conditions that will absorb the immense quantity of highly trained professionals in the social sciences. This will only be possible if social science specialists not only reflect on their own society but also on the ways they connect to the world and specifically to Europe. In the same manner as there is a Science and society programme in the EU (in FP7 Capacities programme) there should be a specific programme for Med countries --designed for the Med countries with the support of Med countries experts.

This reflection is indispensable when one observes the way Med countries have been drawn into dramatic political, cultural and social situations. An effort in organizing this reflection, without the traditional esoteric and epistemological debates that are usual among social scientists, is needed. It should be based on a detailed analysis of the social conditions of training and employment of social scientists and humanities. It should be done by giving material conditions for an intellectual activity that, although costs little, can reap tremendous results. ESTIME has begun this state-of-the-art in some areas and in some very few disciplines and on a limited scale. A larger effort should be engaged in this regard. This effort could be done with the support of UNESCO social sciences division which is engaged in a similar reflective activity on its future (See the Report of Marc Renaud for UNESCO).

Although it was not a part of ESTIME's agenda, interviews with researchers made a case on the rarity of students that orient themselves in scientific careers. Most researchers in the countries covered by ESTIME have been engaged in science by a convergence of pure chance and bright minds. This haphazard and heroic pattern of recruitment does no justice to the countries capabilities. It also underscores the social standing of science. A major effort needs to be done **on awareness of scientific research** to lay people as well as professionals not engaged in research. The support of an information tools like the website SciDev.net (www.scidev.net) , the cooperation with the major funding agencies in Europe like **SIDA** (Sweden) or outside Europe like **IDRC** (Canada) should be promoted actively. These two institutions have been mentioned by interviews and in the ESTIME meetings because they have deployed a research for development perspective which is unique and needs to be supported. International cooperation appears a privileged tool for a major initiative on awareness of science and promotion of science for development in the near future. Not

tackling this issue specifically for the Med countries would be letting obscurantism regain its territory.

Increase awareness for research policy at the highest levels of the governments

ESTIME identified a need to increase awareness of research policy and S&T policy matters in the higher spheres of government. High-ranking officers are usually trained in law, political sciences or engineering. In their career they seldom have opportunities to encounter scientific research, an activity that is misunderstood and usually confused with engineering or textbook teaching. Scientists are seen as academics –in the best cases– or teachers. Those rare persons who have an understanding of research activities are seen as "technocrats" and have less political power.

It would then be advisable to create **a specific training session on research policies for high-level functionaries**, not necessarily limited to those who are engaged in science policy. Since these are persons with little time and high expectations, a session with a few well known trainers, in a high-end environment, and the sense of exclusiveness of the experiment they participate in, could favourably influence them and decide them to participate.

These training sessions could be designed at the regional level for the Arab world.[1] ALECSO could then be partner in such high level training. EU could propose some of its best experts who are famous world-wide. It should be noted that this is very different from a management issues of programmes (these are issues that could be covered by national contact points). The basic need is not so much on management as in promoting awareness on research, on policy design, on knowledge creation and dissemination, on what is at stakes at the global level and why research can be a tool for national strength.

END-OF-EXECUTIVE-SUMMARY

[1] Draft version of the possible contents for such a training session can be examined in the EOLSS On-line Encyclopedia section on Science and Technology Policy (See www.eolss.net and introductory article by Arvanitis, Rigas (2003) 'Science and technology policy', in UNESCO (ed), *Knowledge for Sustainable Development - An Insight into the Encyclopedia of Life Support Systems (Volume 3)* (Paris, France, Oxford, UK: UNESCO Publishing / Eolss Publishers.): 811-48. Also available on-line at http://rigas.ouvaton.org/article.php3?id_article=77)

ESTIME
Final report

This final report examines the objectives of the project and some of the main results (all countries and teams). It also shows the composition of the working teams and the main deliverable results, including reports and meetings. Details about how these activities have been implemented are contained in the three periodical activities reports. The final report shows the effort committed by the consortium in reaching its objectives and its outcomes. Finally, the main recommendations and priorities for the future are presented.

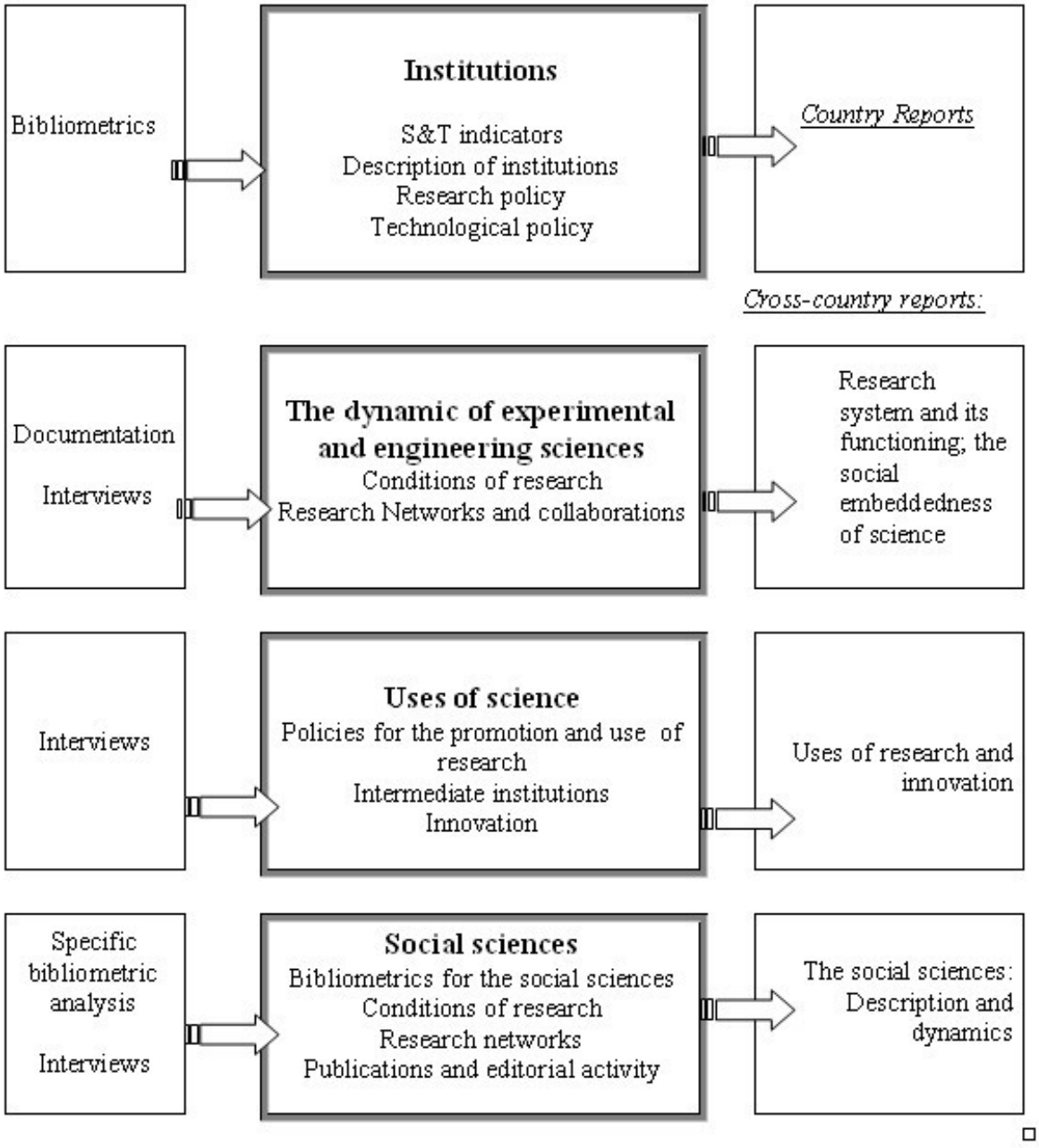
1 Presentation of the project

The **ESTIME** project (Evaluation of Scientific and Technological capabilities in MEditerranean countries) aims at the description of the scientific and technological capabilities in 8 research partners countries of the Mediterranean (Morocco, Tunisia, Algeria, Egypt, Lebanon, Syria, Jordan and Palestinian Territories). The project is aimed at contributing to closer links between the European research space and the Mediterranean research space by providing precise indications on research, technological development, and innovation in the Mediterranean countries, supported by *empirical investigations* and a thorough revision of sources of information.

The investigation concerns all of scientific activities, including the social and human sciences. It was funded by the European Union for a whole period of three years (September 2004 to August 2007). It has been designed after the proposal of the Mediterranean countries and the European Commission that was drawn in the Cairo meeting of the "Barcelona Committee on science and technology" also known as "Mediterranean Countries Committee on scientific cooperation" (MoCo).

The project draws a synthetic vision on science, technology and innovation in these countries by proposing:

- A statistical overview based on bibliometric analysis of the scientific production (publications in all fields of science on a ten years period);
- A description of the research institutions, higher education institutions and science and technology policies ;
- An analysis of the dynamics of research activities in a choice of disciplines, based on interviews with laboratory and research personnel previously identified by the bibliometric analysis;
- An analysis of the uses of science and scientific results (relations of research centres with enterprises, development of innovation projects, activities of R&D in enterprises, NGOs activities that work with public sector researchers);
- A panorama of enterprises' motives and of intermediate organisations that promote technological development and innovation (including re-using "innovation surveys");
- An analysis of the social sciences. They needed a specific treatment because of methodological problems. World bibliographic databases cover poorly the production in these countries, specifically the non-occidental social sciences. We needed to find in each site a strategy that permits to seize the production in these disciplines. It was completed by interviews with researchers in 3 or 4 disciplines (two common disciplines to every country: Sociology/Anthropology and Law).



A summary of priorities for the work inside the project

After the Institutional Capability meeting (Amman 2005), the coordinator of ESTIME drafted some priorities for the work to be engaged in the project in order to obtain the objectives mentioned above (paragraph 1).

- Highlighting the principal **caveats in policy making** and **information gaps** on S&T statistics, In the course of the project it clearly appeared that **evaluation** of scientific activities should be the focus of policy-making.
- The **interpretation of quantitative data,** whenever they exist, on resources and research outputs. We had to construct indicators that are meaningful, robust, validated by fieldwork and that can be updated in the future;

- **Understanding the formation of scientific communities** in the eight countries of the project. This is a historical process that we needed to document precisely.
- Respond to the query **on the role of social sciences** in relation to other scientific disciplines. Here, we needed to show concretely and materially how scientists work in the social sciences, as we had to do in the exact and natural sciences.
- Discuss on **the system of innovation in Mediterranean countries** and the participation of Mediterranean partner countries to the European research space and the creation of a Euro-Mediterranean innovation space.

2 Description of the activities of the project and main outcomes

Overview of activities

The participation of each country is different in the project. Research teams have been identified everywhere but not on all subjects. National authorities or persons dedicated to science policy analysis have been contacted everywhere and all, except one, have answered favourably and participate to the project.

The project has been mainly gathering information in each country independently. Workshops showed a wealth of information that needs to be formatted, interpreted, presented and disseminated adequately. A serious intellectual effort was necessary in order to interpret the data and compare the research and technology systems in all the countries.

Table 1. Thematic Areas Covered by ESTIME

	Institu-tional description	**Macro-biblio-metrics**	**Micro-biblio-metrics**	**Innovation & uses of research**	**Social sciences**
Morocco	*Yes*	*Yes*	*Yes*	*Yes **	*Yes*
Algeria	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Tunisia	*Yes*	*Yes*	*Yes*	*Yes **	*Yes (partially)*
Egypt	*No*	*Yes*	*No*	*No*	*Yes (partially)*
Jordan	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Lebanon	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Syria	*No*	*Yes*	*Yes*	*Yes (partially)*	*Yes*
Palestinian Tterritories	*Yes*	*No*	*No*	*Yes (partially)*	*Yes*

Note: * Morocco and Tunisia have also innovation surveys and R&D surveys in industry.

The project has obtained information on:

- statistical and institutional analysis of all countries of the project (excepting Egypt and Syria). We can, for the future, engage in a critical assessment of information needs.
- bibliometric analysis at institutional level and macro level on seven countries (excepting Palestine);
- comparison of macro and micro bibliometric data.

- review of science and technology policies in six countries (does not include Syria and Egypt) ;
- analysis of the dynamics of research activities based on interviews of researchers;,
- secondary analysis of innovation surveys in at least two countries, Tunisia and Morocco;
- review of innovation policies in all countries (except Egypt) : relations of research centres with enterprises, development of innovation projects, activities of R&D in enterprises, NGOs activities that work with public sector researchers;

The results on each of the above items are mainly contained in the country reports and strategic reports (mentioned at the end of this report).

Next, we present the main types activities: macro and micro bibliometrics, fieldwork, discussions and reporting.

Organisation of the project

The project is coordinated by the "Knowledge and Development" team of *Institut de la Recherche pour le Développement* (IRD). Bibliometric macro-indicators are managed by the *Observatoire des Sciences et Techniques* (OST) in Paris. National teams have been selected in Algeria, Morocco, Tunisia, Jordan, Lebanon, Syria and Palestinian Territories (see list below in section 4). Because of the type of funding (SSA) the project had no pre-defined set of participants in all countries. Nonetheless, all national authorities have been contacted for the institutional description.

Macro bibliometrics

Macro-bibliometric indicators have been delivered with data until 2001 and published as information provisional leaflets by OST. OST has produced new leaflets with figures published are based on the Science citation index until year 2004. See: http://www.estime.ird.fr/article159.html.

Micro bibliometrics

Microbibliometrics, which are data on publications at the level of institutions and cities, are delivered on a case by case basis for each country (data up to 2005) by IRD. Analysis is also performed on the PASCAL database, a french multi-disciplinary database.

A large effort has been devoted at using an alternative database, PASCAL, in order to identify the scientific production by cities and institutions and serve as guides for interviews in the eight countries. The database has been cleaned, its content has been systematically analyzed and a consistent coding of institutions has been processed. This last effort is divided in the following activities:

- Coding of the *institutions* and *cities*, based on address field in the database;
- Coding of *disciplines* along a simplified coding system.
- Presentation of data by *specialisation indexes* and *concentration index* in sub-disciplines
- Analysis of the evolution of the data over time.

Specific Bibliometrics for the Social Sciences

A specific database has been created, based on the library catalogue of the "*Fondation Abdul Azziz*". IRD team created specific indicators for Maghreb countries. No equivalent database exists in other Arab countries.

IFPO in Lebanon coordinated a work in order to create a database of researchers working in the Middle-East countries. A database of researchers and institutes for for Lebanon, Jordan and Syria based on a survey in the social sciences has been created.

The initially planned work in Egypt with the Faculty of Arts (Sociology) which detains a bibliographic compendium of research in Egypt and the Arab world, has been cancelled.

Fieldwork

Identification of research teams for field work:

Research teams have been identified in different countries. Fieldwork has been going on in all countries. Nonetheless, all aspects considered initially could not be covered satisfactorily mainly because the identified teams were not sufficiently aware or could not be engaged in specific tasks that involve a know-how they felt they didn't master sufficiently. *The central need here is surveying skills in qualitative research and reporting on surveys.*

Field work activity

Field work activity is mainly interviewing researchers or research managers in the eight countries of the project. In all countries, such a work has been done. In some cases, delays have occurred. In Egypt, it must be underlined that no interviewing has been done under the project in the natural and exact sciences. The project has received no answer from the Ministry of Research.

Discussions in workshops and meetings

The project had two **general meetings**:

- Institutional Capability Meeting was also the kick-off meeting of the project, in Amman (Avril 25-26 2005). A presentation of the project was offered to the MoCo *Ad hoc* committee in Amman meeting.
- The *Final Meeting* Hammamet, Tunisia 28-81 June 2007. Organized by ONST (Tunisia) and ESTIME.

Given the difficulty to organize large encounters, we opted for specific workshops instead of two large intermediate meetings as it was initially planned, each on a major topic of the project:

- A *social sciences workshop*, Paris Expert Meeting (28 November 2005)
- A *science policy meeting* : Evaluation workshop, Algiers (3 July 2006)
- An *innovation and uses of research* workshop in November 2006 (23 to 25 November in Casablanca);
- A field-work workshop titled "*Dynamic of research*" in December 2006 (7 to 9 December in Beirut).

- Joint ASBIMED-ESTIME meeting took place in Barcelona in October 2005. This meeting has been instrumental in advancing both projects. And fulfilling the work package assignement: the creation of a structure on which observatories could rely upon.
- The project had many *internal meetings*, of which two were important since they gathered the complete core team: Nantes (3 November 2004) and Bondy (January 2007). Also many coordination meetings took place with OST in Paris.

Social Sciences workshop, Paris (28 November 2005)

This was a workshop organized by ESTIME project and Institut d'études de l'islam et des sociétés du monde musulman (IISMM – EHESS) with the participation of several scientists involved in the social sciences fieldwork realized for Estime project. This workshop gave the opportunity for local teams to exchange their first results concerning fieldwork in social sciences and present issues related to methodology.

The meeting gathered 14 people: 7 people from Estime Core Team (Pénélope Larzillière, Anne-Sophie Boisard, Mina Kleiche, Rigas Arvanitis, Ali El Kenz, Roland Waast, Pascal Renaud), 5 local partners involved in Estime project [Jacques Kabbanji, Sari Hanafi (Liban), Mohammed Benguerna (Algérie), Abdel Hakim Al Husban (Jordanie), Jillali Al Adnani (Maroc)] and 2 scholars from Paris EHESS (Hamid Bozarslan et Eberhard Kienle)

Evaluation of research workshop, Algiers (3 July 2006)

This was an expert workshop organized by CREAD and ESTIME. It gathered persons responsible for research in Algeria, Morocco, Tunisia and Lebanon. It focused on Evaluation of research since this was the strongest most important theme in policy making. A publication on evaluation methods and practice in the region will be produced soon.

The meeting benefited from the presentations of Abdelkader Khelladi (CERIST - Centre de recherche sur l'information scientifique et technique), Houria Rebbah (Ministère de l'Enseignement Supérieur et de la Recherche Scientifique, Alger), Mona Assaf and Hassan Charif (Centre National de la Recherche Scientifique du Liban, Beyrouth), Ahmed El Hattab (Ministère de l'Education Nationale, de l'Enseignement Supérieur, de la Formation des Cadres et de la Recherche Scientifique, Rabat), Rachid Ghrir (Ministère de la recherche scientifique, de la technologie et du développement des compétences, Tunis), Mohamed Benguerna, Yacine Ferfera (CREAD, Alger), Ali El Kenz, Rigas Arvanitis, Roland Waast, IRD. The debates were important and lively.

Evaluation of innovation and uses of research workshop in November 2006 (23 to 25 November in Casablanca);

This was one of the most important meetings for the project. It permitted to gather all participants that had a subject related to innovation and technological development. Presentations were done by: Participants from Tunisia: Yamina Mathlouti, Hatem Mhenni and Samy Mhenni; From Algeria: Mohamed Benguerna and Hocine Khelfaoui. From Lebanon: Jacques Kabbanji; from Jordan : Isam Mustafa ; From Syria : Jameel Alshene ; From Palestinian territories : Imad Khatib. From Morocco : Ilham Laaziz, Sanaa Zebakh, Anass Mahfoudi, Hamid Bouabid, Rajaa Maghrabi, Latifa El khadry, Amine Basri, Youssef Fadil, Mohsinne Semmar, Kamal Mellakh, Noureddine El Aoufi, Latifa El Hadri, Jamal Assad,

Abdelhak Chaidi, Aziza Mokhtari, Mohammed Smani. From France: Rigas Arvanitis, Jacques Gaillard, Roland Waast, Anne-Sophie Boisard, Paolo Pasimeni, Aberraouf Hsaini.

A field-work workshop titled "*Dynamic of research*" in December 2006 (7 to 9 December in Beirut).

This meeting brought together all the persons that had worked on field-work on researchers and on research institutions. From Morocco: Jillali El Adnani, Mohamed Janjar; From Algeria: Assia Guedjali, Mohamed Benguerna; From Tunisia: Chiraz Ghozzi-Nékhili; From Egyt: Sarah Benefissa, Karim Al-Chazli, Abdel El Alim Mohamed. From Syria (but couldn't come because of visa issues): Hassan Abbas, Maher Charif, Louma Saman. From Jordan: Nedal Ouran, Arda Dergarabedian. From Lebanon; Mouin Hamze inaugurated the meeting; Jacques Kabbanji, Ali Moussaoui, Joseph Bechara, Franck Mermier, Eksa Zakhia, Moheb Nader Chanesaz, Sari Hanafi, From IRD : Roland Waast, Ali El Kenz, Pénélope Larzilliere, Jacques Gaillard, Pier-Luigi Rossi, Rigas Arvanitis, Anne-Sophie Boisard.

Joint ASBIMED-ESTIME meeting

It took place in Barcelona in October 2005. This meeting has been instrumental in advancing both projects and fulfilling a work package assignment: the creation of a structure on which observatories could rely upon. The end result was the MIRA INCONET project.

Reporting

Reporting has been asked to local teams and the core teams early in the project with the main objective of publishing the intermediate reports on the web-site for circulation of the information. This activity has nonetheless been the most difficult to assure. A special reflections text has been written by the coordinator on the working of the project and the dissemination of the information inside and outside of the project.[2] The reporting scheme was to gather the field work material, discuss the material, draft the country reports, which integrates and summarizes the background material and summarize discussions.

It appears that our reporting difficulties are common to collaborative projects (Cornu 2004): reporting is always delegated to someone else inside the project and the coordination has to be both referee and player, an uncomfortable position. Moreover, the intense communication activity of the project[3] shows the strong needs in terms of coordination and explanations. Due to the complexity of the project, the reporting activity has been underestimated and intermediate reports versions have been insufficiently discussed. In part, the coordination and the author of this final report think that the difficulties are due to the novelty of the domain.

[2] Dionigi, Olivier, Anne-Sophie Boisard et Rigas Arvanitis (2007). La collaboration dans les projets de recherche (version préliminaire, v.6), IRD. Coordination du Projet ESTIME: 11 pp. (Juillet 2007).

[3] over 2,500 electronic mails have been exchanged between the coordination and the teams.

Co-ordination with ASBIMED

As part of the project dynamic, it has been found that it was necessary to co-ordinated activities with the ASBIMED project. A joint meeting took place in Barcelona in October 2005. The meeting permitted to highlight common difficulties and help the ASBIMED project by proposing a common fieldwork base from the ESTIME project. Also, many discussions took place between the two coordinating teams.

Design of a new project: MIRA, an INCO-NET devised as the pursuance of the monitoring and assessment activity of science, technology and innovation

The ESTIME workplan had a work package (WP14) dedicated to writing a follow-up proposal for ESTIME based on the idea of creating a network of observatories in the Mediterranean region on Science and technology. The end result of this activity has been the writing of an INCONET proposal with the coordinator of ASBIMED. The proposal has been evaluated positively and is now already funded.

In many countries initiatives have been taken in order to create observatories of science and technology. In the ESTIME countries, Tunisia (ONST), Jordan (inside HCST) and Lebanon (as part of CNRS activities) have been actively pursuing this task. Syria in the newly created Higher Commission for Scientific Research has been undertaking a survey of scientific research. Statistics on S&T are still not a routine activity in any of these countries and reporting to UNESCO's Institute of Statistics is still not common practice. ESCWA (from UN system) has planned a regional initiative in the Middle East (with main contribution from Lebanon and Jordan) in order to create such a network; the initiative has been interrupted.

The **MIRA** INCONET contains a work package specifically oriented toward creating a EU-Med countries observatory. The proposal states: "The observatory of S&T will be geared toward understanding the state of research and technological cooperation between the EU and the MPC. It will focus on the establishment of standard indicators for these purposes, to be used for the MoCo to support their recommendations. It will maintain a database on scientific production of the cooperation. It will engage in analysis of the dynamics of research system."

3 Conclusions of the project

The main result of ESTIME was to create a network of specialized personnel, a task that needs to be consolidated by follow-up studies and through the MIRA project. It has also been to accompany the policy work by proposing methods and ways to implement them and to promote the discussion on science and technology and science policy making. Some of the general results are presented below.

A large diversity of countries

It should be noted that ESTIME countries have an Arab heritage in common but are very diverse in size, wealth, administrative organization, geography and history. It is therefore difficult to have general *common* results. Great care should be taken when making generalizations about the "Arab world" or the

"Mediterranean countries". The EU policy has created a common interest but the countries respond to it differently and according to their own needs and characteristics. It should be noted that all participants in the project insisted on their specificities more that their common history. This delicate point can be dealt pragmatically by showing data and analysis that highlights the specific organization for each country. The common features can be easily grasped in three tables: population, GDP and schooling rates.

The first common feature is that these countries have a rather low population density. This common feature is related to the special geographic and ecological environment of the South and East-Mediterranean region.

Table 2. Population data

Country	***Pop 10^6 inhabitants***	***Inhab./km^2***
Algeria	33,8	13
Egypt	78,8	75
Jordan	5,2	56
Lebanon	3,8	360
Morocco	33,7	75
Syria	19	93
Tunisia	9,9	64

The socio-economic indicators show a second common feature: the ESTIME set of countries should be located in middle-income developing countries, with the exception of Lebanon and to a lesser degree these countries are low in the ranking of the Human Development Index. Remarkably, the eight countries of the project are more or less in the same range.

Table 3. Socio-economic indicators

Country	***GDP per capita US $ (rank)***	***GDP per capita US $ PPA (rank)***	***Rank HDI***
Algeria	1930 (112)	5930 (103)	103
Egypt	1390 (126)	3940 (132)	119
Jordan	1850 (116)	4290 (129)	90
Lebanon	4040 (81)	4840 (124)	81
Morocco	1310 (128)	3940 (132)	124
Syria	1160 (130)	3430 (138)	106
Tunisia	2240 (126)	6850 (92)	89

As it was repeatedly mentioned in the Arab Human Development report (UNDP) one crucial social difficulty in these countries is the low level of literacy and low schooling rates. Morocco has had among the worst schooling rates since many years: it is a difficult question that has been the topic of many official and academic studies and to a large extent the actual policy aims at increasing the literacy and schooling rates particularly in the primary schools. Again, Lebanon is an exception with a larger portion of students who attend school. Another well known exception, are the Palestinians whose level of literacy, attendance to school and educational degrees are much higher that other Arab countries to which they are usually compared.

Table 4. Education and literacy

Country	*% literate adults*	*% literate young (15-24)*	*% Students / pop that can attend*
Algeria	70	90	20%
Egypt	71	85	29%
Jordan	90	99	35%
Lebanon	-	-	48%
Morocco	52	70	11%
Syria	80	92	34%
Tunisia	74	94	26%

A large variety of institutional settings

Some general questions on the national research system

The concept of « National research systems » is the product of economic analysis and the national accounting systems. In this sense, science indicators have always been related to national public economic policies (Godin 2005). Because of this relation, science and technology indicators have been mainly oriented toward understanding inputs dedicated to research. The main figure has been the proportion of expenses dedicated to R&D as related to the National Gross Product (GDP). It is called Gross Expenditure on R&D (GERD). This figure is more difficult to obtain than it would be assumed since it is based on an assessment of the financial resources of public and private sector institutions. This assessment is difficult to obtain and involves a budget analysis that could permit to differentiate what is dedicated to R&D and what is dedicated to other tasks inside universities and other public institutions. Also, estimates for investment, extra-mural resources, and inclusion of taxes for instance, are difficult questions that explain the lack of easy and clear-cut methods for such an estimate. In the Mediterranean countries these difficulties are highly critical since research is rarely identified as such either in University budgets or in public institutions. An exception has been the budget of research inside the budget of the Ministry of Education in Morocco. This research budget is not “hidden” inside the ministry’s budget but appears and is discussed as such in the parliament. In this case the research budget does not cover the public resources from the technical ministries (agriculture, mines, industry, etc.).

Another difficulty has also some importance in the case of developing countries: the distinction between R&D activities and S&T activities. R&D is part of S&T activities and it is usually recommended that 10% of scientists and engineers involved in scientific and technological tasks should be considered doing R&D tasks. All other task covering 90% of the S&T personnel would include, management, funding activities, organization, control, education, meetings, as well as market development and more generally speaking diffusion activities. These are usually not considered as part of R&D, but are essential for it. Arguably, R&D is also not the main activity in acquiring a technology: technological adaptation of products and processes, management and negotiation of technology transfers agreements, training and adaptation of processes, copy and design of delivery systems are all very crucial aspects in the acquisition of capabilities of a developing economy.

These cautionary notes seem important to underline in a project whose aim is to gather the S&T indicators of a variety of countries. Nonetheless, the most difficult task continues to be the comparability of data. This is why, whatever definition is adopted for the specific indicators, it is important to create a consensus on the definition, and use of the indicators.

The institutional settings

We have been witnessing a large array of institutional settings in the countries of the project. It might be of some use to make the following distinctions. In most countries, one observes the existence of a unique authority in charge of research at a high governmental level. This authority can be either

- A Direction of Research (or "research and technology") inside a larger Ministry of Higher Education and a collection of "technical" ministries (industry, agriculture, health, communications, transportation, etc.) that act autonomously (Algeria, Morocco, Tunisia).

- Or, a coordinating body at inter-ministerial level, not related directly to higher education, coordinating both technical ministries and research as exercised in universities. In this case, technical Ministries are in charge of mission-oriented research institutes (Lebanon, Jordan, Syria).

The tendency in Maghreb countries is the existence of a large Ministry that includes research and higher education, rather than the previously autonomous research-oriented department or "secretariat d'état" clearly separated from higher education. The position of the research authority either inside Higher education or autonomous from Education is not dealt on the basis of efficiency considerations but of political arrangements that are related to the political choices of the government. Repeatedly we have been told in interviews that the grouping of research under a larger Ministry of Higher Education is not a satisfactory solution, because less importance is given to research as compared to higher education (notably so in budgetary negotiations). It has also to do with the level of acceptance of research by the government. Finally, research inside the higher education (or education) ministry disconnects public research from the innovation policy. These considerations are the product of discussions in the specific case of Maghreb countries rather than the Middle-East countries where research is under the umbrella of a coordinating authority.

Another issue is the type of funding. More and more funding is distributed along competitive lines by having calls for offers and asking the research teams to respond. This is clearly different from having a credit line in the state budget for each public research institute or university. More often than not, the governments adopt a median way. Nonetheless, the principal difficulty is in having the governments to accept that they need a budgetary line dedicated to research, whatever can be the form of distribution of the funds.

Historical variety

A glance at some historical highlights is enough to persuade the readers of the variety of circumstances and institutional histories we deal with. There is no unique way of doing research and of including it either in specific institutes or in universities. The main characteristics of the institutional set-up are product of history. Lebanon, Syria and Egypt have had the oldest teaching and academic institutions. In the Maghreb countries only Algeria had a real colonial university.

The colonial past has not affected in the same way all the countries but a fact is common to all: research institutes are the product of independence. This explains the late appearance of research institutes in Jordan, the absence of such institutes in Palestinian Territories. Whenever such institutes existed before independence they had a hard time reconverting to the missions of an independent state.

The very difficult story of the modernization of Algeria is a good example of an extreme case of this difficult path from dependency to independence. Research was always part of a National project everywhere in the world: Arab countries are no exception and it also explains both the difficult appearance of research institutes and the necessity to consolidate them as part of the state's policy.

Apart from that common feature, the historical variety is very large. Specialists of the history of modern sciences would certainly not dare to draw generalisations in the view of the variety one can observe in the countries of the project.

Table 5. First research institutions

Country	***Universities***	***Research institutes***
Algeria	Algiers: 1909 (1857)	Obs. Astronomique: 1880 Inst. Pasteur: 1894
Egypt	Cairo: 1925 (1908) American University of Cairo: 1919	National Research Center: 1929
Jordan	Jordan: 1962	National Center for Agricultural Research and technology Transfer: 1951
Lebanon	American University of Beirut: 1920 (1866) Université Saint-Joseph: 1875	Ksara Observatory: 1920
Morocco	Mohamed V, Rabat: 1959	Labo d'Hygiène / ISC: 1914
Palestine	First institutions in the seventies (first Palestinian doctors trained in Germany in the thirties)	
Syria	Damascus: 1903	
Tunisia	Tunis: 1959	Inst. de Carthage: 1893

Growing funds for research

The data on budget funding, as we just mentioned above, are difficult to obtain and interpret. Moreover they are difficult to compare as the perimeter of budgets is different in each country. Figures were unavailable for Syria, Palestinian Territories and Lebanon. In Lebanon, ESTIME accomplished a very intense effort to present an estimate which can be considered as reasonably sound. This effort in Lebanon will be continued in the newly created Lebanese Observatory for Science, Technology indicators (LORDI).

The data gathered by ESTIME in the last two years are reported in relation to GDP. This table to the best of our knowledge is unique in the sense that no one has intended to make comparison of budgetary data in the Med countries.[4]

In the late nineties we can see that the efforts for financing research has been very low, ranging from 0,20% to 0,40% of GDP. The figures have grown in year 2005 from a low 0,20% (Algeria, Lebanon) to a high 1% (Tunisia).

Algeria has witnessed a stagnation of its figure after a strong growth, mainly because of a very recent stagnation of its S&T budget which corresponds to the changing of framework law. Jordan seemingly is also on a stagnating path. After the fieldwork, it appears that this might not be the case since new budgetary funds have appeared that supplement the budgetary scheme which was used until 2004. It is also impossible to estimate a pattern for Lebanon other than a high growth after the war. Nonetheless, budgets have increased steadily. For the first time since many years, the government will authorize to hire new research personnel in the CNRS this year (2007) or in year 2008. Syria, has increased its university research budgets in 2003/2004. The agricultural and environmental research has probably also increased after the new law on research. Morocco consolidated its science budget since the first years of the new millennium reaching 0.8% of the GDP in 2004.

Tunisia is the only country that claims having accessed the 1% of GDP and has declared it wants to attain an objective of 1.25% of GDP for 2009. Morocco is probably heading towards the 1%. Of course these figures would appear little if compared to Sweden (nearly 4%), Japan (3%) or France (little more than 2%). The EU as a whole is around 2% of the GDP dedicated to R&D. Nevertheless the general trend is a growing financing for R&D in all countries.

Table 6. 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	--	--	(half million USD research fund to be released)
Syria	--	(?)	(?)
Tunisia	0,43	0,53	1,00

We also witness a large diversification of budgetary sources. In Tunisia, the share of public expenditure is relatively slowing down and the share of private funding is increasing. In Morocco we found a clear growth of private funds jumping from 6%

[4] We know of little cases where such effort is done. See for example Pardey, Philippe G. and Beintema, Nienke M. (2001) 'Slow Magic. Agricultural R&D a Century After Mendel', in (Washington,D.C.: Agricultural Science and Technology Indicators Initiative, International Food Policy Research Institute (IFPRI)). Report of the Agricultural Science and Technology Indicators Initiative, International Food Policy Research Institute (IFPRI).

in 1998 to 12.3% in 2003. In Lebanon, the diversification of funding sources is very visible in some institutions such as the American University of Beirut or the Institute for agricultural research (IRAL). Finally, universities in some countries have created a direction for research with specific funding mechanisms (Lebanon, Palestinian territories and Syria).

A recurrent problem is the limited capacity of the research system to absorb more funding. Algeria, Tunisia and Lebanon funding figures show a large portion of the budget which is dedicated to R&D that is not spent on time or that is not distributed because of lack of specific structures to manage, distribute and report on this budget. In that sense, it appears that increasing funding per se is not sufficient if it is not accompanied by some structural measures that would permit to enhance the capabilities of the country to absorb more research both in management terms and quantity of research activity.

Finally, because of this lack of growth it seems that specific funding mechanisms based on calls for offers can become inefficient after some time because the research population is unable to generate and perform more projects. This has been the case of funding schemes like CEDRE programmes between France and Lebanon or similar national funding schemes that were distributing funds through call for offers.

Table 7. Data from UNESCO Institute for Statistics - Data Centre 2006

	Researchers per 1 million inhabitants	***Expenditure on R&D as a % of GDP***	***Reference year***
Algeria	170	0,2	2004
Morocco	166 *	0,7	2003
Tunisia	492 *	1,0	2005
Jordan	280 *	0,3	2005
Lebanon	200 *	0,2	2006
Syria	...	...	
Palestinian T	...	...	
South Africa	379	0,9	2004
Thailand	287	0,3	2003/2004
Chile	833	0,7	2004

* Data from the ESTIME project intermediate reports.

Human resources

As can be seen in this table the figures on human resources are also very difficult to compute and to gather. Overall, as computed in relation to the population of each country, we see a small population dedicated to research with the notable exception of Tunisia. A large country like South Africa has around 18 000 researchers – a figure similar to a small European country like Greece. In large countries (see table 9), the proportion is similar to the one in Tunisia and only Jordan approximates a similar proportion of researchers in the total population.

Table 8. Estimates on FTE 2005 All countries of the project

Pays	*individuals*	*FTE*	*FTE/ 10^6 hab*
Algeria	12 000 professors-researchers (« enseignants-chercheurs) 1 400 researchers How many doctoral students?	5 000 (?)	156
Jordan	42 151 (out of which 15 800 scientists and engineers and 62% university personnel)	1 464	280
Lebanon	13 770 university teachers 316 researchers, engineers and technicians	724	178
Morocco	14 616 professors 2 900 researchers +8 000 doctoral students	5 000	166
Tunisia	25 445 persons out of 758 full time researchers and 9 723 third cycle students (Master + Phd level)	14 650	492

Note: The inclusion of doctoral students changes very importantly the data on FTE since they declare 100% of their time on research. Morocco would be 433 FTE/million inhabitants (instead of 166) and Tunisia would be 1465 (instead of 492).

These small figures are only a part of the story. In particular, as we show in the table, there is confusion between the university teaching activities and research activities. Apart from relatively few research institutions, most research is located in academic environments where research personnel are also teaching personnel. Also, doctoral students have a high level of participation in research and Tunisia is counting them as part of research personnel when they work in one of the research labs/units that are evaluated as being research labs. This large array of possible status of research personnel is making difficult comparisons over time and across countries.

There has probably been a growth in research personnel – except some very particular situations – in all countries of the project (we have no data on Egypt on this aspect). It is this dynamism that we wish to underline since it is very characteristic of the situation today.

Table 9. Researchers (FTE) in a choice of countries

Country	*Total FTE 2005*	*FTE/ 10^6 inhabitants*
Thailand	18 114	287
Mexico	33 484	312
South Africa	17 915	381
Turkey	33 876	451
China	926 252	696
Argentina	31 868	817
Chile	13 427	833
Greece	17 024	1 547
Poland	62 162	1 593
Portugal	21 003	1 981
Spain	109 753	2 438
France	200 064	3 126
Sweden	54 041	6 000

* Year 2003 for Thailand..

A relatively small participation in the global production …

Another way to measure the size of the scientific community is to examine the scientific production in the international databases. The ESTIME project has made a considerable effort in getting acceptable figures based on the Science Citation Index database or the PASCAL French multidisciplinary database. Today we believe that these figures are better indicators of the rate of growth and size of the scientific research than input figures.

The following table 10 gives the figures based on SCI database after isolating the production on the address field of each record. Figures 1 and 2 show the evolution over time. Figure three compares Egypt and two “control group” countries: South Africa (largest African producer) and Thailand (quickest growth in Asia).

Table 10. Total publication production scores (2006) and world shares (2004)

	Morocco	*Algeria*	*Tunisia*	*Egypt*	*Jordan*	*Lebanon*	*Syria*	*Chile*	*Thai*	*South Africa*
Scores SCI 2006 (+)	756	728	1079	2743	421 *	481 *	146 *	2972 *	2235 *	3330
‰ World shares 2004(++)	1.26	0,73	1.08	3.42	0.69	0.48	0.16	3.04	2.43	4.64

Sources : SCI 2006 ou * SCI 2005. Non expanded. Integer counts. (+) Calculation P.L. Rossi / IRD; (++)Calculation OST.

As can be seen, even if this participation to world science is limited in quantity, it gives these countries a good position in Africa. After South Africa, Egypt and Tunisia then Morocco closely followed by Algeria, have a good record of publications. Apart from Syria, smaller players like Lebanon and Jordan have also an honourable record of publications. The Gulf countries or Saudi Arabia are also close in terms of quantities of production. (Iran is shown here because it belongs to the larger MENA definition).

What may be stressed is that some countries like Thailand, Chile, and South Africa (ZAF) have a rather best record mainly because they have had a permanent effort in education, S&T as well as today an innovation-oriented effort.

Figure 1. Evolution of the scientific production of Maghreb countries

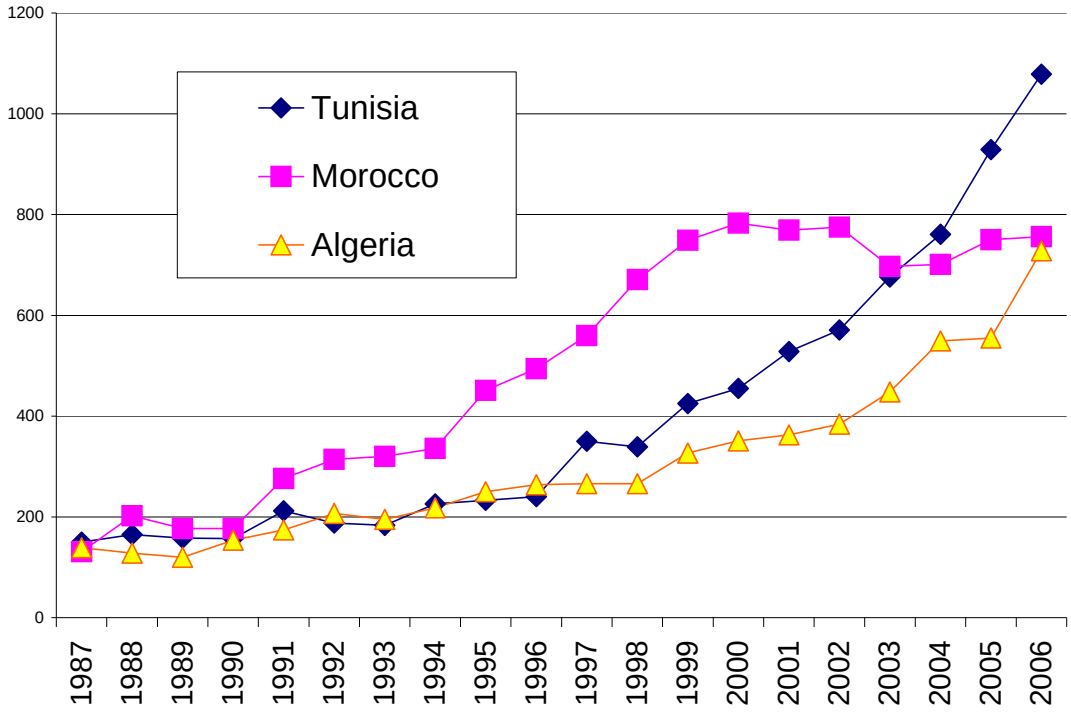


Figure 2. Evolution of the scientific production of Middle-East countries

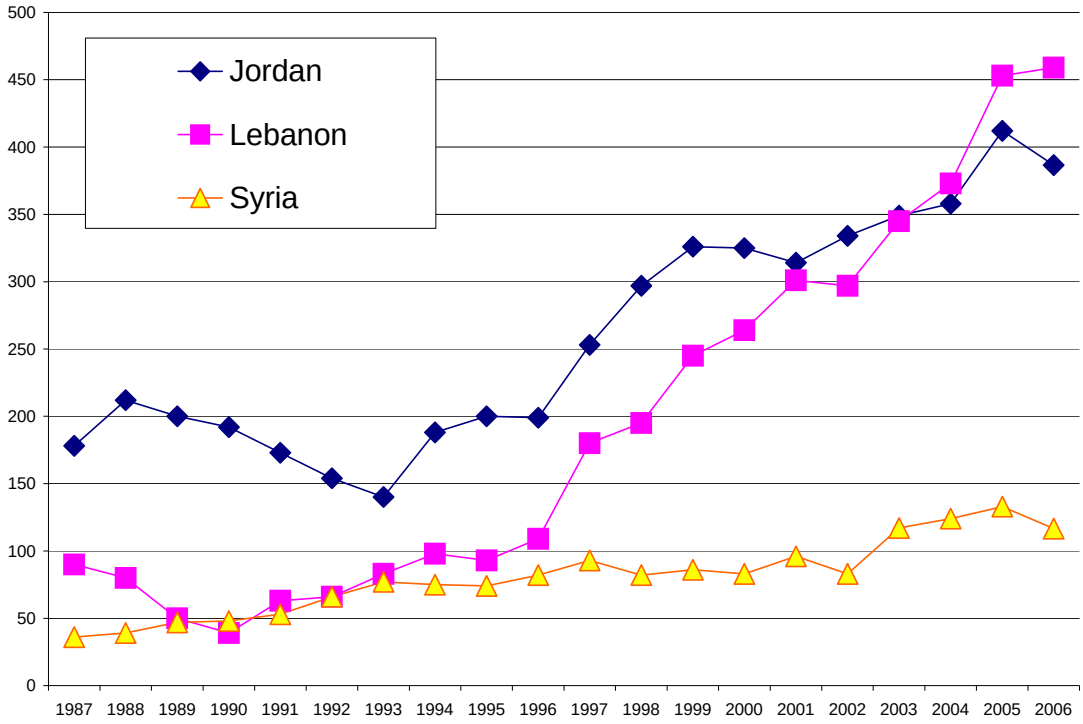
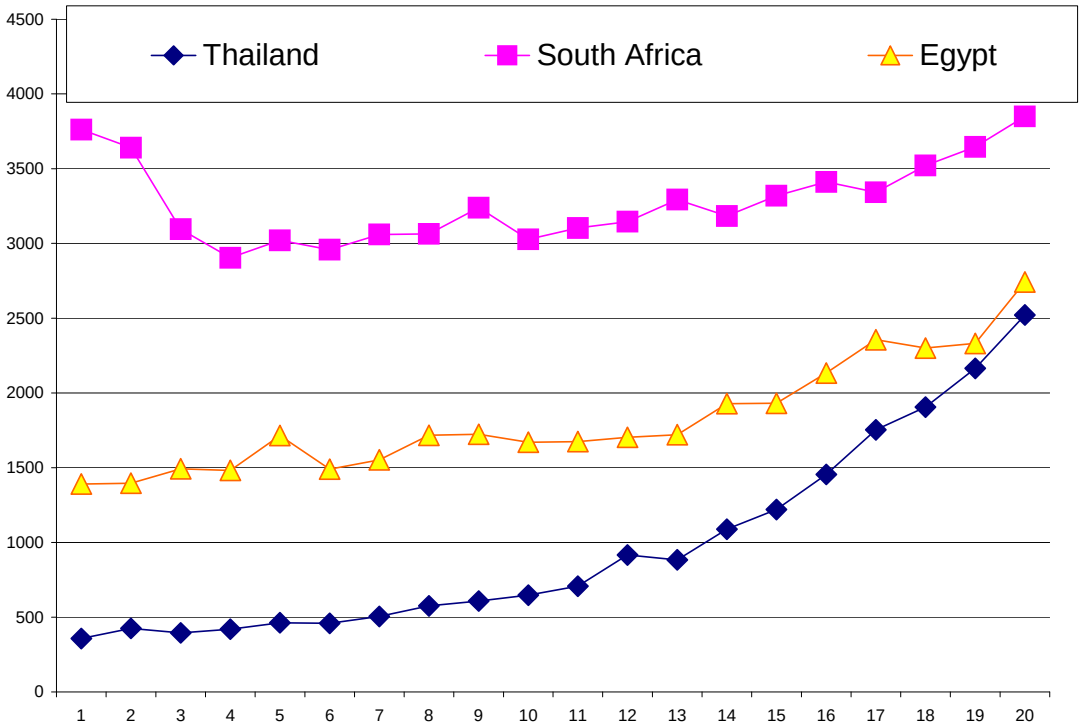


Figure 3. Evolution of the scientific production of Egypt and two comparable countries



… but a growing and dynamic production

What is very reassuring is the fact that the growth pattern in the last twenty years is dramatic and impressive (see figures 1 to 3). Their growth rates are always above the world growth of publications and comparable to the three countries chosen as "control group" (Chile, Thailand and South Africa). The whole region was still invisible to computation some twenty years ago and represents today nearly 1% of world production. The main cause for this growth is the extremely strong growth of Maghreb countries. Morocco has had a previously stronger and longer growth period which does not appear in this table.

Table 11. Growth of publication production – 2001-2006 and of world shares

	Morocco	*Algeria*	*Tunisia*	*Egypt*	*Jordan*	*Lebanon*	*Syria*	*Chile*	*Thai*	*South Africa*
Growth 2001-2006 (+)	0.98	2.0	2.05	1.23	1.60	1.35	1.33	1.75	1.85	1.16
Growth of World shares 1999-2004 (++)	4	48	63	14	17	49	1			
Growth of World shares 1993-2004 (++)	100	89	125	5	94	250	18			

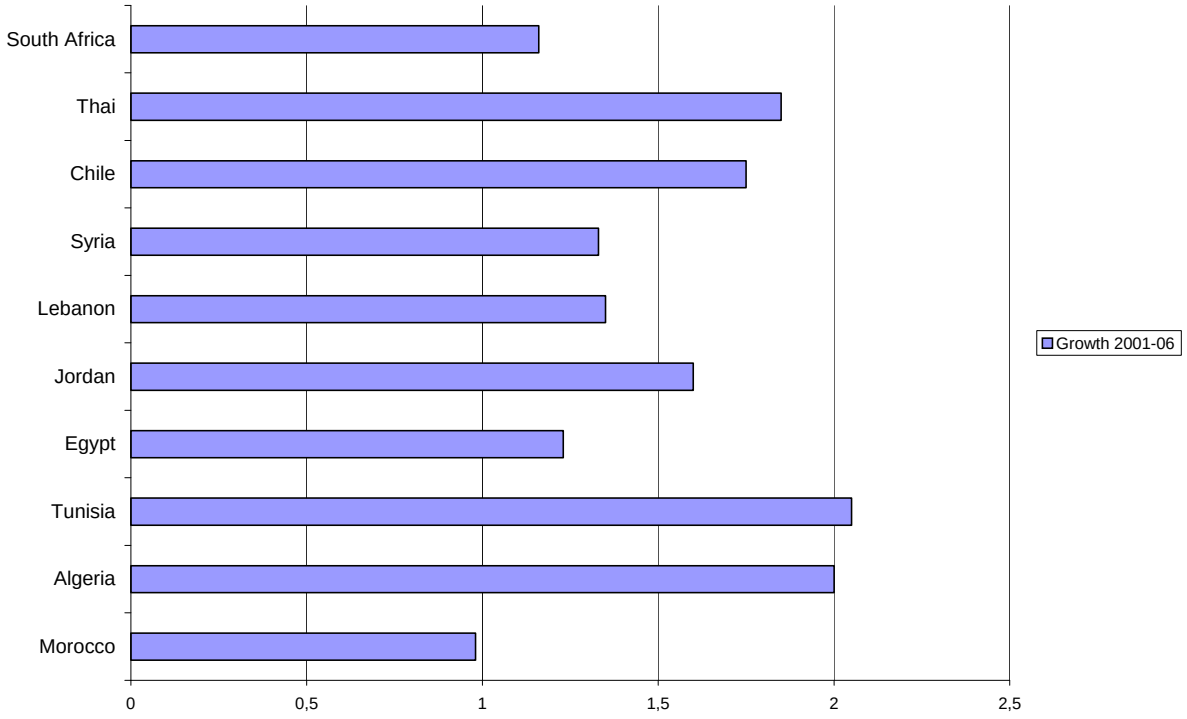
Sources : SCI Non expanded-2006. Integer counts. (+) Calculation P.L. Rossi / IRD; (++)Calculation OST.

These figures are also very sensible to political influences: Algeria practically stopped its progress between 1988 and 1994. Lebanon had no production during the war period and until 1995. Jordan production has been subject to the effects of the first Gulf war. Less dramatically, Morocco after a very strong and decided priority given to research between 1998 and 2003 saw its production stabilize and even decline. The policy that was promised to all researchers is long to come by, the status of researchers has not been approved, universities decide of their own course in a less ordered and rapid manner than when the reform policy for universities was launched. Syria has still not reaped the fruits of a policy change that was only defined with a new law in 2005 and the creation of the higher council for research in 2006. Finally, only Tunisia has been constant in its support to research and technology and inventive in the manners it can consolidated research and finance it. The figures of growth are here very impressive and difficult to object since bibliometric data are largely more objective measures than figures produced by actors themselves.

On the whole, the research systems in Maghreb countries are real and autonomous even when the state has been less constant or when wars have

ravaged the institutions and societies by and large. Research is now more a professionalized affair which means social status, recognized institutional positions and mechanisms, the respect of a minimum academic level, a place for research inside universities and inside the public authorities. Nonetheless, the lack of specific policies seems to affect research very heavily.

Figure 4. Growth rates 2001-2006



International Collaboration

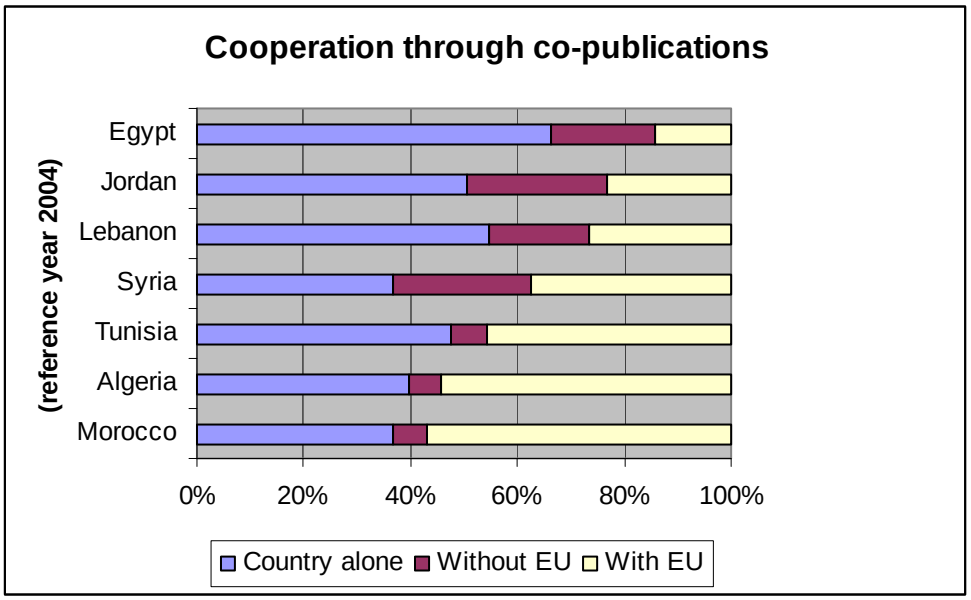
S&T activities everywhere in the world are more international. The degree of internationalization can be measured by co-authors in scientific publications. In 2004, SCI reports 25% of scientific publications with authors from at least two different countries (8% in 1988).

International collaboration is also increasing in the region, as it was also indicated by the ASBIMED project. This last project studied the bi-lateral cooperation programmes between Europe and the Med countries. Most of these schemes were “based on spontaneous proposals by the stakeholders, which in their large majority come from academia” (p.12, Final Report). Moreover, ASBIMED found little if no correlation between the number of bi-lateral cooperation programmes and co-publications. The authors speculate on the reasons for this lack of correlations that it comes from the very formulation of the cooperation agreements. In most cases, cooperation agreements are quite large in scope and particular researchers included under these schemes of collaboration do not necessarily report under one unique heading.

Most importantly co-authorships patterns are very different from one country to the other. Egypt (with 32% of co-publications), and Jordan (37%) have, in relative terms, less co-publications with a foreign country; Lebanon (48%) and Tunisia (49%) - which both have many co-publications with France - are less “open” in

relative terms then Morocco (60%) and Algeria (65%).[5] Details can be found for each country and each discipline in the OST country leaflets.

Figure 5. Cooperation through co-publications



Source SCI/Thomson, Calculations: P.L. Rossi/IRD

A very peculiar type of specialisation pattern

The Med countries of the ESTIME project all reflect a very particular specialisation pattern. That is, the disciplines in which they publish most in relative terms are mainly in the physical and sciences related matters: physics, chemistry, and engineering. They also favour mathematics, mainly in Maghreb and Lebanon. And, by contrast they also under-publish notably in life sciences: biology, bio-medicine. There are variations around this pattern: Egypt and Algeria have an overspecialization, the first in chemistry and engineering the latter in physics and engineering. Morocco and Tunisia share the same smoother specialization pattern. Jordan and Syria give some more space to environmental and life sciences; or medical research in Lebanon.

In all these countries sub-disciplines related to basic biological research are under-rated: general biology, biochemistry, cellular and molecular biology, immunology are all very low; the same is true with some sub-disciplines of bio-medicine like oncology, haematology and endocrinology. Algeria has also some very strong teams publishing on informatics, opto-electronics, and electronic data processing. Algeria and Jordan share also a specialization in chemical engineering and polymers. Pharmacology is strong in Egypt, Jordan and Morocco. Some vegetal biology is visible in Morocco, animal production in Tunisia, nutrition and agro-alimentary sciences in Egypt. Jordan and Syria have some strong production in agricultural sciences and ecology (the Syrian

[5] Figures of co-publications in the text relate to SCI 2001 (OST figures based upon fractional counts).

specialization may be an artefact due to the presence of ICARDA an international agricultural research institute). Lebanon has some strong points in health sciences: cardiology, biological engineering, and public health. On the contrary, Egypt is under-specialized in all health-related domains.

Moreover, the evolution of these specializations over time shows that the acquired positions are consolidated: the countries reinforce their specialization over time rather than diversify the disciplines.

Quality of production

Quality is better measured by impact factors – that is the proportion of received citations –than by the degree of specialization or the volume of production. Although this measure has limitations in the form of computing, and in the way it is used (Moed 2002; Monastersky 2005), at a general country level, it is a good proxy for the acceptance of scientific work by peers (OST 2007).

The impact factor of Mediterranean countries (0.25) is relatively low: three to four times less than publications of central scientific countries. It is also lower than Latino American production (Chile: mean impact factor 0.5) or some other developing countries (Thailand, South Africa: impact 0.5). There is no large variation of the impact factor in the eight countries for which gathered the data: Egypt is a minimum of 0.20 and Morocco: 0.23).

Another striking feature is that the high impact factor is not systematically related to the specialization fields. In effect, by looking at the production by fields and impact factor of the country in these fields there is no direct relation between these two figures. The reasons of this absence of relation should be investigated further since it demonstrates both specificities of the field worldwide and the participation of the country in the field. In any case, specialization should be kept as a better indicator of the trend of research. The evolution of this specialization should be looked at very cautiously (as is suggested by the shift-and-share analysis proposed by the micro-bibliometric analysis).

It is important to underline that impact factor is not the only way to assess quality; neither is it the best one. It depends enormously on the journals and the publishing habits of the scientific community. In effect, a scientific community is dependent upon the creation of common public places where it can diffuse and discuss its research results. This is why the journals are so important as well as the creation of scientific professional association, the creation of regular meetings and the creation and maintenance of collaboration networks.

Interviews with researchers, apart from institutional difficulties, mention an important activity in international collaboration and a deficit in terms of creating meeting areas in the Arab countries. Researchers try to keep up with the best science which they consider is located outside the frontiers of their country and contribute to nurturing the future researchers. The most difficult aspect in their everyday life, they declare, is assuring this link between the needs expressed in the country and the resources and diffusion means located outside their country. International collaboration, in this sense is a manner to resolve this ambiguity by being inserted in international research networks that recognize their role locally.

Follow-up tools : the institutional scoreboard

We have created a table of publication production that summarizes in two pages (sciences of matter; life sciences) that lists 100 sub-specialties and around thirty institutions (or type of institutions) that we have coded in the bibliometric database. We call this table the institutional scoreboard. It permits to have in a whole view the contribution of a specific institution to a particular sub-discipline. In Morocco, for instance, we found that Universities were the main contributors in a large variety of domains, we could name specific schools and institutes that were strong contributors in domains like information technologies, civil engineering, soil sciences, agro-alimentary sciences) and the contribution of specific enterprises in limited areas. What is important here is the position of the institutions in a fine grained categorization of sub-disciplines that gives better information than the production by large disciplinary distribution.

The same table or institutional scoreboard can contain in each cell instead of the contribution the evolution from one period to another. This progress scoreboard can give surprising results: we could for example see that new universities have risen in an un-expected way entering rapidly in some specific domains. Some domains weren't even in the eye of local authorities: soil sciences in the small and new university of El Jadida, information technologies in the School of Engineering (EST) of Fez, energetic engineering in Marrakech. In the same vein we could observe evolutions in the progress tables that were practically invisible in the larger specialities: Egypt was decreasing its participation in practically all sub-specialties in agricultural sciences and biology; Tunisia was increasing in all medical areas; or the diminishing production in otherwise strong specialities, like pharmacology in Morocco and Jordan like earth sciences, construction, information technologies in Morocco.

Innovation policy

Innovation policies in Med countries can be gathered under the following headings:

1. Catching-up of industry (in French "*Mise à niveau*"), what the project has named "learning of industry" in its methodological notes. These policies have been the backbone of "innovation" policy. Practically all the measures supporting technology in enterprises have been produced inside these programmes, many of which have been supported financially by the European Union.
2. Technical linkages with research centres, technical centres, innovation centres, experimentation platforms, and the like. This is the newest form of support of innovation.
3. Orienting individual researchers toward more applied projects (incentives in universities, promotion and evaluation). Quite rare and sometimes not known from the main target population.
4. Creating specific institutions devoted to innovation or technological innovation.
5. Clustering of industry and support of such clustering.
6. Specific funding and promotion of R&D, venture capital, etc...

7. Publicity, diffusion, sensibilisation of the public on innovation and technology. These are usually addressed to younger people and children. There exist also schemes like the "science weeks" in Jordan and other types of similar programs.

A large variety of these instruments has been used around the Mediterranean basin and each country has built a specific type of institutional arrangements in favour of innovation. Also many incentive schemes have been devised.

Only Morocco and Tunisia have designed what appears to be a complete innovation policy that includes practically all of the above measures. They have also created specific institutions dedicated to the promotion of technology, industrial upgrading, technical training, funding for innovative projects, clustering and technoparks. In all the other countries many initiatives are going on but no coordination between the different entities. Also, non-research entities such as industrial ministries, normalization institutions, patenting offices, banks, funding agencies, industrial development units, numerous "bridging" institutions that create networking between economic actors, and so on, all play a crucial role. This "innovation world" is very much developed in Tunisia and to a lesser extent in Morocco. In these two countries the state is the central actor of this policy.

Algeria has a diversified "innovation world" but seems less dynamic as such. Nonetheless, the enterprises seem very dynamic. In Egypt, innovation is rather the object of non-research oriented ministries. Jordan has numerous bridging institutions and specific support for SMEs. Lebanon strikes because of the absence of any innovation policy although incubators, and a specifically industry related institute exist. In Syria, no innovation entities have been detected even in the Aleppo region where a real industrial growth has been taking place.[6]

Most countries have focused first on creating technology transfer units in universities and high engineering schools. These units have great difficulty in doing their job. Apart from institutional difficulties in the administrative management of technology transfers, enterprises (mainly SMEs) are less likely to address to a university or a technical centre. As a paradox, Tunisia, although its consistent innovation policy has rather put little emphasis on university technology transfer units. This is probably due to its size as well as to the fact that it has eight technical oriented centres that are aimed at reaching the SMEs. In Jordan the centers that depend on the Higher Council have a function of disseminating the more applied work. The institutional reports of every country shed more light on these measures.

The Tunisian innovation policy serves as a good example of a systematic innovation policy which has to take into account the specificities of enterprises and the specific resources locally. The way enterprises use the resources available locally and the way they articulate these resources is essential in the creation of an innovation-oriented industrial world. An additional effort should be made to help enterprises integrate technology, decide to promote R&D and experience their technologies or "technological learning" as it is called in the literature (Arvanitis and Vonortas 2000).

[6] Some of the observations we are making can be verified in Crehant, Patrick and Chaabouni, Reffaat (2004) *Annual Policy Trends Report for MEDA countries: Algeria, Egypt, Jordan, Lebanon, Morocco, Syria, Tunisia* (Bruxelles: European Commission, Entreprise DG Innovation SMEs Programme).

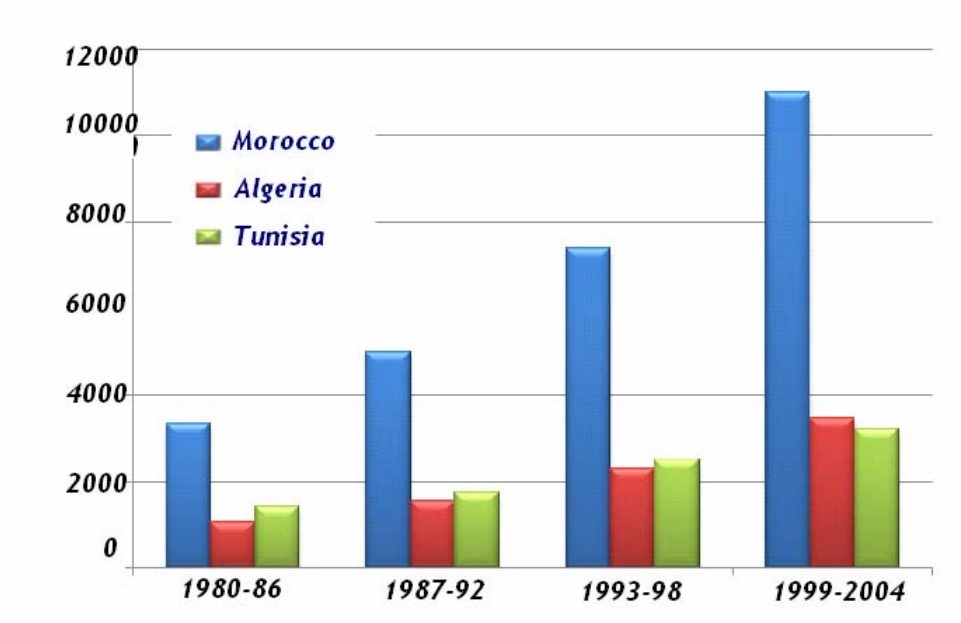
The Tunisian state found that the territory has a grip on the companies and that this rooting of the enterprise in its territory is a major aspect of the economic dynamic. An innovation policy should then be thought in relation to the territory and local administrations. It also means that technoparks should be thought in conjunction with the geographical policies of the State (what in French is known as “Aménagement du territoire”).

The social sciences

ESTIME has tried to evaluate the importance of research in the social sciences. No bibliometric database has been found to be satisfactory for the evaluation of production in the social sciences as in the natural and exact science.[7] After a thorough investigation on various sources of information and publications we chose to exploit one of the largest catalogues of the social and human sciences in the Arabic speaking world: the catalogue of the *Fondation Abdulaziz* in Casablanca[8] which gathered all the production in the social sciences in Maghreb countries. No equivalent exists in other countries.

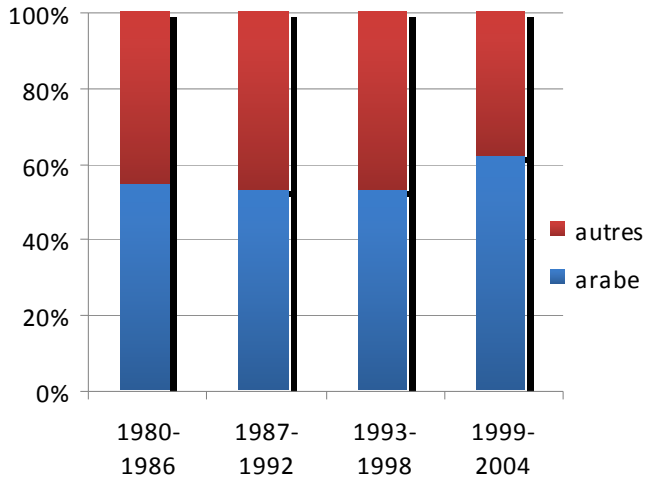
The growing importance of the social sciences (the case of Maghreb countries)

The analysis of the production in the library shows a corpus of more than 100,000 academic publications. The three Maghreb countries of the project are distributed as follows: 35000 references for Morocco, 12.000 for Tunisia and 12,000 for Algeria.

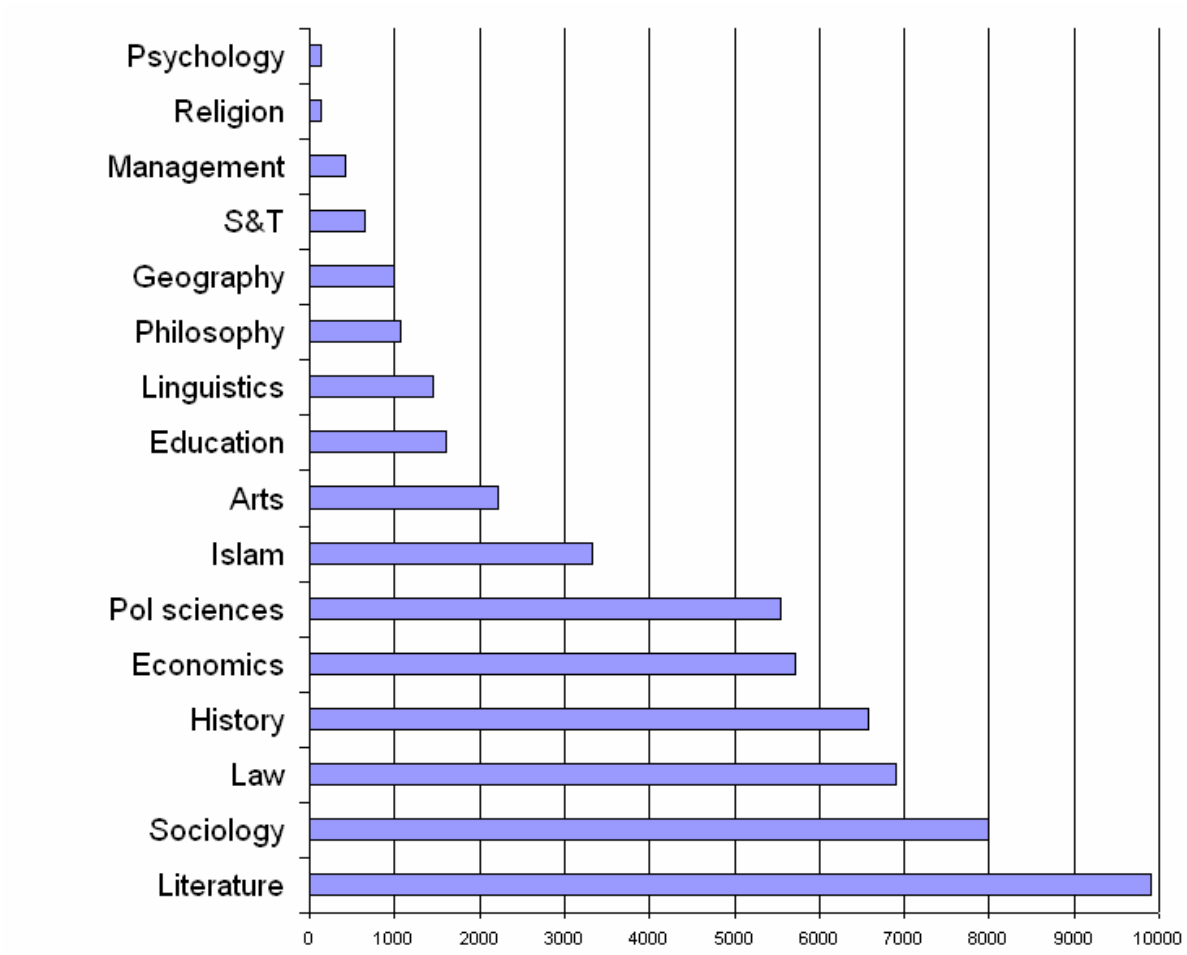


[7] This has to do with the fact that social sciences produce more importantly books rather than articles in journals. Moreover journals that are represented in the large bibliographic databases have strong biases against non-English speaking languages. And they don’t speak Arabic.

[8] A bibliometric database makes choices and defines what the mainstream production is. What is different when choosing a library catalogue is that it is not choosing on the basis of quality criteria but on the interest for its public. But the library of the Fondation Abdulaziz has a research service and has accepted to proceed to a coding that permitted to distinguish the academic from non-academic material.



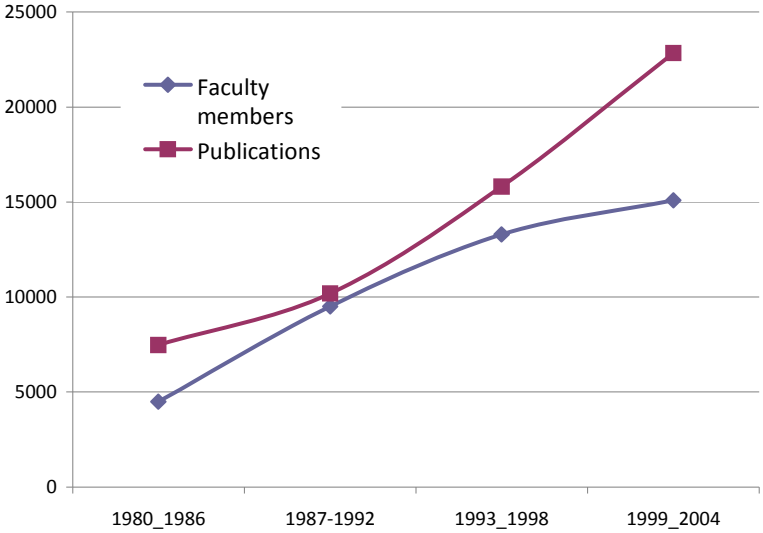
Arabic language accounts for 60% of the production, from a low 50 % in 1980. French is the most common foreign language (33%). In the 34,000 references written by non-Maghreb authors, French accounts for 42 % of the publications, Arabic 20 %, Spanish 20 %, and English 15 %. The distribution by language is very different among the disciplines: Law, Philosophy, History and Literature analysis are mainly in Arabic; Management, Economics, Sociology, Linguistics are publishing less in Arabic. Those disciplines need to go global. In the same way the themes of research that are related to the international agenda and to public policy appear mainly in European language. Cultural themes, education, local history are mainly in Arabic



There are six main disciplines in terms of production: three classical disciplines (literary analysis, law and history) and three “new” disciplines: sociology,

Economic and political sciences. Philosophy and islamology are quite modest disciplines in the academic production.

The growth of production has been strictly following the number of faculty members in universities.



The mean productivity is similar in these three countries, for the same period, around one article every three years. It has grown by a proportion of 20% since 1980 which gives an average annual rate of 0.4% for Algerian, 0.44% for Tunisian and 0.6% for Moroccan social scientists in a period of 21 years. This rate of growth in such a short period (one generation) is reflecting not a quantitative growth of the total number of authors but the growth related to the life span of each individual author.

The Middle Eastern countries

In the Middle East the comparison of Jordan, Syria and Lebanon shows a very different situation from one country to the other.[9] The profile of researchers in Lebanon and Syria seem as two extreme opposites. In Syria, researchers are rather less mobile, staying in their country for both research and teaching activities; publications are also more prone to be restricted to Syrian publishers and journals. In Lebanon, researchers are younger, more mobile (they tend to work in different universities than the one they were originally graduated) and more often than not have an international trajectory. They also tend to publish more easily in foreign journals. Finally, they also have a professional activity that is rather more varied; they are working not only in universities but also in NGOs and consultancy centers very frequently.

Research centres are also rather different: in Syria, practically all research centres are located in public universities with some very notable exceptions (like the centre for Arabic Scientific Heritage in Aleppo), whereas in Jordan and Lebanon the profiles tend to be more varied: NGOs, consultancy centres, semi-public centres, are numerous; in Lebanon, public research centres are practically inexistent. All of the research centres tend to be private. Some disciplines are known to be important and specific to each country: the most famous case is maybe that of political sciences in Egypt. In some cases it is a specific institute that makes the difference like for example the Centre for Strategic Studies of Damascus University.

[9] IFPO (2007) *Répertoire des chercheurs et répertoire des centres de recherche Liban/Syrie/Jordanie. Projet ESTIME*. Beyrouth: Institut Français du Proche-Orient. Août 2007.

NGOs and international organizations play a crucial role in the Middle-East. But this role is also more diversified than might be expected.

Finally, we observe a low level of dissemination of reports and publications in the region. This seems due both to a voluntary confidentiality from part of the authors and of dissemination policy from part of the institutions.

The place of social sciences

Social sciences play a significant role in understanding the political, cultural, religious activities and roots of our world. Globalization has affected in many ways the Med countries and the technocratic promotion of research, science, technology, engineering, and education is insufficient.

Although the social sciences have grown considerably in the last years, no adequate reflection exists on the role that should be given to them. Social sciences are usually not part of science and technology policies. They are usually considered under the aspect of university training. A good example is Jordan which lacks specialized independent research institutes in the fields of social sciences and humanities. The relation between research and teaching, in Jordan suffers from serious problems. It appears to be inefficient and unproductive for reasons which are essentially structural: they relate to the structure of the Jordanian society (for example society does not recognize the individual through accumulated individual accomplishments but rather through affiliation with a group, a clan or an area) and the structure of institutions dedicated to scientific research on the other hand (Jordanian universities tend to focus on teaching and are characterized by strict bureaucracy). This is unfortunately not exceptional.

Research suffers also from other difficulties. To take another example, emigration from Algeria in many cases can be explained today among other things from these stiff bureaucracies that plague the university and which many researchers see as an obstacle to their work. The single most important issue is that research teams are practically inexistent or rare, at best.

Moreover, it appeared clearly from interviews, that an instrumental view of the uses of the social sciences (for example by adding a social science work package in health-related projects or in environmental projects) is clearly necessary but also insufficient. There is a need to create the economic conditions that will absorb the immense quantity of highly trained professionals in the social sciences. This will only be possible if social science specialists not only reflect on their own society but also on the ways they connect to the world and specifically to Europe. In the same way as there is a “Science and society” programme in the EU (in FP7 Capacities programme) there should be a specific programme for Med countries --designed for the Med countries with the support of Med countries experts –on “Science and knowledge in Mediterranean countries”.

This reflection on social sciences is indispensable when one observes that Med countries have been drawn into dramatic political, cultural and social situations. An effort in organizing this reflection, without the traditional esoteric and epistemological debates that usually exist among social scientists, is needed. It should be based on a detailed analysis of the social conditions of training and employment of social scientists and humanities. It should be done by giving material conditions for an intellectual activity that although costs little can reap tremendous results. Such an effort is illustrated by the recent Report of Morocco for the Fifty Years of Independence where a profound analysis and mobilization of intellectuals has been driven, producing one of the most important pieces of social

and political analysis concerning the country. It should be noted that the 50-years anniversary report of Morocco included not only primary education as is common in such type of analysis but also scientific research and technology (Comité directeur (Rapport du Cinquantenaire) 2005).

On the whole, the social sciences appear critical, there role is strategic but they lack real structures, support or organization.

The issues at stake

Diversified institutional arrangements around the State

After reviewing the policies on research and innovation in the Arab countries on the banks of the Mediterranean, we could find no real common institutional pattern, but a limited set of institutional arrangements that were designed back in the early seventies. Most research is done in universities by individual researchers whose careers began by some scholarship or studies in a foreign country. These individuals, depending upon their energy and personal contacts, create labs under difficult conditions in an academic context that promotes mostly university teaching and that recognizes mainly teaching, not research. Next to these academic small teams disseminated in the universities, public research institutions, with exclusive public funding and public civil servants as staff, have been created by the state for the promotion of its own policies, like the modernisation of agriculture or public health services. Public research institutions are rarely related institutionally to the universities. Because of a strong “service” pressure they orient their projects on applied projects which are designed to serve the national priorities defined by the state. University labs, on the other hand, are usually more inventive because they have less stress on the type of work they should do. This overall picture of “academic-plus-public-research” institutions has been designed in the seventies and follows the rules of capacity building that were clearly described by UNESCO and other international organizations. Variations around the Mediterranean find their sources back in some historical peculiarity: for instance Moroccan institutions were mainly designed under French rule; Egyptian Academy of S&T was created on the blueprint of the Soviet Academy of Science; the large variety of universities in Lebanon goes back to the religious community history (and policy) of the country. Nonetheless, the academic-plus-public-research” arrangement is very diverse in its governance, management, recruitment, funding and composition. Thus it is difficult to state some common institutional pattern.

What seems common is that the state is still the main sponsor; budgets are fixed (and low); careers are civil servants’ public careers. The same seems to be true for universities: although they are weighted down by the massive arrival of students, they are basically organised in the same way today as they were when they served a small elite. Because of that, public research laboratories are effectively run in the same way today as twenty years ago as far as funding and recruitment is concerned.

On this common institutional arrangement, the need for coordination appeared as an urgent task. In the last years, coordinating bodies of scientific research have been created and usually consolidated or, in some cases, have been recreated. This has been true for all countries. This coordination task can be found in two largely different models: countries with a coordinating institution that is independent from the performing institutions, mainly in Machreq countries, or countries that join the coordination and heading of research, mainly Maghreb

countries. The French word “tutelle” expresses perfectly this tutelage function of the ministerial body that decides upon budgets both for programmes and salaries. Nonetheless, Ministries are being reorganised periodically: research is sometimes under a large Ministry including higher education and research or, alternatively, research is located inside a more specific ministerial office, but the basic pattern of the tutelage model keeps being one of subordination of funding and governance under the same central Ministry.

In all these countries, regional governorates have practically no say in research policy matters. Public money is distributed under a classic centralized funding mechanism of public institutions. Agencies distributing funds by a competitive process to scientific research projects (“call for offers” or “call for proposals”) are rare around the Mediterranean. The EU has been one of the few new sources for fresh money pouring into research, along with the German Stiffungs, American agencies and some large Japanese or European “research for development” institutions. These international funds, it seems, are vital for research in practically all countries of the ESTIME project.

The only new institutional arrangements that appeared, in the last twenty years, concern technology and not science, as we will show hereafter.

Science is not in the agenda

Is science or technology the prime need for Arab countries under review in this report? It might seem a very anachronistic question.

Curiously enough, although we witness a variety of institutional arrangements these seem to have some common characteristics: first, science has no clear function inside the society; second, public research is not used in a collective way.

Academic institutions are clearly cut from the rest of society. There is a clear frontier rather than a seamless world between knowledge and social use of knowledge. The academic world seems difficult to cross by, closed by some invisible frontier, like a frontier between two countries. For an individual, it is difficult to cross the frontier and it is hard to join them, and become a “citizen of science”. Once inside, it seems even harder to keep up the pace of a research career inside the academic institutions. It is hard to exercise the activities of research (like reading others’ results, publishing, experimenting, going to conferences and meetings) inside the universities and “research” positions do not really exist. When institutions dedicated to research exist, they are not very visible from the outside (with some rare exceptions) and no one really knows what goes inside.

Public research is not used in a collective way. Some research institutions are mobilized by political forces in some opportunities but are rarely integrated in the design of agricultural, industrial, educational or social policies. They seem to have attributed functions but no one can distinguish them from educative purposes. Strategic plans are designed and immediately forgotten, some urgent political matter is always entering the field of realization. Knowledge that is bred inside the research world is not used in a collective and social way. The connexions between the research institutions and the social and economic world are rare and disorderly. In some cases, mainly in agricultural sciences, expertise is entering the fields. But research is usually limited to apply well-known recipes rather than proposing new avenues for production. It is rather a traditional dissemination of known techniques which are named research. The health sector is benefiting little from research where the population serves the laboratories rather than the

laboratories serve the people. Curiously enough that “uselessness” of research does not undermine the respect of professors, researchers or experts who are seen as knowledgeable and stand very high in the social imagery. Individuals do benefit from their position inside the public sphere as professors or researchers, but it is a social standing that has little to do with the content of their knowledge.

Science is definitely not in the agenda for any of these countries. And this is not so because of lack of funding. The absence of recognition for science, which is also translated in pattern of specialisation in engineering fields rather than natural biological and human sciences, gives the impression that knowledge is systematically unrelated to science. On the contrary, technology seems more to be of interest for governments, but also for economic and some social actors (like some very few NGOs). As such, technology is disconnected from the making of science: knowledge is only valued if useful and learning is not a value per se. A clear symptom of this situation is the persistent use of the word “applied research” which, as we know, is a strong commitment to a linear model of research where basic science is really left to its own. It could be claimed that this state of affairs is not harmful to development, since what counts is application of knowledge, wherever that knowledge may come from. We disagree: the consequence for this absence of interest for science is also an absence of interest for some fundamental aspects in research, an absence of collective understanding for science, and an absence of capabilities inside firms and public institutions to grab the inner making of life and matter. In today’s technologies, it is of paramount importance to have a working knowledge of physical, chemical and biological properties of matter and of processes that lie deep inside the physical and biological material used in production. This knowledge –the knowledge we commonly call science– seems unattainable to most engineers in firms or public institutions in the ESTIME countries, because they lack the means of scientific research.

The disappointing engagement of public institutions in supporting technology

“Technology” has not the same meaning everywhere: in firms, it is related to the design and making of already known products and processes. It is related to enhancing the technological learning capabilities of firms. It is dependent upon the experience of technical processes and the acquisition, mastering and maintenance of technology. But at the same time, public institutions devoted to science know really nothing of all these processes related to the business world: the world of science and the world of enterprise are clearly not connected. ON the contrary, individuals are very conscious of this disconnection. They themselves are quite acquainted with the economic world.

They create firms, they buy, operate and maintain equipment, they design products, and processes. They enter the economic game with no real fear. It is not uncommon to learn by pure coincidence that a person who teaches in an engineering school or a university is also part of some firm, or has set up his own firm. In some cases, this goes down to creating small industrial workshop. They are small only because of economic difficulties common to all firms, not because of any impossibility in the abilities of individual to enter in manufacturing and productive activities. And this participation of scientists and engineers to economic activities goes far way beyond the usual consulting companies or the dominance of managerial skills. No state in the Arab world is using any of this activity, a quasi-clandestine activity because it clearly opposes the rules of public civil service.

Technopoles or technological cities are the newest tool of policy promoting "science-and-technology" in the Mediterranean. In the spirit of the eighties, when this policy was conceived, technopoles were supposed to become the living nexus of science and technology, of academia and firms. Innovation was to be bred inside these news institutions which were bringing closely the universities, the engineering schools, the public research institutions and the companies. The European Union has had these policies much in favour and the French speaking countries were fond of technopoles. There was also a grand policy to connect all of these technopoles and business-oriented scientific activities all around the Mediterranean and for some political reason this effort was brought to an end. The results were disappointing although the policy and the financial support were constant. The technopoles now exist, they have been transformed in some cases in specialized industrial clusters or business incubators and they are the siege of local and foreign companies that work in similar industrial activities. These enterprises have been pursuing a strategy of domestic development and have used their presence inside the technopoles as a way to enter not only in the markets but also in the structural aspects of the economy. They also benefit from high-level engineering students who are formed in engineering schools located in these technopoles.

It should be underlined that the "knowledge-based economy" in these countries is *already* there: firms exist that are intensive knowledge users, mainly in the information and computer technologies. R&D already is a reality at least in 10 to 15% of firms and in some sectors up to one-third of them. None of this silent revolution has been in the hands of governments. The initiative came exclusively from engineers and businessmen who are outside academia, outside the public institutions and outside the technical world built-up by the governments. In countries where public-owned enterprises are dominant like in Algeria or Morocco they seem to have undergone the process of technological learning and innovation without the state. We have a paradox: companies belonging to the state that are in demand of support do not obtain any help in any preferential way. Moreover, the government policies committed to free-market are strongly opposed to any intervention in the industrial policy and thus are objectively supporting the activities of importing firms which are clear competitors to the national public-owned companies. The clearest examples of this situation are the cases of SAIDAL, ENIEM, SONELGAZ and SONATRACH in Algeria.

Uses of academic knowledge are thus much more frequent than what a survey of S&T potential would suggest but they occur at a very individual level and in a dispersed manner. It goes much beyond consultancy and it is in real opposition to the academic institutions. We thus have what can be called the basic paradox of research of the South-Mediterranean countries: policies supporting research are designed in such a manner that they do not permit to rip benefits out of knowledge.

Examining the experience of "bridging" technical centres

Among the various experiences in the countries of the ESTIME project of technology transfers and technological intermediation we can highlight the technical centres in Tunisia. They seem like quintessential technical centres. They are working in eight sectors. As the institutional report notes: "Ces centres sont co-gérés par l'administration et la profession. Leur conseil d'administration regroupe 9 représentants de la profession et 3 de l'administration." The mixed « public-private » nature of these centres is both an advantage and has some drawbacks. The *main advantage* lies in a certain proximity to the needs of

enterprises. Their clients are 80% industrial enterprises, 6% professional associations and 14% public institutions. This last percentage is related to work that is ordered by the public administration in programmes such as the follow-up of funding mechanisms of industrial development funds (like FOPRODI or FODEC funds). Technical centres also provide the government with diagnosis studies for modernization of firms (something that is usually done, for example in Morocco by the Ministry of Industry).

Table 2. List of technical centres in Tunisia

CETIBA – Centre Technique de l'Industrie du Bois et de l'Ameublement
CETIME - Centre Technique des Industries Mécaniques et Electriques
CTC – Centre Technique de la Chimie
CETTEX - Centre Technique du Textile
CNCC - Centre National du Cuir et de la Chaussure
CTAA - Centre Technique de l'Agroalimentaire
CTMCCV- Centre Technique des Matériaux de Construction, de la Céramique et du Verre
PACKTEC - Centre Technique de l'Emballage et du Conditionnement

The main drawbacks are management issues. Budgets are mainly managed as a public budget. This is due to the fact a large portion funding comes from the public administration. The ESTIME institutional report notes the following aspects:

1) The majority of these centres seem to be rather not knowledgeable of the legal possibilities offered in favour of technical development of enterprises in the country. Moreover the centres do not seem to be concerned by these measures or their implementation. Moreover they have had a limited impact on the creation of enterprises (start-ups or incubation of companies).

2) Intellectual property rights are not an issue they seem to be aware of sufficiently. Most results that could be protected are not brought to patenting.

3) Very few centres seem to have a good knowledge of university competencies.

4) In many cases R&D needs are related to some funding or a demand of the Ministry of research (MRSTDC). Funding is usually national (funds of the Ministry) and occasionally international (mainly EU funds, like projects RESIT and STREN in the 6th Framework Programme of DG Research). The centres participate to the PNRI (National Research Programme on Innovation) a specific programme designed to bring together research and enterprises since 2003.

5) Most relations with university or research structures are through students internships, just as an enterprise would do it.

Tunisia has a real experience in the management of these centres and it would commendable to have a full fledged evaluation of their functioning. The technical centre on Leather and Shoes has more than 30 years of existence, but most were created in the last ten to fifteen years. It is quite interesting to note that overall the technical centres of Tunisia seem to share the same qualities and defects with the French technical centres. Some years ago, an evaluation of these centres concluded that they were split by too many contradictory missions: technical support, training to enterprises, expertise for the government, negotiation between enterprises and also between the entrepreneurs and the authorities. The particular mix of diverse functions can be useful but is too large and diverse to be easily managed by structures that are quite small.

It seems necessary to see these centres closely and to avoid dismissing them on the grounds of them being "just" technical centres. The question arises : are they

really viable in the context of globalization? It is a strategic question, not only in Tunisia but in all the countries of the project.

Secondary processing of innovation surveys

In an innovation survey, questions concern the number of innovations, their degree of novelty, patents, licences, R&D and engineering activities, technical links with technology centres, other companies or agencies devoted to the development of new products and processes. These questions can reveal a specific technological profile for a company. The answers are usually not standardized. They can be expressed in relative terms like % of sales for R&D; number of persons working in an R&D unit as % of the total personnel of the company. The presence or absence of links with universities, technical centres or other institutions for product and process development can be deduced from various questions (for example, about suppliers). A secondary analysis involves simplifying these questions and includes them into variables for factorial analysis. The statistical classification analysis allows identifying similarities and differences in behaviour. In this way a taxonomy of innovating companies can be obtained by this secondary processing of innovation surveys (Arvanitis and Villavicencio 1998; Arvanitis and Villavicencio 2000; Pirela, Rengifo, Arvanitis and Mercado 1993). The analysis can be directly verified by fieldwork. This exercise has been done only in Morocco.

The Morocco survey showed that there could be six different types of enterprises

- Group 1. **Passive enterprises**: They don't innovate and don't do R&D. Small mechanics and individual companies;
- Group 2. **Low innovators.** Enterprises geared to the foreign market, mainly in textile. This is the typical medium Morocco Company.
- Group 3. **Low innovators, but with a markedly domestic market orientation**. These enterprises are very much like group 2 but apparently in different markets and industrial sectors.
- Group 4. **Autosufficient innovators**. The terms wants to underline the fact that these enterprises are mainly self-financing their activities, and have relatively little partnerships in order to develop new products or processes. In any case they have very few if none relationships with the public sector.
- Group 5. **Dynamic enterprises.** These have important investments in innovation projects and R&D. Usually large enterprises often exploit a licence and are mostly oriented towards the domestic market.
- Group 6. **High performers.** These enterprises are similar to group 5 but are also exporters, not limited to the domestic market. They have partnerships with both public and private entities.

It is possible to draw some generalizations out of these results. Innovation, R&D and more generally speaking technological learning are becoming more important. They are deeply embedded in the history of particular enterprises and are not only determined by the sector or the market. This counter-intuitive result is very refreshing for policy-makers. It means that policy can act and there is no such thing as a "medium" enterprise, no standard enterprise. Policy can influence the firms or, on the contrary, the firms may decide to act alone. In the case of Morocco, SMEs are becoming more sensible to R&D as also is the case for Algerian SMEs (Khelfaoui 2006).

Industrial clusters are not necessarily limited to technopoles. Claude Courlet and his team since many years have proposed an analysis of these institutional

arrangements located in a specific region. They propose to go beyond the neo-institutionnal approach which has an exclusive reference to the market. Entreprises and institutions are created after a specific pattern that is not necessarily the product of market rationality. History has a profound impact on the configuration of this world of innovation (Salais and Storper 1993) Innovation is always produced in this social space defined by both the enterprises, institutions and territories.

Innovation in industrial companies, in the same way as the *uses of research outside the realms of industry and laboratories*, comes about in a fertile milieu. This milieu can be described with precision. It is made up of institutions which take part in technological and economic development (a good presentation is found in (Amable, Barré and Boyer 1997).[10] The system is composed of enterprises, public bodies for the promotion of industry, organizations that finance technological development, intermediary bodies such as associations of engineers, scientists, business people, technical research centres, consultancy firms, venture-capital firms. More complex entities can be mentioned: technological networks (that some governments have promoted as a result of a deliberate policy) and industrial districts. Standards (patents, ISO standards, quality standards, and son on) and infrastructure are also part of this world of innovation. In some countries the multiplication of intermediate structures has been one of the principal ways

Give science a better chance

Although it is was not part of ESTIME's agenda interviews with researchers made a case on the rarity of students that orient themselves in scientific careers. Most researchers in the countries covered by ESTIME have been engaged in science by a convergence of pure chance and bright minds. This haphazard and heroic pattern of recruitment does no justice to the countries capabilities. It also underscores the social standing of science. A major effort needs to be done on awareness of scientific research to lay people as well as to professionals not engaged in research. The support of an information tools like the website SciDev.net (www.scidev.net) , the cooperation with the major funding agencies in Europe like SIDA (Sweden) or outside Europe like IDRC (Canada) should be promoted actively. These two institutions have been mentioned by interviews and in the ESTIME meetings because they have deployed a research for development perspective which is unique and needs to be supported. International cooperation appears a privileged tool for a major initiative on awareness of science and promotion of science for development in the near future. Not tackling this issue specifically for the Med countries would be letting obscurantism regain its territory.

4 Results per country

We gathered institutional reports only in five countries and the Palestinian Territories. Egypt had no participation in this aspect. Syria's institutional report

[10] See also, for a review the relationships between technology and development the report by Calestous Juma Juma, Calestous and Lee, Yee-Cheong (eds) (2005) *Innovation: Applying Knowledge in development* (London: Earthscan, UN Millenium Project, Task Force on Science, Technology and Innovation).

has been delayed. In the following a brief paragraphs a brief summary of the five countries and Palestinian Territories is given.

Morocco

Morocco has lived at the end of nineties and beginning the new century a complete modification of its institutional setting. In the process of opening of the economy, of smooth democratization, the country experienced a whole series of changes in educational institutions, public health institutions, research centres and the economy. Science and technology profited from this profound change.

In 1986, the first large seminar on research (Premières Assises de la Recherche Scientifique) was organized. More generally, this period of the eigthies has seen the creation of many public research institutes : Institut National de Recherche Agricole (INRA, 1982) ; Institut Nat d'Urbanisme et d'Aménagement du Territoire (1985) ; Centre National de l'Energie, des Sciences et des Techniques Nucléaires (CNESTEN) (1986) ; Laboratoire de Géophysique at CNCPRST (1988). The expansion of the university institutions, the creation of faculties of science and engineering, the introduction of professionalizing training courses inside the universities was accompanied by a worrying growth of unemployment of PhDs (it has been of 31% for university diplomas in 1997). This tragic state of affaires, as it was qualified then, has triggered a large reform of the university system which was undertaken in 1997, with the creation of teaching departments (UFR) and the implementation of the peer evaluation committees. The reform 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 that can be heard of at the *Makhzen*, in the Ministry of Education but also in the other components of the government. The creation of an Academy of science has also been securing the role of research. It was this national consensus on science that permitted the major overhaul of the university and research system.

Budgets have been growing steadily. Expenditures on R&D have attained today an honourable 0.8% of GDP. More interesting, there is a specific budget for research in the general budget of the state as well as a clearly identified budget for research in each university. Still, there is no unique document reporting the state's expenses on research. Also of importance has been the creation of funding agencies 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). Interestingly, the presentation of the funding makes a clear distinction between non competitive (or recurring) funding that goes to the institutions; competitive funding managed by an Agency; strategic funding that is shared by technical ministries and enterprises not necessarily for research but rather geared toward innovation; and private or contractual funding.

Human resources did not grow in the same proportions, although the student population has been growing steadily. In 2004, Morocco numbered more than 10600 teachers at universities, 3976 in high schools (mainly engineering schools, "écoles normales" and the like) and 2900 researchers in institutions dedicated to research. Post-graduate levels in universities (Masters and PhD) account more than 19 000 students, of which around 8000 are PhD students. Outside the public sector, scientists and engineers were estimated around 2800, 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 the 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 by the instability that has been surrounding the function of research inside universities in the last years. This is a highly controversial point in Morocco. The coordination team of ESTIME believes the explanation that was valid in 2002 does not hold anymore. In effect, apparently nothing seems to have changed in Morocco in the last period of three years on the institutionalisation of research, and this seems a symptom of an uncertainty. Research is a fragile activity in Morocco. The political consensus is still present and great care needs to be taken so that the institutional structures reflect this consensus.

The small private R&D universe which has been mentioned above is probably much larger today and growing quickly.[11] The survey on R&D and innovation of "RD Maroc" has shown that 41% of enterprises are innovating somehow; and 27% of the enterprises declare having an R&D department. What is interesting is that an analysis was made inside ESTIME project to compare the 2000 and 2005 data. For this sample of around 500 firms, R&D grew importantly: around 9% of the enterprises in 2000 declared performing R&D against 23% in 2005. Expenses for R&D grew from 1.3% to 1.6% of sales. Interestingly the growth is mainly due to medium-sized enterprises not large ones (neither, of course, small ones). A qualitative analysis of the motivations and functions of R&D in companies confirmed this singular trait: R&D is more and more used in products and process development. Some enterprises are created with an R&D function from the very beginning. In general, a sharper interest exists in overcoming the traditional defects of low-technology sectors. The survival of the textile sector to the competitiveness challenge posed by the new and rising competition of large Asian producers (including India and China) is a good indicator of this new and firm orientation.

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[12] (ex-MICMANE) has supported in

[11] Enterprises in Morocco are rather small and family-owned. See EL AOUFI Noureddine, *L'entreprise côté usine : les configurations sociales de l'entreprise marocaine*, Publication de Groupe d'Etudes et de Recherches sur les Ressources Humaines et l'Entreprise Rabat 2000

[12] Until 2007 known as Ministère du commerce, de l'industrie et de la mise à niveau de l'économie (MICMANE).

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).[13] 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.[14] 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.[15] The association “**R&D Maroc**”: created in 1997 is becoming a central actor in the world of innovation in Morocco. All the largest companies in the Kingdom are represented in its Board (OCP, Maroc Telecom, ONE, CDG, CGEM, Cooper Maroc….). It organizes fairs around innovation, promotes logistic support for R&D, and has become a partner in all large operations that are launched by the Ministries. It also distributes small funds supporting innovative projects (INNOVACT). Its success is only limited by the size of its funds. Also one has to remember the difficulty in the mobilization of SMEs on the topic of innovation. On the whole the world of innovation is now created in Morocco. If anything it is too complex rather than not enough. The qualitative evaluation of the R&D effort in the enterprises has clearly confirmed that enterprises are somewhat sceptic as far as to where and how to get support on innovation.

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 mentioned that after the important and quasi-exhaustive evaluation of

---

[13] *RDT : Réseau de Diffusion Technologique ; RMIE ; Réseau Maroc Incubation et Essaimage ; RGI : Réseau Génie Industriel ;

[14] *Provision pour la R&D (PRD) : exemption of taxes for R&D and innovation activities (maximum 20% of profits before taxes and not superior to 30% of investment in these activities).

*Fonds de Promotion des Investissements : helps buying technology (maximum 10% of the investment) ;

*Fonds Hassan II pour le Développement Economique et Social.

*Morocco has also access to EUREKA projects.

[15] R&D Maroc, Enquête nationale sur la R&D et l’innovation, 2005 rapport statistique Rabat

science that took place in 2002[16] 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 has performed an innovation survey in 2004 after having also investigated on its R&D capabilities in 2000. It is repeating this exercise and it has also been preparing for a S&T potential survey along the lines of the Frascati Manual. An observatory of innovation is to be created, as well as an observatory for S&T. This strengthening of the analytical capacity for science policy is more than needed. Nonetheless, there is still a gaping need for specialists that can interpret the data. Sociologists, political scientists, economists, engineers, managers and other specialists are rather little interested in making "science study" a professional activity. There is no recognized training in this matter; very few specialists have had some reflexive analysis of their own fields.

Also linked to policy making is the observation that 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. It would be advisable to promote a private sector that serves the needs of enterprises in approaching the support of the state. It would also be advisable to professionalize experts that work inside the policy making institutions. Finally, Morocco has to share more openly its experience, a task that should be a priority inside the EU-Mediterranean policy.

Algeria

Algeria is a case where research has been through very hard times, with a strong emergence followed by collapse and renewal after what can be qualified as a "civil war". Interestingly, the issues here are not financial; they are mainly political and organizational. Since the independence there has been stability only in very few occasions although the government has been a strong promoter of science. From independence to 1971, research was limited to some public institutions and some specialized centers. In 1974 after the reform of higher education (which had begun in 1971) the creation of the ONRS (Organisme National de la Recherche Scientifique) impulses a "golden age" of research. It was dissolved in 1983 with no real institutional succession. From then on and until recently, research has lived under a number of different institutional roofs. The Higher Commission on Research created in 1986 resulted from the fusion of two coordinating institutions: the former Commissariat à la Recherche Scientifique et Technique and the Commissariat aux Energies Nouvelles. Again, the Higher Commission was dissolved and replaced in 1990 by the Delegate Ministry to Research, technology and Environment. Two years later it was transformed in a State secretariat inside the Ministry of Higher Education. Finally, in 1993 research became part of the Ministry of Higher Education. This very brief reminder shows the political instability. And, as researchers told us, the relative complexity of the whole

[16] A book will be published soon with the main results

structure inherited from this past was also unreadable for the people involved in this field

Today 27 universities, 13 university centres (not consolidated or affiliates of some university) and 16 higher schools (following the model of French Grandes Ecoles) and all the structure is under the responsibility of the Ministry of Higher Education and Research (MESRS). A survey identified 597 research laboratories. Three agencies comply with promotion and coordination functions: an agency on health sciences (ANDRS), a pluridisciplinary university agency (ANDRU) and a technology transfer agency (ANVREDET). Nine research centres have a specific status of institutions specialized on research (and their personnel are considered full-time researchers). Some 21 other research units depend on different Ministries.

We can state that research has been given some priority with the framework law 98/11 voted on August 1998 covering the period 1998-2002. This law had an objective of stabilizing institutions, promote long term budgets, announce priorities, and provide the necessary means for its implementation. The law defined 30 research programmes as priorities and 6026 projects were funded inside these programmes. A figure of personnel between 12,000 and 14,000 “professors-researchers” (of which 1,400 were full-time researchers) were mobilized under these programmes. The law had fixed an objective of expenses for researchers equal to 0.2% of GDP in 1997 and 1% in 2000. It, unfortunately have not attained this objective, although around thirty thousand millions DA are spent each year on research. In 2003 research budgets represented 0.21% of GDP, amounting to 36,38 billions DH. Internal figures assured only 5.6 billions were finally authorized. This very low percentage of spending is a sign of governance problems that are difficult to overcome. It is usually heard in Algeria that the research institutions and university labs have a “low absorption capacity” because of them being young institutions with administrative difficulties. It might also have to do with the very large difficulties encountered by university personnel in performing research activities, organize stable laboratories, spend time on research, and maintain a network of international partners. Research in Algeria is awaking and all these difficulties cannot be reduced to administrative difficulties. Moreover, a large part of research is performed inside the university system which is plagued with all the burden of having to teach to a growing population of students.

Additionally, the salary levels are dramatically low: a professor earns 50 000 dinars, an assistant earns 28 000 dinars. The research bonus for a university teacher is between 9 000 and 12 000 dinars. It becomes vital for teachers to complement their salaries by some external activity, additional teaching hours, consultancies and expert work outside their institutions.

As a product of the rhetoric of applied research, university teachers have a rather strong commitment to applied research. An analysis published by Hocine Khlefaoui shows that what usually happens to good projects is a strategic difficulty to include the good ideas into the technological portofolio of enterprises. On the contrary, R&D in enterprises is probably growing rapidly. A good example of this is the activities of R&D in the state-owned enterprises. These R&D units were usually reorganized in the late nineties and early years 2000. They have a more focussed agenda and they usually concern the products that are in direct competition with imported products. Something equivalent is probably happening to a large number of industrial firms. Algeria would need a better knowledge of its

innovation capacity in firms. A strong recommendation on our part would be to promote an innovation survey following the standards of the Oslo Manual.

Finally, ESTIME did a quite exhaustive survey of the social sciences in Algeria, which serves as a typical case. First, in this country the growth has been very strong. Between 1962 and1971, social sciences existed only at the University of Algiers and its annexes: Constantine and Oran. There was no specialty in the social sciences and economics was part of the law curriculum. The reform of universities took place in 1971 with the will to form the managers of the country's industrialization and the socialist spirit. This phase is also marked by the arabisation of all social sciences disciplines, the suppression of the faculties and their replacement by departments and institutes, but also the mass access of students to higher education. Finally, social sciences begin to appear as a specialty and economics becomes autonomous from law. The eighties are marked by algerianisation of curriculae. This period is also marked by a rapid growth of the universities on the territory that was weakening them. New teaching programmes appear in the nineties. In this period, National Programmes were promoted and consolidated in the social sciences as in other disciplines under framework law 98/11.

The arabisation of curriculae has been promoted too quickly and was badly prepared. Today each discipline uses French and other foreign languages differently. Law in essentially in Arabic, economics mainly in French. It is the labour market that defines the linguistic needs. Some disciplines like sociology suffer from insufficient written and teaching resources in Arabic.

Publications in the social sciences are considered insufficient by all social sciences researchers. Explanations for this low level range from the high cost of publications of books and the rare number of good journals in Algeria, which usually belong to research institutes (Les Cahiers du CREAD, Insaniyat et la revue algérienne des Sciences juridiques et Administratives). Researchers who are also teachers prefer to publish textbooks for college and university levels. Good books that are used as a reference in Algeria are the product of individual initiatives that gather a number of authors in a publishable product.

By itself the history of Algeria can be only a strong inventive to understand the causes of violence (Moussaoui 2006) and the roots of what El Kenz call the basic misunderstanding about the role of knowledge in society (El Kenz 1996). Before the civil war, scientific knowledge and technological development were at the forefront of modernisation and of the industrialisation of the new independent economy. In the process of building a new country, politics, social and culture considerations, anthropological permanencies, economic trajectories, historical remains were all forgotten. Thus the modernization process appeared to the eyes of a large part of the population as being constructed against their own will. "Fille du nationalisme algérien, la technocratie algérienne aura toujours été perçue comme « une bâtarde », dont on est parfois fier, mais qu'il faudra toujours surveiller. "(*ibidem*, p. 276). The collapse of the social sciences, the pressing needs to recreate the society and the economy have given way to a new view. Research in the newly constructing national scenario is no more the sole heritage of a modernising elite. It is a means that can be in the hands of any social and political programme, any political and cultural project for the country. But under one and only one condition: that the young Algerians be kept inside the learning institutions of the country. Research is needed in the same way as schools, universities, private enterprises, are needed for the future of the country. The integration on more young people inside the learning institutions is a project by

itself. The social sciences participate strongly in this project which raises the question of the uses of this massive newly formed human resource. The next challenge for Algerian society is precisely that of matching needs and competencies in the growing labour market.

A real progress can be seen with the advent of research framework 98/11. It permitted to recreate the institutional structure of the country and impulse some new to the country concepts such as evaluation, programme, and knowledge transfers. A rapid learning administrative phase is going on today. Nonetheless, it is this management capacity of research that appears to be the weakest.

Tunisia

Modern research in Tunisia can be traced back to the late 19th Century, under the French protectorate. The Institut de Carthage (health) was founded in 1893, the "Ecole Protectorale Agronomique" opened in 1898 and the 'Institut des sciences océanographes et de la pêche' in 1924. After independence, a new institutional framework was established by the setting-up of the University of Tunis, the 'Ecole Normale Supérieure' (training of professors) and the Tunis Engineering School. The creation in 1978, of the Ministry of Higher Education and Scientific Research achieved a first step in the construction of the Tunisian system of scientific research. The political change of 1987 gave second wind to the scientific research and technology sector by the setting up of the National Scientific Research Foundation and the State Secretariat for Scientific Research and Technology (SERST). This structure was again reformed in 2001 by integrating research into the Ministry of Scientific Research and Technology (MSRT) and again in 2005 into the Ministry of Scientific Research, Technology and Competency Development (MSRTCD).

Research Bodies: The fundamental operational structures of research are the laboratories (20 peoples or more) and the research units (small teams). What should be underlined is that Tunisia is the only country where these structures are given a label (either Laboratory or Unit) which is evaluated by a National Committee for the Evaluation of Scientific Research Activities on a four year basis. At the end of 2005, 139 research laboratories and 624 research units were gathering about 25 500 personnel. Researchers are also distributed into universities and 32 research establishments attached to relevant ministries: Scientific Research, Technology and Competency Development (11), Agriculture and Water Resources (5), Public Health (5), Higher Education (2)…

Supervision: The High Council for Scientific and Technological Research advises the government on the general orientations of national policy, the National Consultative Council is in charge of replying the questions submitted by the Minister, the National Committee for the Evaluation of Scientific Research Activities organises the assessment of activities, projects, programmes and results.

Budget: It underwent a significant development during the period 1998-2005 reaching USD 80 millions. This trend stems from growth in gross domestic expenses in R&D (considered to have attained 1% of GDP in 2004). It has led to a continual increase in the number of structures. The number of researchers per 1000 active members of the population rose from 3.26 in 2003 to 4.28 in 2005 (this figure includes the post-graduate students). The life sciences and biotechnology sector, which also embraces the agricultural sciences and health sciences, are doted with the greater part of the budget.

Publications: The overall number of publications of Tunisia increased by a factor of almost 2 from 1993 to 2001. Its world share also increased, but not as fast (+54% for the world share and +81% for the total number of publications). The disciplines that have experienced the strongest increase are physics and mathematics. Except for medical research, all the disciplines have raised their world share, meaning that the increase was stronger than the world average. The discipline with the higher world share in 2001 (mathematics, with 1.94 ‰) is followed by chemistry and engineering. It should be noted that Tunisia is today the largest scientific producer in Maghreb having surpassed Morocco in 2003. It has also more publications than Egypt in practically all medical sub-disciplines. Finally, Tunisia has a pronounced different specialization pattern from all the other countries: it specializes less on engineering and physical sciences. Its pattern is rather oriented toward the medical and biological fields of research.

International cooperation: About 80% of co-publications are done with France. A growing number of Students (8000 in 2002) is also going to study abroad, France is the first choose before Germany (1500) and the US (500).

Tunisia has slightly improved its participations from the 4th to the 5th Framework Programme, but not much. Most of the projects were within the INCO programme. Main co-participant countries were France, Italy and Spain.

Innovation: Innovation policy is what probably strikes most in Tunisia. Eight sector-specific technical centres co-managed by the administration and the profession, disseminate information and ensure assistance to small businesses in Leather & Shoes (since 1969), Mechanical & Electrical industry (since 1982), Mechanical, Ceramics and Glass (since 1982), Textiles (since 1991), Food, Construction, Timber & Packaging. These last centres are younger. An evaluation of these centres by ESTIME shows that they are a privileged instrument of the industrial policy and should be better used in the making of innovation policy. Although they are performing important R&D activities internally and externally, the results of their work is too little transferred to productive enterprises. A clearer emphasis on their role and activity would be welcomed.

Specific programmes and funds are aimed to transfer of research results and development of co-operation between businesses and the academic sector. Most of these funding schemes date back to the modernisation programme of 1996, probably one of the more successful upgrading programmes ever in the Mediterranean (see Moisseron 2005). With the same objectives, a large programme is conducted since 2000 for the creation of technoparks, and incubators of start-ups in the different regions of the country. *El Ghazala,* the first more famous technopark started in 1999 and became a symbol of the priority given to ICTs in order to preparing the post-textile era. Today, it hosts 47 units (2006). The tenth five-year development plan (2002-2006) is essentially geared towards building a “knowledge society” and several support governmental programmes, especially aimed to small and middle size business, where launched since 1999 such as “IT innovation funds” , “ICT exportation support funds” et “industrial competition funds”. In the same period Computer product imports almost doubled, reaching nearly USD 300 Millions.

Finally, a complex world of innovation has been created in the recent years with the aim of promoting investments and innovation. We can mention the “Agence de Promotion de l’Industrie (API)”, which has become a main instrument of promotion of innovative investments in the country and is today clearly business-oriented. Its parent agency, the Agence de Promotion des Investissements Agricoles (APIA) has insufficient funding in order to make a real difference in the

agricultural sector. This is probably based on a mis-conception where agricultural activities are less prone to innovation than industrial ones. In any case, APIA today is used by the Ministry of Agriculture in order to promote private investments in agriculture. The newly created « Agence de Promotion de la Recherche, de l'Innovation et de la Création d'Entreprise » (APRICE) is supposed to act as a bridging institution between research and production, mainly in the ITCs. Finally the patenting agency of Tunisia (the « Institut National de la Normalisation et de la Propriété Industrielle » (INNOPRI) is much more active today than it used to be: 250 patent demands are deposited each year, mainly form foreign enterprises. The national demands come mainly from individuals (65%), enterprises (22%) and research institutions (13%).

Tunisia has developed a specific legislation and specific funding schemes for innovation (venture-capital funds called SICAR). These have already been used actively and a clear enhancement of the innovation policy is happening today and a more informed reflection about the role of research and innovation in a small peripheral country.

Jordan

The Hashemite Kingdom of Jordan -a constitutional monarchy- is classified as a lower – middle income country whose economy is constrained by limited arable land and scarce water mineral and energy resources. Foreign aid has always been an important source of funding of the state and the Hashemite regime. After its creation in 1921 and until the forties of the 20th century the whole public budget was financed by the British mandate. Until now, foreign aid still plays an important role in the Jordanian economy. Concerning the general indicators on scientific research, Jordan is in the lower average category but slightly above the average of Arab countries (0, 2%), with an expenditure on scientific research representing 0.34% of the GDP in 2003.

Since the 1950's, Jordan has made efforts to develop its national science and technology capabilities. Past development plans aimed at integrating more technology in the economy and the productive and services sectors and upgrading the country's scientific capacity. Jordan's ability to undertake scientific research was enhanced with the creation of private and public scientific institutions, of which 193 are involved in science and technology. Of these institutions, 82 have laboratory facilities totalling 379 laboratory units. All the governmental documents and agenda insist on the importance and value of applied research and innovation for the country.

Jordan occupies a small share of scientific publications in the world production. But its bibliometric level is increasing significantly, especially in the disciplines where the country shows a strong specialization: computer and information sciences, pharmacology/chemistry, and energy engineering.

Research can be found in universities, NGOs, private centres, and research centres directly linked to the Higher Council for Sciences. But most scientific research is carried out by the universities. Jordan has private and public universities; however the private universities, which are new, market-oriented and of a lower level carry out hardly any research activities. The contribution of the private sector is very low. A confusion between NGOs and the private sector exist because NGOs can only be partly considered as independent as one specificity of Jordan is the prevalence of "Royal NGOs". This is particularly the case of the Royal Scientific Society, a strong "private" institution that is close to the main

scientific institutions (HCST, University of Jordan) but is also a non-profit institution and has a real independence.

Researchers themselves do not believe research occupies a central position. According to them, in the public universities, they occupy a contradictory position as they are evaluated on their publications but unable to really spend time on research because of time-consuming teaching duties. They also find the administrative procedures very unwieldy and opaque. They consider these cumbersome administrative procedures to slow down their initiatives. They also believe that the public universities do not favor connections between the researchers and the productive private sector; the actual system is considered unfair as far as payments are concerned. Budgets dedicated to research by the universities are low, especially for the social sciences, and almost inexistent in most private universities. The high salaries in the private universities and in the Gulf countries are encouraging professors to quit the public universities. That happens even when public universities are more prestigious or have a more substantial budget for research, and although the university professors salaries are generally high as compared to the average salaries in the country.

Applied research is highly praised as well as links with the enterprises, not only by the state but also in the researchers' discourse. They wish to see their research having immediate applications, and concerning social sciences in close connection with the social agenda. Nevertheless, they seldom engage in research that needs some investment in means in order to do experiments or fieldwork (low budgets and low connections with the users of technology). The lack of means also has consequences on the capacity to be kept informed on the latest developments of research in their disciplines, to obtain the last publications.

Concerning the agenda for research, a thematic convergence can be observed between the state priorities and the subjects of research. Researchers themselves, especially in social sciences may be incited to choose thematics that have been put forward by the government to have better chance of being funded and acknowledged. At the same time, researchers consider that they freely choose their research subjects, especially in exact sciences. Some of them have been asking for more state coordination and cooperation with other countries. The situation is a bit different in the social sciences which are more politically sensitive.

The influence of international organizations in Jordan is high. It is part of Jordan policy to search for international development funding, which is also one of the role of the royal NGOs. Jordanian institutions try to develop the statistical tools required by such institutions and to respond to their criteria. This also has indirect and direct consequences on research and the research agenda. Indirectly, the priorities of the government will often be linked to those of these organizations; directly, the researchers apply to get fund by these donors and therefore elaborate research projects with thematics, objectives and vocabulary that correspond to their expectations. In the social sciences, a lot of small research centers have emerged, with the objective to act as consultants for these organizations. This has consequences on the agenda and the tools used in research, but it is also a trend where Jordanian researchers have become more or less "informants" on their country, producing numerous -often unpublished- reports, intended to the organizations. As a consequence, they are not in the position to be considered as real analysts who could exchange views internationally with their colleagues in their discipline.

The Jordanian state is administratively very present, but financially marginal in research. The marked influence of international organizations, which bring budget and agenda, has direct consequences. This type of international influence does not orientate research in Jordan towards a better cooperation with foreign research centers or a better integration on the international scene. On the contrary, it transforms researchers into informants, well paid but without impact on subjects, theoretical tools and analytical grids.

Lebanon

The origin of modern higher education in Lebanon can be traced back to the second half of the 19th Century and linked to the proselytism of different religious groups but many new private universities were also created during the 1980s, 1990s and early 2000s. National research institutes are more recent.

Lebanon has a small but diverse and dispersed S&T community embedded in 41 universities and higher education institutions (12 of them with science and/or technology faculties) and 6 rather small research centres. All indicators (publication output, research budget, number of active researchers …etc), show that most of the research is carried out in three universities: the Université Libanaise or Lebanese University (UL), the Université St-Joseph or St-Joseph University (USJ) and the American University of Beirut (AUB), sometimes in collaboration with one of the four specialised research centres of the National Council for Scientific Research (NCSR) and/or the Lebanese Agricultural Research Institute (LARI). Given the small size of most manufacturing companies in Lebanon, private sector R&D is still very limited. There is also an increasing number of private research institutes, often NGOs, that carry out studies, mainly socio-economic studies such as opinion polls, market studies, and studies for international organisations e.g. the UN system. They very frequently use the services of university staff, mainly from the UL.

For a number of other reasons detailed in the report, the estimation of R&D personnel and expenditure data in Lebanon is problematic, particularly within the universities where the bulk of R&D personnel is presently located. It is estimated that the number of persons active in R&D in Lebanon today, calculated in FTE, would be slightly over 700 (724), or slightly under 200 R&D staff for one million people. This is approximately 18 times less than in Europe, and slightly under the regional average. The R&D budget as a percentage of GDP is estimated to be 0.22%. This percentage is comparable to the most recently available regional average, i.e. 0.2% for 2000 (UNDP, 2003), and is equivalent to Egypt and Kuwait, but below Jordan (0.34%) but far below Tunisia (1%). The official target for Lebanon is still 1% by 2010. The report also points to the paucity of reliable statistical information on STI activities and the lack of a central institutional mechanism to collect such information. As mentioned earlier, more studies are needed, including a special comprehensive survey to measure national capacities and efforts to confirm, invalidate, and/or complement the preliminary STI indicators presented in this report. A STI Observatory is being created, under the auspices of CNRS at least during the creation and development phase, with support from the United Nations Economic and Social Commission for Western Asia (ESCWA) and possibly other partners.

Despite all sorts of constraints, in particular the civil war of the 1970s and 1980s and the most recent conflict that ended in August 2006, the development of S&T activities in Lebanon has been relatively dynamic over the last 15 years. Although still modest, Lebanon has significantly increased its publication output in the

recent past, and the number of publications indexed in international databases registered an almost fivefold increase between 1995 and 2005. Lebanese research capacity and activity are concentrated in three universities, the top and most visible science producer being the American University of Beirut (AUB). Lebanon's scientific production is also highly specialised in medical sciences. Apart from the fact that AUB is the oldest university in Lebanon, its success is mainly due to an enabling research environment discussed in detail in this report. Two other universities play a very significant role: the Lebanese University (UL) and the Saint-Joseph University (USJ). The UL has, by far, the greatest human potential of the three. It is the largest and the only public university in Lebanon, but it is confronted with a number of lingering structural problems that prevent its staff from engaging more actively in research and performing more satisfactorily. These problems have been recognised and a number of well-targeted actions have been proposed. Most of them have not yet been fully implemented.

The contribution of the national research institutes, although tangible, is more modest and much less visible. First, they are younger than Lebanon's first universities. Second, they have a very limited research potential and no serious succession plan to replace the many permanent staff who will soon reach retirement age. Third, their budgets, largely allocated by the Lebanese government, often fluctuate and are rarely disbursed in full. Fourth, they devote an important part of their time to non-research activities, e.g. extension and other services, data acquisition and monitoring, training and teaching, etc. Yet, there has been a noteworthy tendency over the last three years (2004-2006) for research staff in national research institutes to publish more in international journals. During the interviews, several Lebanese researchers in the basic sciences also said that one of the most conducive and enabling research environments was the laboratories of the CNRS research institutes when working together with university staff on. This strongly supports the argument favouring the operationalisation of the recently launched CNRS Associated Research Units (URA) programme.

With regard to the national S&T policy framework, during the past several years the CNRS has been very instrumental in initiating a new policy for science, technology and innovation (STIP). CNRS has used this policy to develop and implement a number of integrated action programmes aimed at strengthening, facilitating and promoting research activities throughout the country. Some of them, such as the CNRS Grant Research Programme (GRP) and the PhD Fellowship programme, have been running for several years and have produced tangible results, others, younger ones, such as the CNRS Associated Research Units (URA) were launched during the study period. However, we believe that CNRS should refocus its mandate on two main core functions: facilitation (as above) and advice.

The implementation of these integrated action programmes also brings out potential weaknesses of and opportunities for the Lebanese Scientific, Technological and Innovation (STI) system. On the one hand, statistics on the outcome of the RGP over the last seven years (2000-2006) confirm the supremacy of AUB, by far the top recipient (42.3% of the projects and 47.8% of the funds). Lessons should be learned from AUB's success. On the other hand, the response to this research grant scheme, after reaching a peak of 156 projects submitted in 2005, has shown a tangible decline during the last two years. The same trend has also been observed with the research grant scheme managed by the UL. Although the reasons for this decline still need to be interpreted, it is clear that the potential of Lebanese researchers actively involved in research activities

on a permanent and sustainable basis remains very limited in comparison to the theoretical full potential. Although both figures still need to be confirmed, it is important to remember that more than 90% of the teaching staff in the Lebanese universities probably do not conduct any research at all. This means that there is a vast reservoir of fragmented and dispersed human resources, particularly in the higher education system, just waiting to be tapped. Doing this would require an even more dynamic policy at the national level and at the level of each institution that wants to create a more enabling and rewarding environment for research. It would also require better structured and stronger – sometimes inter-institutional – research teams as well as laboratories with a critical mass of researchers, PhD students and technical staff. Research as a function must also be made more professional and given greater recognition.

The bibliometric studies (see Part 4, Lebanon's publication figures) and the interviews brought out the low visibility of scientific publications, particularly in the research institutes. Developing a more comprehensive understanding of Lebanon's publication outputs would require a deeper analysis of the Lebanese scientists' total production, based on their complete publication lists. A methodology for such a study is proposed in the report.

Finally, the Lebanese people are highly mobile. An estimated 9 million Lebanese people, (figures vary between a low 4 million and a high 15 million) are living outside their country. International migration is affecting all categories of people, including and in particular students and high-skill workers. To get a PhD degree, most Lebanese students have to go abroad, and many do not return home after graduating. Although we do not have precise information on the rate of return, we know that Lebanese people in the diaspora are better educated than in Lebanon (Kasparian, 2003). Given the above figures and information, we can realistically assume that the number of expatriate Lebanese scientists is at least equal to the number working in Lebanon. Although the "Lebanese scientific diaspora" cannot make up for the shortcomings and weaknesses of Lebanon's national scientific community, some people see the "remote mobilisation" of Lebanese scientists and technologists all over the world as a source of great benefit for the home country, e.g. access to scientific information and expertise through extensive social, technical and professional networks, increased training opportunities, and the development of collaborative projects between expatriate and home-based scientists. The idea is attractive but, considering the complexity of the Lebanese society, needs to be approached with circumspection. However simple and enticing it may seem, members of the diaspora may not be easy to enrol. For this approach to be successful, a number of difficult steps must be taken, the first one being the creation of a database of highly qualified nationals living abroad. This task could be one more to assign to the impending STI Observatory.

Palestinian Territories

Under the project, the Palestinian Academy of Science and Technology, PALAST, made a survey of research in the Palestinian territories. The survey was a follow-up of a survey published earlier by the Academy.[17] It shows that Palestinian research is mainly done in Universities. These occupy over 4,088 teaching staff, of which over more than 3,500 hold masters or doctorate (4592 in 2004/05). Moreover 2625 teaching staff holds Master or PhD degrees and teach in

[17] The Palestine Academy for Science and Technology. (2002) Scientific Research in Palestine. The Reality, Challenges, and Means of Activation and Development. Palestine Academy Press.

traditional Universities (that is, not including college and open university).[18] Post-graduate students accounted around 1,600 students in nine universities (2005). Most Universities are public (only two are private). Private universities as well as the Al Quds Open University and Al Aqsa University do little or no research. 50% of the students go abroad to study and only one third comes back after graduation.

Research in all cases is mainly an individual effort. It is usually an individual affair, related to the need for promotion of professors. Also, little cooperation exists between Palestinian university teams. Moreover, the large difficulties encountered in daily life of the universities and difficulties related to the circulation of people in the Territories hinder the growth of research.

A lack of planning or strategic view on research has been strongly mentioned in all the interviews under the project. Coupled to the insufficient funding, it is hampering the progress of the research activity. The results of this institutional survey along with recommendations that were formulated by the researchers themselves are to be published on the ESTIME project website.

The production of Palestinian scientists has grown considerably even under the difficulties mentioned above. As part of the project, IRD (independently from PALAST) examined the level of publications during the period 1996-1999 as compared with that of 2000/2003 on the basis of a large international bibliographical database (Pascal) and in terms comparable to the production of other countries. This effort to identify Palestinian researchers' production is the first of its kind. It showed, apart from the large increase in recent years in absolute terms in the fields of engineering and to a lesser degree medical sciences, a marked change in research orientations toward fields of science very different from the former specialization pattern. The relative growth of agricultural sciences, biological sciences and to a lesser degree, medical sciences is quite spectacular.

As far as funding is concerned the Ministry of Higher Education came with the proposal to allocate a fund of half a million US Dollars (to be released in 2005). This brings the percentage of funds for research on GDP for functional budget (that is without including construction, infrastructure, salaries and maintenance) around 0.02% of GDP. Including salaries and basic institutional costs, the spending on R&D should stand between 0.06% and 0.1% of GDP. Considering the turbulent environment, this figure is a high estimate. It is useful, again, to underline that this estimate is not validated by the universities or the MEHE.

A new effort is now under way: the Palestine Academy for Science and Technology in 2001 came in response to recommendations raised by the national S&T stakeholders. The Academy proposed to establish a Science Fund (2002) as a pool of scientific research funds and has therefore prepared relevant policy, guidelines, and documents to administer the fund. The initiative has been accepted largely and the Fund has been created in 2007 although it does not seem clear when it will be functional. Apart from this, universities try to allocate a small budget for research by the deanship of scientific research.

[18] Recent statistics of the Ministry of Education and Higher Education, 2005.

5 General Conclusions and recommendations

The need for strategic or programme evaluation

Evaluation plays a key role in Science policy. It has many facets and intervenes at many different moments, before or after the performance of research, at the individual or collective level. These issues have bee discussed in the first intermediate meeting of the ESTIME (Evaluation meeting, Algiers Meeting, 3 July 2006). Recommendations are based upon the discussions that took place in this workshop.

We may distinguish in the countries of the project the following types of evaluation:

- individual evaluation for career purposes;
- project evaluation for funding purposes;
- laboratory or team institutional evaluations for labelling purposes;
- strategic evaluations for strategic planning and policy purposes.

In the ESTIME project we found that evaluation at the *individual level* which concerns researchers, particularly in the academic and public sector institutions is quite rare and when it occurs is an obscure and totally opaque process. The official texts of practically all universities oblige teachers to pass a promotion process where a research document has to be presented. This evaluation appears as one of the most important moments in their careers, since it is through this mechanism they obtain recognition of their work by their institutions. It is usually seen as a mere promotion mechanism. Moreover when research institutions are not strong, when there is little funding or little interest in research, the promotion mechanism in the only moment where research appears: it is reduced then to an individual activity, decided by an individual teacher or academic person, in order to write a document that will be considered as a proof of his capacity to do research. An extreme example of this kind of research takes place in the Palestinian universities, where research is difficult to undertake. Of course, it takes courage and strong will to write down such research pieces for promotion. But the content of these documents is rarely an original piece of work: more often than not, it is a state of the art of some literature that has been accessed to by the author, with no real analysis of either experimental or field work. This kind of research written for university evaluation purposes for the promotion of its author is little related to research and has more to do with the demographic distribution inside the university. Moreover, and this is probably the most important difficulty, these evaluations are not made by *peers* (specialists in the same field and not working in the same institution) but *colleagues from the same institution and often from different disciplinary fields.* It appears quite clearly from the interviews that this process is harmful for research even though we are told it is important for the institution. Academic institutions should clearly think about this very basic issue because without an evaluation by theirs peers, researchers get no recognition for their work. By having no research evaluation inside the academic institutions, the research system relies on external sources of judgment coming from foreign institutions (foreign publications where there is a peer review process, international cooperation projects where foreigners are playing the role of judges of the quality of the local researchers).

Of course there are some exceptions. Usually, individual research evaluation happens in public institutions devoted to research where the researchers are full time researchers outside university. This is related to the status of researchers. As It has been mentioned in the Evaluation meeting (Algiers Meeting, 3 July 2006), individual evaluation is easier to impose inside an institution that has a specific research status like the EPST (Etablissements publics de science et technologie) in Algeria or Morocco. The difficulty lies in Universities and goes far beyond the sole legal injunction imposed by the law. As one participant mentioned in that event, in the law that modified the universities in Morocco it is not specified how much time a person should devote to research. In general, the legal status of researcher does not exist (so the evaluation of individuals in the Universities is not considered as a necessity).

The issue of individual peer evaluation is a serious one. Up to now it has never been raised as an important matter because either budgets were insufficient –and thus research was not a valid institutional issue– or it was performed in specific (and usually small) institutions were research was more a matter of smaller teams and that made the issue irrelevant. As research budgets grow and the activity gains legitimacy, evaluation becomes a central issue.

It is a strong recommendation of the project to promote peer evaluation of individual researchers (where evaluation boards are not limited to colleagues from inside the same institution as the evaluated person) and to promote a specific status inside the universities for individual researchers.

Project evaluation is an essential tool in the ex-ante policy making process. Projects in “calls-for-offers” programmes funded after proposals have been through an evaluation and selection process. Experts and scientists are the evaluators and they have to judge the nature of the proposal, its quality, and its adequacy to the programme’s objectives. This ex-ante evaluation is the main screening instrument used by an indirect policy. The choice of evaluators, the definition of evaluation criteria, the way the evaluation committees is functioning, the relations between evaluators and programme managers, and the time scale of the evaluation procedure, all have an impact on the evaluator’s choices and on the quality, image, and acceptance of the programmes. It appears that as universities have created funds for research (Lebanon, Syria, for example) the funding through peer evaluation of projects is become more frequent. The larger research universities in Lebanon for example created specific research committees to promote research in their institutions. Funds are usually distributed on the presentation of a project. But the main impulse comes from the research councils or the national research funds that are distributed through competitive funding. CNRS in Lebanon has a good experience in that form of funding and evaluation. It should be mentioned that project evaluation based on limited funds is unable to modify the institutional scenario: in fact, peer review of project functions correctly only if there is a stable institutional basis for the research units and laboratories. In case no stability exists, funds for projects will not by themselves be able to create a stable institutional environment. Moreover, the number of scientific teams able to absorb the funding is limited. The Lebanese experience shows that too much funding given on the basis of call for offers can arrive to a certain ceiling resulting in a situation where there are not enough proposals for funding. The Maghreb countries have a different experience since the budget comes mainly from the institutions where researchers are working and not from agencies or external funds. None the less, Maghreb teams participate in projects that get funding through these kinds of project evaluations such as, for example, the EU funds or, the French cooperation funds in Morocco. They also

have some specific funds for research that are attributed on a competitive basis. In any case, these limited sources of funding are a marginal contribution to the basic working of the research system. Project evaluation in competitive funds is perfectly well adapted to a research system where the main actors are private institutions or effectively autonomous institutions; this is the case of Lebanon and Jordan. It will always play a marginal role in countries where research is organized and coordinated by public research institutions belonging to the State (Maghreb countries, Syria and Egypt).

Research programmes evaluation (a programme is composed of many projects) has rarely –if ever– been undertaken in the countries of the project. Nonetheless, Tunisia has expressed the need for a programme evaluation on biotechnology. The Morocco evaluation in 2002 is what looks closest to a programme evaluation although the unit of analysis was rather the laboratory than the programmes per se. The purpose of a programme evaluation is to study the outcomes of a programme, generally over a long period of time. This exercise has technical aspects – the implementation of analysis tools, indicators, and survey instruments – but also political aspects. The conclusions of a programme evaluation generally serve as a sanction for the strategic choices of the programme as well as its day-to-day functioning. These ex-post evaluations are now becoming more common.

The clearest example of an institutional laboratory or research team's evaluation has been in Tunisia. As was presented at the Algiers Meeting, Tunisia decided of a procedure of evaluating laboratories and teams. By getting a research label, these 139 laboratories and 624 research units (2005) can have for a four year period a specific research budget. The evaluation was done by the a National Evaluation Committee (CNEARS) which is composed of 6 renowned scientists, 2 persons from the economy and society life that have contributed to science, and 2 qualified persons in administrative and financial matters. The evaluation of teams has greatly stabilized the research system and the important growth of production of Tunisia proves it.

It is a strong recommendation of the project to promote laboratory evaluations at the national level and, in case the unit gets a positive evaluation, to give this unit a budget for a period of time no less than three years.

Finally, as has been repeatedly mentioned in interviews of researchers and laboratory directors, in all the countries, there is a need to undergo in a reflection on the needs of research for the economy and society. In all countries where research has been mentioned as a valid policy area, ESTIME found there is a clear expression for prospective thinking on the future and areas of concern for research. Three countries have done an exercise in national priority setting: Jordan (Strategy plan 2006-2010), Lebanon (STIP) and Morocco (Vision 2025). Other countries have clearly expressed the need for such an exercise. MED7 permitted also to identify future areas of common concern between the North and South banks of the Mediterranean. A general framework has been envisioned for a common Euro-Mediterranean innovation space (EMIS) as part of the MED7 project. A specific DG Research project, geared toward this need, has been INNFORMED which concerns Egypt, Jordan, Morocco and Tunisia: "INNFORMED will use Innovation Systems thinking and a Foresight approach to develop a structured Euro-Med dialogue in research and innovation, to embed innovation systems thinking in the region, to deepen and strengthen MEDA capabilities in RTDI related policy process design and implementation, and to develop success scenarios for turning current MEDA strengths and RTD investments into growth opportunities." (from the project presentation).

These initiatives show that it is possible to make prospective and strategic evaluations a reality. Usually, these exercises tend to make a priority setting exercise. This may not be actually what is needed. Strategic planning can be rather different than the SWOT type of analysis where research is supposed to *serve* the economy. In the national policies about research, basic sciences have been largely left to their own. Most effort in the national plans has been on innovation and applied research and technological development, rarely on basic sciences (with the notable exception of Tunisia). The same goes true with the exercises in prospective analysis in Lebanon, Jordan or Morocco. Unfortunately, these plans are usually left in the drawer as soon as they are defined. Partly this comes from the fact that the research dynamic can difficultly be designed from above. What seems much easier is to locate the actual forces in terms of research teams/capacities and to give these specific means in order to build-up a critical mass (means, people and infrastructure).

As a recommendation, ESTIME would prefer to promote specific strategic evaluation tools rather than large priority setting exercises or national plans.

National strategies are necessary as a way to give research a legitimate place inside the government activity. But they are rarely the tool for the promotion of research areas. On the contrary, we have a strong case for the promotion of specific tools for evaluation of scientific disciplines or technological areas (not individuals or projects). Indicators, bibliometrics, analysis of activities in a specific sector/discipline/area of knowledge can, under certain conditions, be strong accelerators of research. This is possible only if these indicators/tools are not used as sanctions of quality, or as way of distributing penalties and rewards but rather as guidance for future funding and support. By looking at research activities per se (and not on how they correspond to some socio-economic priority) such a strategic evaluation can encompass both applied and basic research.

The word “evaluation” has been misunderstood because of fear of the results. It is closely associated to the possibility of a sanction. We believe this is only the result of the lack of experience. Again we base our view on the discussions of the case of Tunisia and Morocco, but also to a large degree to the nascent experience of Algeria. In the evaluation exercise of Morocco experts from the EU have been called to evaluate disciplines in connection with their Moroccan counterparts. This expertise exercise was fruitful and permitted to identify avenues for future research, specifically in basic sciences.

It would be advisable to engage in similar exercises maybe on a more limited scale. This is precisely what the work “programme evaluation” is suggesting. In this case, the prospective exercise would then choose specific areas (like nanotechnologies, biotechnologies, technopoles development, biomedicine, energy engineering, food technology, marine technologies, water management and so on), and limit itself to identifying the research potential, the production in terms of publications, the technologies, the cooperations and the opinions of research teams in the domain. The result of such exercises is to identify avenues of future research funding and training of human resources.

It is necessary to underline the importance not only of programme evaluations as we have just mentioned but also of technology assessments.[19] Evaluations are one of the rare moments where the work of scientists can be highlighted. A research project is always at the crossroads of multiple influences and receives multiple funds. Evaluation makes it possible to show how these influences act upon the domain under review. By looking at the future impacts of a research programme, and the connections between the programme and the rest of the research and innovation world, the strategic evaluation can also act as an alert system. At this point prospective and forecasting methods share some common tools with evaluation: indicators, scenarios, socio-economic projections, surveys of users of the research or the technology. The main difference lies in the fact that the programme evaluations use information generated by the programme itself, whereas the predictive exercises use a wider range of information sources.

In the discussions it appeared that the necessity to promote programme and strategic evaluation is usually thought of as a way of justification in order to gain support from stakeholders, mainly powerful ones such as the Ministries of finance and economy or the large enterprises. This is one of the reasons for the need of strategic evaluation.

The need for strategic evaluation (or programme evaluation) goes far beyond that justification role: it is a substantial need for researchers, for the country, for the stakeholders. It is even more so in rapidly changing fields such as information technology, biotechnology, material sciences. The absence of thinking about the domains acts as an inhibitor rather than a tacit promotion of a field of activity. The “market” will never choose to promote the activities that are new to a country. A fragile research infrastructure can only benefit from the highlight of the strategic evaluation exercise. The definition of the programme will necessarily give words to needs: it will permit to identify possibilities. Its budgets follow the identification of a promising area where some initial effort has been already made and where some competencies already exist, then thee is a large probability this area will be one of excellence of the country. It is important to sustain the teams and domains where some capacity exist; it is important to give them voice and funding.

To sum up, Strategic evaluation appeared as a necessity to all participants at the Algiers Meeting. It showed that the definition of a strategic view or a programme evaluation is a delicate issue: it needs some very fine-tuned information on institutions, teams, laboratories, fields of discipline. Real opportunity niches for research are always a difficult matter to locate. To find them is necessary to make a correspondence between economic or social opportunities and capacities, a somewhat difficult exercise. What might be easier and probably more fruitful as a first step is then to ensure a continuous look at what the local forces are, what others do, what collaborations can be engaged, and identify the various orientations. Such an exercise on the limited scale of a programme can be served

[19] Process evaluation is less widespread and is still difficult to implement because the evaluation capacity needs to be embedded in the programme structure. The example of the Alvey programme in Great Britain, which had the objective of enhancing university-research collaborations, has often been cited as a paradigmatic example of process evaluation. Evaluation in this case went on throughout the life of the programme. It also continuously examined different aspects of it: first it evaluated the selection procedures of the projects, then at mid-term it examined the way the collaborations between partners funded by the programme were developing, and finally it examined aspects related to the transfer of results from the laboratory to productive sites. Process evaluation would probably be more needed in applied areas of research.

usefully by specific indicators, surveys and information. ESTIME has a series of proposal on such items.

Observatories of research, innovation and technology

It seems that there is a strong necessity in enhancing the tools and also their use in policy-making. What is at stakes is opening the discussion on science policy outside the very walls of the ministries. The positive experience of Morocco, Jordan and Tunisia is interesting in this regard.

These three countries have given a strong support to research policy. Jordan immediately assessed the need to re-focus the science policy process, to enhance the role of HCST and to re-orient the policy making process. A large part of the recommendations of an expert report especially devoted to this question[20] concluded: "The Mission believes that the evaluation function and its necessary linkage to future planning is an area in which the HCST needs to pay more attention in the future." (p.69). The IDRC review we just mentioned found also that programme evaluation was an exception in Jordan. This is quite worrying since Jordan has probably a quite well organized research system.

In Tunisia, the evaluation of research, the support to new research teams inside universities, the structures needed for funding innovation, the enhancement of technical centers, the connection between upgrading of industrial firms and innovation have been discussed. The ONST was the result of an accumulation of data on science, technology and innovation that have been feedding these discussions. What is important here was less the form of the discussion and more the permanency of the S&T policy, of the support to research, of the commitment to technological development.

Morocco has had a large, democratic and quite open discussion on its research strategy. It accompanied the university reform since 1998 and up to some point it has been triggered by the public administration itself in intent to rationalize the research institutions and to promote research where it was not yet a priority. It can be said that the reform of universities and research created a research system, not only a conjunction of public research institutions but a more coherent research system.

If we mention and underline the importance of the policy-making in these three countries it is also because *today* these same three countries are at a crossroad.

Jordan is experiencing a new policy orientation which is more uncertain. The recommendations concerning the HCST have not been implemented as such. The political pressure on the Council and the "urgency" for more innovation and more applied science has been stronger; as a result the Council has decided to undergo a reform of its own procedures but it still lacks the coordinating power that was envisioned in the early 2004 when it began its participation in the ESTIME project. This pressure will not necessarily translate in more research and more innovation if the state has no means to monitor it. Jordan has showed by the data it has gathered and the report it produced for ESTIME that it had the capacity

[20] Mullin, James, Abeledo, Carlos, Mazzonis, Danielle and Whyte, Anne (2002) 'Science, Technology and Innovation: Policy and Programs in Jordan', in: HCST/IDRC Mission on Science, Technology and Innovation: Policy and Programs in Jordan): 217.

for sound policy analysis, surveying and reporting on the research system. It would seem now that this effort should be made permanent.

Tunisia has modified its administrative organization; the actual re-integration of the authorities responsible for research inside the ministry of higher education does not give research the same priority and visibility it had before. This might appear as a wrong signal for the research community. Nonetheless, the creation of the ONST and the support for policy analysis is, at the same time, the result of the continuous support for research and innovation. Tunisia will organize in November 2007 a large research meeting gathering researchers from all research institutions to discuss the organization and orientation of research institutions; it will continue to promote its innovation-oriented policy. Most importantly, it should give science and technology indicators a strong and visible position.

Morocco is also reorganizing, rather slower than expected, its research administration. And it has yet to find which institution will be responsible for the science indicators. A recent presentation of ESTIME results in Morocco showed that the Academy of Sciences Hassan II will promote a report on the sate of science; the R&D Maroc will create an observatory on innovation. And the Ministry of education and research will undergo a real survey on human resources in science following the recommendations of the Frascati Manual.

In the three countries, one central question is that of the *analytical capability of the authorities* in order to monitor and base their decisions on research and innovation. These three countries have an acute conscious of the need for better data, more rigorous and sustainable data production and analysis for policy-making. It is not unique to them:

- Lebanon, has recently decided to create a Lebanese Observatory for Research, Development and Innovation (Esterle, 2006).

- Syria is undergoing a survey on research personnel under the auspices of the brand new Higher Council for Scientific Research. In its workprogramme, the HCSR has put very high the need for a better knowledge on who is performing research and where is research located.

As we found in the project and in the process of writing a proposal in order to network all the institutional actors involved in measuring and analyzing research and innovation data (project **MIRA**), the conditions are reap in order to create more stable and permanent science and technology indicators units. OST (France) can participate to such an effort by offering its know-how in the processing and presentation of research-related data. The first and foremost recommendation in this regard is thus already beginning to become true through project MIRA.

The situation we have just mentioned above concerning the efforts to create science indicators units or S&T Observatories and to discuss on the evaluation of research programmes shows that in the Med countries we now have a real network of institutions that is being created. Only Tunisia has created an observatory, the ONST, directed by Dr. Hatem Mhenni. In all countries we found such initiatives (with the notable exception of Algeria): These initiatives should be encouraged:

- at the national level, by supporting the small teams that have been created in the specific institutions devoted to producing indicators of science and technology, as for example:

- Jordan (inside HCST)
  - Lebanon (as part of CNRS activities – see the feasibility report by Laurence Esterle, former director of French OST)
  - Syria inside the newly created Higher Commission for Scientific Research
  - Palestinian territories in an independent organisation which is the PALAST
  - Morocco: probably inside CNRST and/or the Academy of Science Hassan II

- at the regional level, by joining effort with ESCWA, ALECSO and UNESCO;
- inside the cooperation agreements with the EU, by promoting the experience gaining in European countries on observatories and S&T indicators/innovation indicators.
- by promoting more actively the efforts done by European academics on S/T indicators toward these countries (for example through networks of excellence already existing such as PRIME).
- by comparing the Med countries with similarly-sized countries (See the report prepared by J. Mouton and R. Waast for UNESCO, to be presented in January 2008).

Project MIRA should be the right place to discuss these issues.

Create adapted tools for strategic evaluation

A second aspect concerns the design of specific indicators. We mentioned above (section 4) the use of bibliometric indicators that would function as an **institutional scoreboard**. It permits to have in a whole view the contribution of a specific institution to a particular sub-discipline. The table based on an analysis of publication by sub-domains and specialties and by specific schools and institutes permits to show who are the strong contributors in a given domain. This information can be displayed at a lower or a higher degree of detail. The same table can show the evolution of the production from one period to another, a very useful information for science policy. We have called this the **progress scoreboard** and it gives some surprising results when examined at closer look. In order to operate, these tables of data need to be created on a regular basis. They also need to create a specific location where bibliometric data can be cleaned, consolidated, verified, enhanced and shaped in readable indicators. We recommend MIRA examines this issue and names a committee that will choose one location to store and share this information. This will strongly depend on the existence of a team that can do the data-mining and bibliometric analysis. IRD, OST or other teams specialized in bibliometric analysis should be included in this reflection. What is necessary is a regular and accumulative work on scientific production based upon indicators built on a solid methodological foundation.

Finally, we should mention that it is necessary to create indicators that are robust and meaningful. Robust indicators are those indicators that do not vary too much in relation to the source of information they are built on. Meaningfulness is another matter: it is produced by discussing openly the value and meaning of the indicator (what does it describe exactly?). The indicators produced so far in ESTIME project are indicators that we have agreed upon and that we all believe they indicate the real situation of research. This has been the result of intense discussions. They are meaningful indicators. But we have also seen they are fragile and not robust. If we modify the sources of information we have a large chance to have variations that are more than marginal. We need to define the exact perimeter of the indicators. This can be done if we agree on how to count,

what to count and when and where to produce the indicators. As R. Barré puts it we now need “socially robust” indicators (Barré 2001) that is “indicators which have been co-produced by the social actors in an open and public way. We suggest there is room for indicators as a useful device for public policy decision-making, provided indicators are considered not as results, but as entry points for debate ; provided also that such quantitative inputs is understood as a multi-stage exercise involving both analysts, research actors and policy makers. To make sense, it should be seen as a joint learning process.” (Barré, 2001, EOLSS on-line).

Among other things that could be engaged under MIRA we would like to mention the following:

- Create a bibliometric database for the natural and exact sciences

It is common practice to use the *Science Citation Index* as reference tool for evaluation of mainstream science. ESTIME has shown that the bibliographies of researchers in the Arab countries are not satisfactorily covered by the international databases, for a range of reasons that are far from clear. The social practices of the researchers, the functioning of universities and research institutions, the feeble importance of evaluation in their careers, the importance of non-English production, the specific areas of specialization (mainly engineering) all contribute to this bad coverage. It is absolutely necessary to cross-check various sources and there is only one way to do this: **create a common reference** tool that could be closely related to the SCI, and also develop specific tools that would encourage a larger production in the internationally recognized journals and a better image of locally published research. This work can be done by a small team and its benefit can rapidly outperform its costs. It needs to be supported by the authorities of the European Union and cannot be the sole result of a local and private initiative. An institution like the Observatoire des Sciences et Techniques (OST) and the network of European Scientometric teams (European Network of Indicators Producers ENID). (http://www.enid-europe.org/) could be the managers of such a cross-institutional platform.

- Create a documentary network for the social sciences

ESTIME has tried to evaluate the importance of the research in the social sciences. No database has been found to be satisfactory except the very notable *Fondation Abdul Azziz* which has gathered all production in the social sciences in Maghreb countries. No equivalent exists in other countries. ESTIME has found in all countries a growing importance of the social sciences and about half the production (or little more in some countries) is in Arabic. There is no relevant database to make this evaluation. The evaluation of the work done in the social sciences is strategic for the future of Arab countries (see below).

- Prepare common disciplinary evaluations by cooperation of EU & Mediterranean experts

In the national policies about research, basic sciences have been largely left to their own. Most effort in the national plans has been on innovation and applied research and technological development, rarely on basic sciences (with the notable exception of Tunisia). The tools for evaluation of scientific disciplines (not individuals or projects) and the means and resources for research have been the central core of ESTIME, thus encompassing both applied and basic research. The exercise in Morocco in 2002 showed that the Experts advice can be joined with bibliometric and other indicators to identify avenues for future research,

specifically in basic sciences. It would be advisable to engage in similar exercises maybe on a more limited scale (programme evaluation).

- Promote training in statistics and indicators

National policies about research, technology and innovation need also a series of regular surveys on manpower, financial resources, and innovation. All these have been codified to a large extent (Frascati Manual, Canberra Manual, Oslo Manual). The need now is to train specific personnel that will be engaged in accumulating the data necessary to produce these indicators. The UNESCO Institute of Statistics has already begun this process. It is necessary to promote it regularly on a regional basis.

Enabling social sciences related to knowledge, science and technology

A real effort needs to be done to promote an understanding of the social structures that could host a more equitable world and more educated and informed populations. And, these are necessary steps before a knowledge-based society can emerge (see UNDP, Arab Human Development Reports 2003 & 2004).The post-9/11 world is in need of a more careful intervention in the inner making of policy, that associates the diversity of opinions and positions in Europe's closest neighbouring societies.

Moreover, we would recommend to promote what is commonly called "science studies" field (also known as STS or Science, Technology and Society) in the region. Because of the importance of the objective (a lofty objective, we were told by a Minister of Science) we would like to insist on this particular aspect.

The scientific productivity of a research system cannot be captured by a single number. It is the product of multiple interactions between many actors, all of whom are not static either in their opinions or their choices. Innovation policies appeared as a response to the opening of the economy and to the globalization process. The "innovation policy" response (rather than supporting specific sectors at whatever costs) was devised at the beginning of the eighties in Europe. The external influences are translated today in developing countries on the need to maintain the competitive edge of the national industries. The same happened also in the social sciences or the exact and natural sciences for example in what concerns major diseases or environmental issues. The effects of external influences and internal disequilibria of society and the economy become too hard to correct by the usual remedies: desertification, global warming and a series of less well known but also troubling issues are affecting science and the way we think about it.

The actors that make up these issues, the way they translate in each country the way knowledge can be used to attack specific aspects are the object of what is usually called "social studies of science". The understanding of the multiple sources of knowledge and their interdependence translate in institutions embedded in society. The institutional mix of policies, institutions, actors should be a matter of common analysis. The STS field or "science studies" needs to be developed. Although this might be a "lofty objective", it is the only one worth funding teams to untangle the way actors create knowledge on their own societies and with their own knowledge sources. Scientific communities are social and historical institutions. In the same way, scientific institutions and enterprises are also embedded in society. Innovation economics and networking of science and society need to be further analyzed. ESTIME threw a bottle at sea; policy-making

research in our field of "science studies" is possible and needed. ESTIME has been working as a network of researchers and policy-makers and this invaluable experience needs to be pushed further. A suggestion and recommendation would be to establish a "Science in Society" programme oriented toward Med partner countries. This programme could take advantage of the cooperation already engaged by the EU, for example in economics, but should extend its subject matter to sociological and political determinants of scientific research. The network that has been gathered under the PRIME network of excellence is a good (but not the sole) identification of teams in Europe.

Promote a Euro-Mediterranean Innovation Space (EMIS) by promoting an analytical capacity

Innovation is a growing activity in all the countries. It is related to three different forces: the growth of the industrial sector, the growth of foreign investment and the more complex specialization patterns of international commerce. SMEs in all the countries are changing in nature and occupy a central position in the economy. Moreover the increasing foreign direct investments are generating a higher demand for technical personnel. All in all the absorption capacity of all the countries has grown immensely in the last ten years. This is done in a rather paradoxical manner since it relates to a difficulty of matching the educational system and the economy on the one hand (as is proven by the high figures of unemployment of higher diplomas in many of the countries) and the absence of a clearly defined "innovation" policy. As the MED7 project conclusions state it is necessary to improve the industrial sectors, their scientific and technological capabilities and the institutional set-up that will be the building blocks of the Euro-Mediterranean Innovation Space (EMIS). The EU has a unique opportunity in promoting a more active Euro-Mediterranean policy related to innovation and technology.

Innovation surveys at the level of firms have been identified as a basic need of all countries and also for the building of the EMIS (Pasimeni, Boisard, Arvanitis and Rodríguez 2006). ESTIME found that only Morocco and Tunisia have had this type of surveys at the level of firms.[21] In some countries, research teams plan to make this kind of surveys (for example CREAD in Algeria).[22] The recently funded **Medibtikar** project (Europe Aid funding) could be the right place to begin with. It is strategically important to reinforce the collaboration of projects of DG RESEARCH and AID on this specific matter. Innovation surveys are not difficult to set-up if and only if a specific team is in charge of it in each country. The innovation survey activity is strategic for Europe and the Med countries.

A larger understanding of innovation policies and structures should begin by identifying (and evaluating) these "middle-level" or "bridging" institutions that now seem to be created everywhere, along with regional innovation policies promoting technology parks, incubators and industrial clusters. In one country only ESTIME promoted a survey of technical centres that are dedicated to a specific industry (Tunisia). ESTIME has largely begun a mapping of all the technology transfer units in all countries of the project. By technology transfer, we mean uses of

[21] The exact perimeter of both surveys is not the same. Morocco is an innovation survey by sampling; Tunisia has a more R&D focused survey that seeks to be an quasi-exhaustive survey of R&D capabilities of the country.

[22] Other countries have less clearly identified teams, but many candidates.

research from universities to the productive sector. There is a clear need for this effort and recently some countries (Jordan for example) have insisted on promoting “applied research” and reinforcing the structures that permit to have a close collaboration between research and enterprises

ESTIME has also encouraged “secondary” analysis of the data in Morocco and Tunisia. This activity is an “academic” activity that is necessary if one wants to interpret correctly the results. Comparison of R&D units in Med countries wth European or strongly industrialized countries is not straightforward: its needs specific metrics and specific analysis. A *Manual* should be written or at least adapted from the Oslo Manual which serves the purposes of the Community Innovation Surveys (CIS).

The institutions that appear to be in a position of supporting this type of analysis at a regional level in Maghreb: the foundation R&D Maroc in Morocco, CREAD in Algeria and the ONST in Tunisia. R&D Maroc and ONST additionally could also act at a regional level with the support of some international organization. In Egypt, project Medibtikar has also identified many participant institutions that could play this role. Finally, in Middle-Eastern countries, the effort coordinated by ESCWA is already rendering good results and would need to expand its analytical capabilities by supporting specific projects on a more localized level.

It should be noted that the recommendations of the MED7 project in its Casablanca meeting specifically insisted that the EU should promote not only directly innovation projects but also a continuous monitoring and analysis of the innovation activities: it is the basic condition in creating a EURO-MEDITERRANEAN INNOVATION SPACE (EMIS). As part of **MIRA** project (see above) innovation activities will be replaced inside the discussions and strategic activities of the EU-MED cooperation activities in science and technology. But it is imperative to extend this activity to the innovation policies.

Finally, a more general recommendation relates to the capacity of governments to support innovation activities. We found in countries where systematic new measures for the support of innovation were designed that enterprises have little knowledge of these structures and supporting or funding schemes. In fact, it would be advisable to support the creation of a consultancy activity related to innovation policies, a task that has been left until now mainly to governmental structures. But the capacity of the state is limited in this regard. By supporting private (or public/private partnerships) geared toward enterprises that could benefit from the measures of support of technological innovation would help create a new economic activity, and a growing awareness of innovation and funding policies. This activity should include information, intermediation, financial and banking support in all the countries.

Increase awareness for research policy at the highest levels of the governments

ESTIME identified a need to increase awareness of research policy and S&T policy matters in the higher spheres of government. High-ranking officers are usually trained in law, political sciences or engineering. In their career they seldom have opportunities to encounter scientific research, an activity that is misunderstood and usually confused with engineering or textbook teaching. Scientists are seen as academics –in the best cases– or teachers. Those rare persons who have an understanding of research activities are seen as “technocrats” and have less political power.

It is necessary to take measures in order that government officials have a better understanding of what is research, how it is developed in the country, what are its main locations; it is necessary for them to grasp the differences between teaching and research, between development and research; it is also necessary to diffuse the idea that research is needed even when technologies are imported and even more when technology transfers are negotiated with partner countries or in commercial agreements.

One possible suggestion is to create a specific training session on research policies for high-level functionaries, not necessarily limited to those who are engaged in science policy. Since these are persons with little time and high expectations, a session with a few well known trainers, in a high-end environment, and the sense of exclusiveness of the experiment they participate in, could favourably influence them and decide them to participate.

These training sessions could be designed at the regional level for the Arab world.[23] ALECSO could then be partner in such high level training. EU could propose some of its best experts who are famous world-wide. It should be noted that this is very different from a management issues of programmes (these are issues that could be covered by national contact points). The basic need is not so much on management as in promoting awareness on research, on policy design, on knowledge creation and dissemination, on what is at stakes at the global level and why research can be a tool for national strength.

Background documents created by ESTIME

Morocco Final Report

- Kleiche, Mina et Laaziz, Ilham, *La recherche scientifique au Maroc, Rapport de synthèse*, IRD & MRSFC, Sept. 2007

Morocco Reports

- El Adnani, Jillali, Rapport sur la production en matière de sciences humaines et sociales au Maghreb d'après la base de données de la fondation Abd al-'Azîz à Casablanca, 16 p.
- El Adnani, Jillali, Quelques idées de synthèse à partir des enquêtes en histoire et la sociologie-anthropologie, 7 p.
- Aouad, Rita, La bibliothèque du centre d'études arabes, Services culturels de l'ambassade de France à Rabat, Février 2005, 2 p.
- Aouad, Rita, La bibliothèque nationale du Royaume du Maroc (BNRM), Février 2005, 4 p.
- Aouad, Rita, *La bibliothèque La Source (Maroc*), Février 2005, 2 p.
- Aouad, Rita, *La bibliothèque de la faculté des lettres et sciences humaines à Rabat*, Mars 2005, 3 p.
- Aouad, Rita, *La bibliothèque du Centre Jacques Berque-Rabat*, Mars 2005, 2 p.

[23] Draft version of the possible contents for such a training session can be examined in the EOLSS On-line Encyclopedia section on Science and Technology Policy (See www.eolss.net and introductory article by R. Arvanitis. also available on-line at http://rigas.ouvaton.org/article.php3?id_article=77)

- Aouad, Rita, Le Centre national de Documentation de Rabat (CND), Mars 2005, 3 p.
- Aouad, Rita, Bibliothèque Nationale du Royaume du Maroc, base de données Monographies, Février 2005
- R&D et innovation dans l'industrie marocaine, rapport pour ESTIME, Ministère de l'Industrie, du Commerce et de la Mise à Niveau de l'Economie, décembre 2006, 24 p. Rédacteur R. Maghrabi
- Analyse de données sur l'enquête R&D, Ministère de l'Industrie, du Commerce et de la Mise à Niveau de l'Economie, Novembre 2006, 5 p. Rédacteur Amine Basri
- Assad, Jamal, Les résultats de rapprochement entre les trois enquêtes : MICMAE / R&D Maroc / Tunisie, R&D Maroc, Avril 2007, 13 p.
- Assad, Jamal, Rapport sur la recherche-développement et l'innovation dans les entreprises marocaines : Application de l'analyse factorielle des correspondances multiples, R&D Maroc, Casablanca, Maroc, 10 avril 2007, 49 p.
- Mellakh, Kamal, Rapport de l'enquête qualitative sur le dispositif institutionnel et les dynamiques de l'innovation dans les entreprises au Maroc, 2007, 66 p.
- Assad, Jamal, Description des traitements statistiques et des analyses factorielles de l'enquête innovation au Maroc, en cours
- Institutional report. Author is the Ministry MRSFC (Ilham Laaziz, Sanna Zebakh and her team). This document is based upon previous work done by the Ministry and IRD team (report of the Evaluation team, 2002).
- Interviews in the social sciences conducted with historians, economists, sociologists and deans of faculty (compiled by Jillali El Adnani and Rita Aouad)
- Innovation in firms. 2004 survey files processed by R&D Maroc
- R&D survey. 1999 survey files by the Ministry of industry
- In-depth interviews in enterprises (Kamal Mellakh).

Algeria Final Report

- *La recherche scientifique algérienne, Rapport de synthèse pour ESTIME*, IRD & CREAD (Ziour H, Ferfera Y. Benguerna, M. Arvanitis R, Boisard A-S.)

Algeria Reports

- Ferfera, Yassine, Ziour, Hocine, *La recherche scientifique algérienne (1962-2004)*, CREAD, 22 p.
- Ouchalal, Houria, Khelfaoui, Hocine, Ferfera, Yassine, *Situation de la R&D dans l'industrie algérienne. Cas de trois entreprises publiques*, 17 p.
- Khelloudja, Megherbi, Arabi, Mohamed avec la collaboration de Khelfaoui, Hocine, *Les pratiques d'innovation et leurs implications socio-organisationnelles. Cas des PME de la région de Béjaia*, 28 p.
- Benguerra, Mohamed, Ferfera, Yassine, Guedjali, Assia, Belekmari, Houda, Lamria, Azzedina, Belarbi, Yassine, *Contribution à l'étude des capacités scientifiques, techniques et d'innovation en Algérie. Etat des lieux des sciences sociales en Algérie*, Rapport intermédiaire, 108 p.

Tunisia Final Report

- *Scientific Research in Tunisia. Report based on research work conducted as part of the ESTIME project in Tunisia*. P. Renaud (ed.) April 2007, 39 p.
- *La recherche et la technologie en Tunisie*. Avril 2007, 51 p.

Tunisia Reports

- *Le système national de recherche en Tunisie.*, M'Henni, Hatem (coordination), Ben Othman, Arbia, Ghozzi, Chiraz, Ben Salah, Najeh, M'Henni, Sami, Trabelsi, Mhenni, Bureau des Etudes Prospectives, de la Planification et des Statistiques, Ministère de la Recherche Scientifique, de la Technologie et du Développement des Compétences, Janvier 2007, 29 p.
- *La dynamique de la recherche en Tunisie*, M'Henni, Hatem (coordination), Ben Othman, Arbia, Ghozzi, Chiraz, Ben Salah, Najeh, M'Henni, Sami, Trabelsi, Mhenni, Bureau des Etudes Prospectives, de la Planification et des Statistiques, Ministère de la Recherche Scientifique, de la Technologie et du Développement des Compétences, Janvier 2007, 29 p.
- *Les usages de la recherche en Tunisie*, M'Henni, Hatem (coordination), Ben Othman, Arbia, Ghozzi, Chiraz, Ben Salah, Najeh, M'Henni, Sami, Trabelsi, Mhenni, Bureau des Etudes Prospectives, de la Planification et des Statistiques, Ministère de la Recherche Scientifique, de la Technologie et du Développement des Compétences, Janvier 2007, 76 p.
- Mathlouti, Yamina, *TIC et respécialisiation industrielle de la Tunisie : insertion professionnelle des ingénieurs de Sup'Com et système d'innovation*, Sup'Com, Mars 2007, 62 p.
- Assad, Jamal, *Les résultats de rapprochement entre les trois enquêtes : MIC / R&D Maroc / Tunisie*, R&D Maroc, Avril 2007, 13 p.
- Aberraouf Hsaini, Le système national d'innovation et de recherche en Tunisie : Un essai de caractérisation et d'évaluation du rôle des centres techniques,

Activity in Egypt

Desk work and studies by IRD team had been engaged previous to the Minister's definitive rejection of the project.

Lebanon Final Report

- *Evaluation of Scientific, Technology and Innovation Capabilities in Lebanon*, Gaillard, Jacques in collaboration with Jacques Kabbanji, Joseph Bechara and Mona Assaf, May 2007, 54 p.

Lebanon Reports

- Scientfic Research Capabilities in Lebanon. Mouïn Hamzé, Mona Assaf, (Final Report for ESTIME), National Council For Scientific Research – Lebanon, Beirut, 2007, 185 p.
- Kabbanji, Jacques, Moussaoui, Ali, *Rapport sur l'état des sciences sociales et exactes au Liban, Introduction,* Avril 2006, 14 p. + 11 p. et version avril 2007 27 p.
- Kabbanji, Jacques, Bechara, Joseph, *Rapport sur l'état des Sciences Exactes au Liban*, 23 p.

- Kabbanji, Jacques, *L'innovation au Liban, structures, institutions, apports et limites*, 25 p.
- Kabbanji, Jacques, *Les sciences sociales, aperçu historique*, mai 2007, 24 p.
- *Pré-rapport institutionnel,* CNRS
- *Rapport sur les sciences sociales : Répertoire des chercheurs et des centres de recherche*, Liban/Syrie/Jordanie, IFPO, Août 2007, 45 p.

Jordan Final Report

- *Research in Jordan. Country Report.* 10/07/2007. Pénélope Larzillière (ed), Khaled Elshuraydeh (Secretary General HCST), Isam Mustafa (Project Manager), and Abdel Hakim al Huzban, 54 p..

Jordan Reports

- *Science & Technology and Innovation Profile of Jordan*. Elshuraydeh, Khaled, Mustafa, Isam, Al Majali, Mohammad, Al Assaf, Majeda, Sarraf, Falak, Hamarneh, Omar,. ESTIME / HCST, 94 p.
- Al Husban, AbdelHakim, *The State of Research in Social Sciences in Jordan (Anthropology, Archaeology, Sociology, and Law),* Anthropology Department-University of Yarmouk, Irbid-Jordan, 56 p.
- Interviews with researchers in the natural and exact sciences and report by Nadal Ouran. December 2006.

Palestinian territories Final Report

- *Research under the national Palestinian Authority.* R. Arvanitis (ed) based the report of the Palestine Academy for Science and Technology, and the reports of V. Romani and of A. El Sakka. November 2007, 41 p.

Palestinian territories Reports

- *Scientific Research in Palestinian institutions*, Palestine Academy for Science and Technology, February 2007, 54 p.
- El Sakka, Abaher, *Pré-rapport de mission de recherche en Palestine*, 13 p.
- Romani, Vincent, *Les sciences humaines et sociales dans les territoires palestiniens*, 51p.

Syria Reports

- Charif, Maher, *État de la recherche scientifique en Histoire (et en Archéologie),* IFPO-Damas, 15 p.
- Marzouk, Nabil, *Etat de la Recherche en Sciences Economiques en Syrie*, IFPO-Damas, 13 p.
- Marzouk, Nabil, *Etat de la recherche en sociologie en Syrie*, IFPO-Damas, 6p.
- Abbas, Hassan, *La recherche en Sciences juridiques en Syrie*, IFPO-Damas, 45 p.
- Al Mansour, Ahmad, Al Shehne, Jameel, *Report on the innovation system in Syria and Aleppo*, June 2006, 27 p.
- Assi, Ghassan, Report on HIAST: A report for ESTIME, 26 p.
- Statistics on academic research.
- A presentation of the Higher Institute For Applied Sciences & Technology (Hiast) – Damascus, Report for ESTIME. June 2007, 26 p.

Reports on scientific production by OST

Country information leaflets. OST designed and produced country information leaflets for the countries of the project. They are completed and posted on the website of ESTIME (updated data to 2004).

- Egypt Leaflet, F. Laville & J. Thèves, July updated version, 2007.
- Morocco Leaflet, F. Laville & J. Thèves, July updated version, 2007.
- Algeria Leaflet, F. Laville & J. Thèves, July updated version, 2007.
- Tunisia Leaflet, F. Laville & J. Thèves, July updated version, 2007.
- Lebanon Leaflet, F. Laville & J. Thèves, July updated version, 2007.
- Jordan Leaflet, F. Laville & J. Thèves, July updated version, 2007.
- Syria Leaflet, F. Laville & J. Thèves, July updated version, 2007.
- Laville, Françoise. *Bibliometrics as a tool for analysing country's S&T activities*, OST, Paris, 11 p.

Methodological reports.

- Guidelines for fieldwork (main authors : Waast and Arvanitis, IRD) (in French and English):
- Estime, Website (Methodological reports were written at the beginning of the project)
- Study guide for the review of the national research system
- Indicative plan for the report on institutions
- Interview guidelines for research institutions, laboratories and researchers
- Interview guidelines for the social sciences
- Study guide for the social sciences
- Methodological guidelines for innovation and uses of research
- General plan for the final country report

Bibliometric reports by IRD

- Waast, Roland (sous la direction), en collaboration avec Rossi, Pier Luigi et Fondation Abdul Azziz . *Panorama Bibliométrique des sciences sociales au Maghreb*, 79 p.
- Waast, Roland, Rossi, Pier Luigi, Bibliométrie des sciences exactes et naturelles, Pré-rapport, mai 2007, Données OST (21 p.), Outils de pilotage de la recherche tableaux de bord (23 p.).

General content reports

- Arvanitis, Rigas, Identification of innovation capacity in MEDA countries, May 2005, 9 p.
- El Kenz, Ali, Les sciences sociales dans les pays arabes : cadre pour une recherche.
- Hanafi, Sari. *Impact of Western Funding System on Social Sciences' Research in the Arab East. The Dilemma of the Research Centers External to Universities.* Final Report presented to the project ESTIME, Beirut, July 13, 2007, 28 p.

- Hsaini, Abderraouf, *Les SPL au Maroc : examen empirique de deux cas dans la médina de Fès*, Université Pierre Mendès France (Grenoble), 15 p.
- Hsaini, Abderraouf, Le rôle déterminant des savoir-faire dans la dynamique de développement. Éclairages théoriques et réflexion à partir du système productif local de Ksar-Hellal, Université Pierre Mendès France (Grenoble), 12p.
- Courlet, C., Territoire, régulation et Institutions, Université Pierre Mendès France (Grenoble), 8 p.
- Hsaini, Abderraouf, A propos des analyses conceptuelles dominantes du SPL : une présentation synthétique, Rapport à la demande du coordinateur de ESTIME, Laboratoire PEPSE, 9 p.
- Ben Saleh, Najeh, Description des traitements statistiques et analyses factorielles de l'enquête R&D en Tunisie, en cours
- Pasimeni, Paolo, Boisard, Anne-Sophie, Arvanitis, Rigas, Rodríguez-Clemente, Rafael, *Towards a Euro-Mediterranean Innovation Space: some lessons and policy queries*, 31 p.
- Mohamed Abdelalim, El Izaboui Yousri, Benefissa Sarah, *Les sciences politiques en Egypte,* Rapport intermédiaire, 19 p. + version actualisée avril 2007.

Additionnal References

Amable, Bruno, Barré, Rémi and Boyer, Robert (1997) *Les sytèmes d'innovation à l'ère de la globalisation* (Paris: Economica).

Arvanitis, Rigas (2003) 'Science and technology policy', in UNESCO (ed), *Knowledge for Sustainable Development - An Insight into the Encyclopedia of Life Support Systems (Volume 3)* (Paris, France, Oxford, UK: UNESCO Publishing / Eolss Publishers.): 811-48.

Arvanitis, Rigas and Villavicencio, Daniel (1998) 'Technological learning and innovation in the Mexican chemical industry: an exercise in taxonomy', *Science, Technology & Society* 3/1: 153-80.

Arvanitis, Rigas and Villavicencio, Daniel (2000) 'Learning and innovation in the chemical industry in Mexico', in Mario Cimoli (ed), *Developing innovation systems: Mexico in a Global Context* (London: Pinter): 189-205.

Arvanitis, Rigas and Vonortas, Nicholas (2000) 'Apprentissage et coopération à travers la Recherche-Développement', *Technologies, Idéologies, Pratiques* 14/1: 225-46.

Barré, Rémi (2001) '1.30.4.1. Policy making making processes and evaluation tools : S&T indicators', in Rigas Arvanitis (ed), *Theme : Science and Technology Policy* (Encyclopedia of Life Support Systems: EOLSS Publishers/UNESCO): http://www.eolss.net/.

Comité directeur (Rapport du Cinquantenaire) (ed) (2005) *Le Maroc Possible: une offre de débat pour une ambition collective* (Rabat: Editions Maghrebines (Casablanca)).

Cornu, Jean-Michel (2004) 'La coopération, nouvelles approches', in, *Site personnel*: Creative Commons / Version 1.2 du 24 décembre 2004).

Crehant, Patrick and Chaabouni, Reffaat (2004) *Annual Policy Trends Report for MEDA countries: Algeria, Egypt, Jordan, Lebanon, Morocco, Syria, Tunisia* (Bruxelles: European Commission, Entreprise DG Innovation SMEs Programme).

El Kenz, Ali (1996) 'Prométhée et Hermès', in Roland Waast (ed), *Les sciences au Sud. Etat des lieux* (Paris: ORSTOM): 263-82.

Godin, Benoît (2005) *Measurement and statistics on Science and Technology. 1920 to the present* (London & New York: Routledge).

Juma, Calestous and Lee, Yee-Cheong (eds) (2005) *Innovation: Applying Knowledge in development* (London: Earthscan, UN Millenium Project, Task Force on Science, Technology and Innovation).

Khelfaoui, Hocine (ed) (2006) *L'intégration de la science au développement. Expériences maghrébines* (Paris: ADEES/Publisud).

Moed, Henk F. (2002) 'The impact-factors debate: the ISI's uses and limits', *Nature* 415/731-732.

Moisseron, Jean-Yves (2005) *Le partenariat euroméditerranéen: l'échec d'une ambition régionale* (Grenoble: Presses Universitaires de Grenoble).

Monastersky, Richard (2005) 'The Number That's Devouring Science', *The Chronicle of Higher Education* 52/8: A12.

Moussaoui, Abderrahmane (2006) *De la violence en Algérie. Les lois du chaos* (Alger: Barzakh).

Mullin, James, Abeledo, Carlos, Mazzonis, Danielle and Whyte, Anne (2002) 'Science, Technology and Innovation: Policy and Programs in Jordan', in: HCST/IDRC Mission on Science, Technology and Innovation: Policy and Programs in Jordan): 217.

OST (2007) 'Bibliometrics as a tool for analysing country's S&T activities', in Rigas Arvanitis (ed), *ESTIME - Reports* (Paris: Observatoire des sciences et des techniques -): 11.

Pardey, Philippe G. and Beintema, Nienke M. (2001) 'Slow Magic. Agricultural R&D a Century After Mendel', in (Washington,D.C.: Agricultural Science and Technology Indicators Initiative, International Food Policy Research Institute (IFPRI)).

Pasimeni, Paolo , Boisard, Anne-Sophie , Arvanitis, Rigas and Rodríguez, Rafael (2006) 'Towards a Euro-Mediterranean Innovation Space: Some lessons and policy queries', in, *The Atlanta Conference on Science and Technology Policy 2006: US-EU Policies for Research and Innovation* (Georgia Institute of Technology, Atlanta, May 18-24, 2006.

Pirela, Arnoldo, Rengifo, Rafael, Arvanitis, Rigas and Mercado, Alexis (1993) 'Technological learning and entrepreneurial behaviour: A taxonomy of the chemical industry in Venezuela', *Research Policy* 22/5-6: 431-54.

Salais, Robert and Storper, Michael (1993) *Les mondes de production. Enquête sur l'identité économique de la France* (Paris: Editions de l'Ecole des Hautes Etudes en Sciences Sociales).