Assessing international scientific cooperation in the Mediterranean region
An international challenge ahead

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Abstract. The article is based on the White paper that was elaborated by the Observatory of Scientific Cooperation in the Mediterranean. It examines the theoretical and institutional background, then proposes a series of indicators and initiatives that can be taken in the future. The article shows the possible relation between the policy objectives of the Cairo Declaration and the indicators needed. It also examines the needs for the creation of a more permanent Observatory in the region.

Keywords. Sciences – Technology – Research – Innovation – Indicators.

Evaluer la coopération scientifique dans la région méditerranéenne. Un défi pour le futur

Résumé. *Cet article est basé sur le « White Paper » qui a été élaboré par l'observatoire de la coopération scientifique dans la région Méditerranéenne. Il examine les fondements théoriques et institutionnels et propose une série d'indicateurs et d'initiatives qui devraient être mises en oeuvre dans le futur. L'article montre la relation possible entre les objectifs de la Déclaration du Caire et les indicateurs nécessaires pour l'accompagner. Il examine enfin les besoins d'un observatoire permanent dans la région.*

Mots-clés. *Science – Technologie – Recherche – Innovation – Indicateurs.*

I – Introduction and background

MIRA project aims at creating a regional ST dialogue platform in the Mediterranean Region. It seeks to identify common interests in research areas; it helps set up ST priorities and support the capacity building activities. MIRA promotes synergies among the different cooperation ST programs between the Mediterranean Partner Countries (MPCs) and the member states of the EU, and fosters the participation of the MPCs in the Framework Programme. All the activities are aimed at providing a strong institutional basis for the EU-MPC ST cooperation.

Among its follow-up of cooperation activities, it was decided to create an Observatory of the EU-MPC ST cooperation, geared toward understanding the state of research and technological cooperation between the EU and the MPCs.

A first challenge is to establish a standard set of indicators to be used by the MoCo for:

1. Monitoring the state of research and technological cooperation between the EU and the MPCs;
2. Making recommendations based on evidence in order to improve the patterns of the Euro-Mediterranean ST cooperation.

Ideally, the Observatory should be in charge of maintaining a database on the scientific production of the co-operation engaged between European and Mediterranean Partners. It will engage in the analysis of the research system dynamics. Ultimately, this Observatory should promote the establishment of observatories for science and technology among the Partner countries and be in co-ordination with these observatories.

The objective of this article, which is based on a White Paper for the project, is to propose the guidelines on the indicators measuring international collaboration in the context of the Euro-Mediterranean cooperation. It will draw the attention on *methodological issues* related to the measurement of research activities. The article will review the *framework* of the EU-MPC co-operation for which these indicators are proposed, including the political framework as defined by the EU-MPC policy platforms (Monitoring Committee for EU-MPC scientific co-operation and inter-ministerial "Cairo Declaration" signed in 2007). It will propose a *list of indicators* and suggest possible uses for them. It will also identify the instruments needed in order to *actually* provide these indicators, something that is still lagging behind in many countries. The *White paper* will define a roadmap of activities that need to be developed in order to prepare the appropriate measurement activities in the framework of an Observatory for Science and technology Euro-Med Cooperation[1].

In the first section, we review the notions of international scientific collaborations and co-operation and the questions related to the level of analysis and of the reference framework. In section 2 we review the policy framework and in particular Cairo Declaration. In section 3 we cover the different kinds of indicators and the more general methodological issues concerned with the measurement of research collaboration and co-operation. In section 4, we propose a specific framework and indicators to back up the Euro-Mediterranean co-operation at various levels: policy level and programme level. It contains the guidelines and indicators proposed. Section 5 examines the structure of an observatory on scientific and technological co-operation.

II – International scientific co-operations and their measurement

The need to measure and analyze international scientific collaborations has been triggered by the increasing number of such collaborations. Scholars specialized in the field of science policy, sociology and bibliometrics have proposed a variety of methods for their measurement. They all insist on the great range of rationales, drivers and factors identified affecting scientific collaborations. This section will briefly sketch some of the arguments uncovered by this literature. It will then proceed to indicate the different scope of international scientific co-operations as compared to collaborations. Finally, it will review the possible framework of analysis of the international scientific collaborations.

1. Scale and scope of international scientific collaborations

Scientific collaborations have always been an ingredient of science in the making. *Physical Letters*, the prestigious physics journal was born out of the exchanges of letters with Newton and the Royal Academy and dispersed thinkers around the World. Science, as a human endeavour, has always been based on collaborations mainly at the international level, but it is only recently that it became an active ingredient of science policy. What has changed fundamentally is the scale of international collaborations. Their increase has been quite spectacular in the last twenty years (since mainly the mid-90's to now). The number of articles in science co-authored by scientists in different countries has grown proportionally more rapidly than the overall number of publications. This explains the abundance of mainly bibliometric studies depicting the scale of international collaborations.

The internationally co-authored articles have not only grown rapidly; they have also more intensely included countries outside the "triad" (USA, EU, Japan) that has dominated science since the second world war. The developing countries have seen their share of co-publications grow very quickly and even quicker than industrialized countries. This steady growth of the share of co-authored articles has affected all countries until 2000.

Between 2001 and 2006, international co-publications increased in all countries except China, Turkey and Brazil. This has to do with the fact that international co-authorship is related to the size of the scientific community: these three countries have now a rather important scientific community; they also collaborate more domestically. In reality, during the last twenty years, two concurring processes have been taking place: the numerical growth of scientific communities and the growth of international collaborations.

The determining factors of international collaboration in science and technology are based on a wide range of reasons that go beyond the internal dynamic of scientific research (Gaillard, 2001; Wagner, 2008). Demographic, political, economic and social reasons explain this growth. All these suppose to be aware of the varying factors that act upon scientists, and policy personnel when designing measures that support either collaborative research or mobility issues.

Any discussion on international collaboration should take into account the context in which research activities take place. Overall, the recent period has seen not only the emergence of mega-networks of science at international level; it has also seen the pressure of more R&D activities at international level, mainly promoted by the business sector, and a general understanding that innovation needs to be the focus of policy (Arvanitis, 2003). Innovation has also created the conditions for a new science policy discourse that promotes international linkages. Maghreb countries have been very actively engaged in testing these policy measures that support networking of competences (Arvanitis *et al.*, 2010).

A considerable effort has been made thus far in the region for the monitoring of the research activities, although unevenly and quite differently from one country to the other, or from one organization to the other (Arvanitis and M'Henni, 2010; M'Henni, 2009). Nonetheless, the challenge has still not been met and the close relation of the European Union with its Mediterranean partners in research calls for a more intensive monitoring activity (Pasimeni *et al.,* 2007).

The main changes that took place in science have affected the scope of scientific collaborations. They can be summarized in the following way:

- Increasing need to gather high-level basic scientific competences within applied technologies in all new and emerging scientific fields such as biotechnology, nanotechnology, materials science, information sciences; this has been labelled a change in the *search regimes* in science and technology (Bonaccorsi, 2008) or *new modes of knowledge production* (Gibbons *et al.,* 1994);
- More privately funded research, either internally in R&D departments or in close connection with private and public research labs;
- Growth of the global issues such as environmental concerns, public health, specific diseases such as AIDS;
- Active involvement of users in the governance of science, by the creation of large NGOs that actively fund and support research, and a more active demand for participatory research (that is research involving both researchers and non-researchers);
- Increasing use of information and communication technologies creating the infrastructural conditions of the Knowledge Economy, and that has created opportunities for *collaborative research practices.*
- Very deep change in what was once called the 'developing world' with increased presence of some large emerging economies that are challenging the international scene (like China, Brazil, Mexico, South Africa); but also the growing differentiation in medium-level income countries from others in terms of scientific production (Chile, Thailand, Tunisia, Morocco are good examples), and the very rapid growth of scholarly activity in countries that are rich but have had no previous research history (such as the Gulf countries). Challenges and prospects for collaboration are different in this more fragmented world.

2. The framework of scientific cooperation

The motivations and the dynamics of the research collaborations have been relatively less studied than the scale of research collaborations. In other words, the scope of research collaborations at the international level is less well known and needs to define a larger framework of analysis, that goes beyond the scientific networking that appears when performing analysis of the international co-authorships. This supposes a different analytical framework and supposes to use instruments other than bibliometric analysis in order to go beyond the publications and take into account the various dimensions of the internationalization of research. We examine these aspects in the following paragraphs.

Scientific *cooperation* (as opposed to collaboration) appears when support programmes actively promote the scientific collaboration at the international level. Scientific cooperation activities are promoted by both international and national institutions. International programmes and national agencies working at the international level, design, fund and sustain these cooperation programmes. The role of agencies in international scientific activities has broadened and policies are more pervasive today; they aim less at increasing collaborations of individuals, mobility, and research careers than was the case some twenty or so years ago[2].

In an effort to synthesize these tendencies, a recent research, funded by the EC, distinguishes on one hand « the *narrow* Science, Technology and Innovation (STI) cooperation paradigm » and the « *broad* research cooperation paradigm » (Boekholt *et al.*, 2009). In the former paradigm, the drivers are mainly « to improve the quality, scope and critical mass in research by linking national resources and knowledge in other countries ». In the later paradigm, other non-science policy objectives interact with the “intrinsic” science-oriented objectives. For example, the urgency of tackling global societal challenges has opened the discussion for more global research programmes. Other drivers such as diplomacy and historical cultural ties between countries and development or bilateral aid have for a long time influenced the choice of partners and may still form a stable influence in the background.

The ‘governance’ of the new research system has to take into account the changes mentioned above. By ‘governance’ one has to understand that any decision taken by official authorities (governments, international agencies, EU) should include (some say: ‘accompany’) the several players of the new learning economy. Research collaborations are not only at the individual level; they concern public research institutions, private companies, NGOs, institutions performing research as well as regulatory agencies (in fact, the involvement of actors that directly influence the regulatory framework of technologies has been an active ingredient of the growing research collaborations).

The “governance” of international co-operations supposes a particular attention pointed towards:

i. Co-ordination needs: competing objectives and competing funds create a need for coordination activities.

ii. Priority setting: since international collaboration networks seem to respond to their own “ecology” and the economic system imposes its own rhythm to funding and insertion of technologies into the productive processes (also known as “path dependency”), public action needs to be more targeted; therefore, priority setting becomes a necessity.

iii. Stakeholders involvement: the changes summarized above indicated the need to integrate stakeholders that participate both in the definition of objectives and in their implementation.

iv. Evaluation and assessment of impacts: evaluation should be part of the whole policy cycle and feed the process itself.

3. Three levels of assessment frameworks of scientific cooperation

The evaluation, or assessment, of the performances of international scientific co-operations can be performed at *three levels of assessment,* which call for different methodologies.

1. The most natural reference framework for a scientist is his academic discipline –usually also corresponding to some organizational structure: department or faculty. For this type of assessments, bibliometric indicators, closely related to the production of science, are the preferred instruments of analysis. It corresponds to a first level of analysis. Thus all scientific collaboration analysis performed on the basis of co-authorships systematically refer to this first level.
2. Funding agencies –such as the Framework Programme of the EU – do not adopt the same organization of knowledge: they would go along programmes. Programme managers would refer to this framework as the pertinent level of reference of any assessment of the scientific activity, as is usually the case in any evaluation report funded by the EU. This programme level assessment is the second level, and probably the most usual one.
3. Policy (its stakes and implementation) is defined at "higher" level. Indicators in this case need to be related to the policy framework and to its implementation.

In brief, we can conclude by stressing:

- The necessity to define the level of assessment needed in order to use appropriate indicators for the international scientific collaboration;
- The necessity to highlight the target and reference of the assessment exercise;
- The necessity to draw on information and knowledge about the R&D systems of the partner countries.

III – The policy framework of research cooperations between EU and Mediterranean countries

1. The policy framework

The historical conformation of science in the region explains a variable peculiar mix of institutions in each country. ESTIME project as well as the UNESCO Meta-study of science and technology systems (Mouton and Waast, 2007) indicate a typology of national research systems which opposes centralised to decentralised systems. Nonetheless, the overall impression is of a rather large and growing dispersion of research in a great number of institutions. This has to do with the growth of the research system, but also because of a greater role played by universities, and a larger importance of technological activities.

It should be mentioned that the national coordination bodies in charge of providing appropriate governance for science have been created rather late as compared to other continents. In more centralized countries (Tunisia, Algeria), Ministries or State secretariats were created, following the French Model or an Eastern European model (Egypt). In more decentralized countries, Science Councils were usually preferred (Jordan, Lebanon). The Egyptian and Syrian research systems have been evolving more profoundly and rapidly in the very recent past (since 2007 for Egypt, and 2008 for Syria).

A major new ingredient in the research systems is represented by funding agencies at the national level or programmes – usually depending on a Ministry of a national Council – functioning as funding agencies.

Academics of sciences have also played a minor role in the region, whereas they have been an essential ingredient in Europe, the USA and Latin America. In some countries an effort is made to reactivate them as real ‘parliaments of science’ and not mere honorific institutions. National scientific communities were the outcome of the strengthening of the state, and became a symbolic institution in the hands of powerful social and political patrons, mostly tied to some national projects, incarnation of progress and development (Gaillard *et al.,* 1997).

In Lebanon, the Lebanese Association for science has been only very recently re-animated (Charif, personal communication). Its main activity consists in publishing the Lebanese Science Journal and has received support by the National Council for this.

Morocco has recently promoted the creation of a Science Academy modelled not after the American AAAS but the French Académie des Sciences, an elite institution of renowned and recognised persons. It is a quasi-public institution with public funding and independent status.

In Egypt, because of its former strong political relations with the USSR in the fifties and sixties, the model of governance was based on the State Academy. It is only recently, since 2007, that the system has been revamped in Egypt, creating a funding agency and enhancing the Ministry of research. The Academy in Egypt still exists appointively and acts as a think tank for the government on science issues.

Disciplinary associations, although they exist throughout the Mediterranean, are usually of little activity except in some specific areas (for example Public Health,…), where one encounters a strong scientific regional activity. These regional or disciplinary associations for science constitute the living proof of scientific organizations that are independent from the activities of the State. They are usually based on voluntary activity of researchers.

Whatever the scheme, scientific co-operation has usually been managed by the Councils or Ministries, at the State level, in a very centralised manner. Practically, scientific collaborations rely on the performing institutions (universities, labs or public research institutions). Universities usually have the legal authority to sign agreements, which they do indeed, but in the MPCs the national governmental authorities seem to prevail in terms of habits. The governance of the research systems shows this duality between co-operation and collaboration in all countries, including European Union member countries and MPCs. Moreover, the EU has been imposing a scheme of more centralised partnerships: the MPCs have been taking in charge more strategically the co-operations with the EU going beyond the usual very general political agreements.

Historically, science in the MPCs, even when it has a long historical record –as is the case of some emblematic institutions such as the American University of Beirut or the less science-oriented University Al Azhar in Cairo – has been both marginal and rather concentrated in some unique institutions. Still today, this explains the strong variations of number of publications in many countries: they are the *expression of a small number of institutions*. To give an example, nearly 50% of the scientific publications in Lebanon, the more decentralized country in the Mediterranean, rely on one institution. This very high concentration of the research activity is typical of countries with a small scientific community.

Even with low budgets and low priority, with a record of activities with ups and downs, the governing bodies of the research systems in the Mediterranean have not totally left research unattended. Rather it seems that its weaknesses rely on the unstable support given to research. International cooperation has often appeared as a means of supporting research when national funds were rather difficult to obtain or unavailable. But cooperation programmes operate on a different basis than collaborations: they are not the sole result of a need for money. They also express a political will. They are instruments in the hands of the governments, particularly when bi-lateral relations are concerned.

The agreements signed between the EU and the partner countries form a complex web of political and diplomatic relations and serve as a reference framework. MoCo is closely associated to this effort. The ASBIMED Project has tried to review all the bilateral cooperation programmes in the Mediterranean region. It was clear from the results that most of these programmes between Europe and the Med countries were "based on spontaneous proposals by the stakeholders, which in their large majority come from academia" (Final Report, p.12). 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 comes from the very formulation of the cooperation agreements. In most cases, cooperation agreements are quite large in scope and researchers under these schemes of collaboration do not necessarily report under one single heading.

Box 1- Objectives of the Cairo Declaration (June 2007) (elaboration)

A. In Higher Education:
Creating a Euromed Higher Education Area:

1. Approximating the Euromed Higher Education Systems;
2. Promotion of a Permanent Euromed University Forum;
3. Promoting Educational Innovation and Information and Communication Technologies (ICT);
4. Promoting mobility through exchanges of higher education students, teachers, researchers and administrators;
5. Enhancing participation in the Erasmus Mundus External Cooperation Window.

B. In Research and Innovation:
Towards the creation of a Euromed Research Area:

1. Modernizing Science and Technology, R&D policies in the Mediterranean Partner Countries;
2. Supporting Institutional Capacity Building, including human and research infrastructure development;
3. Enhancing the participation of the Mediterranean Partner Countries in the Framework Programmes while taking into account their particular needs, as well as areas of mutual interest and benefit between the EU and Mediterranean Partner Countries;
4. Promoting innovation in the Mediterranean Partner Countries and enhancing exploitation of the RTD outputs by society and industry;
5. Favouring mobility of researchers;
6. Enhancing participation of the Mediterranean Partner Countries in the "People" Specific Programme of FP7.

2. Cairo Declaration

A major change has occurred in the Euro-Mediterranean policy context with the signature of the inter-ministerial agreement known as Cairo Declaration between EU and partner countries, "Toward a Euro-Mediterranean Higher Education & Research Area" (June 2007). It included a series of policy objectives and serves the purpose of a framework for the assessment exercise (see Box 1 Objectives of the Cairo Declaration (June 2007)). The MoCo ad hoc committee of April 18, 2008 decided to focus on the mobility issues. Finally it is necessary to replace the whole effort on research in the more general policy framework of Euro-Med co-operation (see "The policy framework of Euro-Med cooperation on research and innovation" by Arvanitis, Rodriguez-Clemente and El-Zoheiry infra pp. 12-39).

General issues in the measurement of science and technology collaborations.

In this section, we would like to highlight some of the main tools that can be used in measuring scientific collaborations. Since a report has been recently issued for the EC with a literature review (Edler and Flanagan, 2009), we will mention the main tools at our disposal.

3. Indicators & descriptors: general issues and difficulties

In an extended review of types of indicators that are available in science and technology, Rémi Barré mentions that the international standards always prefer to measure inputs and outputs (Barré, 2001):

- *Input indicators* are measuring resources available for research. They are defined by the Frascati Manual (OECD, 2002). They concern human, financial and infrastructure resources.
- *Output indicators* concern publications, patents, production of technology, innovations, and other possible issues of research such as production of new researchers, reports based on consultancies or expertise work, participations of researchers to public debates, activities related to the general public.

Input indicators, in particular "human resources" devoted to research, pose specific problems, mainly because of different status of the research personnel inside the academic or public services system. The methods that are proposed in the Frascati manual for human resources, in particular the estimation of *Full-time equivalents* are difficult to implement. They suppose to establish the time devoted to research for individuals that have multiple roles: teaching, professional practices, administrative activities, consultancy, participation into economic enterprises, and other outreach activities. In most Mediterranean countries, an additional difficulty comes from their social status: 'researchers' rarely occupy a recognized social position inside their organizations. They are first of all teachers in universities or part-time teachers, or professionals (doctors, engineers, lawyers, etc.). The organizations they belong to –mainly universities– encourage them to do research for internal promotion and in order to favour the enhancement of the teaching activities. They rarely acknowledge that research is a full-time activity as can be the case of a public research institution entirely oriented to research. Also, researchers rarely benefit from internal research budgets allocated by their universities, although this is becoming more frequent. Some good academic institutions in the Mediterranean devote up to 1% (rarely more) of their overall budgets to research. Most budgets come from external funding, either from national agencies or international agencies and foundations. International co-operation programmes are an important means of obtaining these funds.

Table 1. Categories and types of indicators.

Type ***Epistemological status*** ***Category***	**Descriptive type Volume and broad category of activity**	**Cognitive type Substantive – thematic nature of the activity**	**Opinion type Opinion of stakeholders on the activity**
human and financial resources (inputs)	volume of resources used as an input for the research activity	thematic nature of the skills and knowledge input for the research activity	opinion on the resources
production (outputs)	volume of output produced by the research activity	thematic nature of the knowledge and skills produced	opinion on the production
interactions	volume of resources flows and number of linkages	thematic nature of the interactions, thematic distances, thematic knowledge flows	opinion on the interactions
performance	efficiency ratio (output/ input), volume of impact and effect	cognitive impacts and effects	opinion on the performances

The most commonly used *output indicators* are publication counts, citation counts, and patents. Contrary to input indicators, there are no general accepted measures for the measurement of outputs beyond publications and patents. For the case of *collaborations*, most bibliometric analysis is based on the analysis of co-authorship. This material is of particular interest: co-authorship measures are robust, probably more than simple output figures (number of publications, either in absolute or in relative measures). Moreover, it is now relatively easy to produce large figures and graphs depicting the networks created by the co-authorships. Nonetheless, still many questions arise from these figures (levels of confidence and degree of strength of the linkages, meaning of presence of co-authors, difficulties in making a correspondence between institutional graphs and content of the research, choice of central points in the graphs,…). These very interesting tools need research to answer these queries.

Other measures try to capture the relations established between different fields, different cognitive areas, or between different institutions. These relational and cognitive indicators are usually seen as more complex. The measurement of co-operations is certainly part of this effort to produce relational indicators, either on the cognitive nature of collaborations in science, or on the institutional networking that is produced by researchers. This a blooming area of research in science policy analysis and bibliometrics. Contrary to input indicators there are no standards in the relational type of indicators.

Innovation activities are probably more difficult to measure; this has led to the development of specific innovation surveys, different in nature from the surveys needed in order to gather data on inputs for research along the lines proposed by the Frascati Manual. The experience of doing innovation surveys has been standardized in the Oslo Manual (OCDE, 1992). Innovation surveys are addressed to companies performing R&D, not to public institutions devoted to ST activities.

Establishing relations between the innovation surveys and the ST statistics has never been proposed. Rather, different proposals have been made to characterize the overall national state of research and innovation by establishing a profile on research, innovation and other knowledge related activities. Examples are provided by literature on economics of innovation when defining the national system of innovation (Archibugi and Lundvall, 2001; Lundvall, 1996; Lundvall, 2006; Nelson, 1993; OECD, 1999; World Bank, 1999), some of which concern specifically the Middle-East and North African region (Arvanitis and M'Henni, 2010; Djeflat, 2002; Reiffers and Aubert, 2002). An alternative to the national innovation system approach is to characterize the overall institution framework of the science and technology system.

Box 2 - Is there an ideal template to gather data on ST systems?

The template that we propose is based on what we have learned from our analysis of the 52 country reviews as well as a comparison with other existing approaches. Much of the detail that is proposed in the template has its origins in specific country studies. However, a few if any of the individual country studies would comply with the proposed template. In fact, we would argue that the template be seen as an ideal-typical framework that suggests (best) good practice in constructing a country study or profile. It should be seen as a heuristic framework that suggests categories and themes as well as different forms of information and data. In many cases information might not be available on every one of these categories. For some countries, some of the proposed categories and variables might be inappropriate. Therefore, it still requires insight and judgment on the part of the researcher.

The Mediterranean Innovation Scoreboard (MEDIS) proposed by the Medibtikar project is also an attempt to characterize the technological environment by establishing a list of indicators around five dimensions:

1. Innovation drivers;
2. Knowledge creation;
3. Innovation & entrepreneurship;
4. Application;
5. Intellectual property.

The underlying model of the Mediterranean Innovation Scoreboard (MEDIS) is based on an enlarged vision of the notions of 'input' and 'output'. *Inputs* here correspond to: (1) "drivers" of innovation such as education, levels of literacy and internet penetration; (2) actual means for the production of knowledge (the usual definition of inputs) such as expenditures on R&D and research personnel; (3) innovation and entrepreneurship, such as numbers of innovative SMEs, non-technological innovations in enterprises, ICT expenditures, venture capital, etc. On the other side, in the MEDIS framework, outputs are more strictly limited than usually assumed in such general frameworks: outputs are strictly market-based, such as employment, products, and outcomes that can be legally protected (patents, trademarks, etc). Nonetheless, MEDIS made the point to show that these commonly accepted indicators are difficult to gather[3].

Indicators reflect also the nature of research activities and the institutional framework in which research is evolving. The heterogeneity of the different national structures, and their concentration into a few universities and research centres is a common characteristic of most developing countries (Gaillard, 2010). The high concentration of research into some establishments or some major projects, as Gaillard mentions, "leads to volatility and inconsistency in statistics. The situation is exacerbated by the great divergence in the circumstances by which R&D take place and is measured in different countries and institutions in the developing world".

Countries need to establish a sufficient body of knowledge on how research is performed within the context of their political, economic and educational scientific and technological systems. They need to gather information on: knowledge producers and R&D performers; informal scientific structures such as associations, academies, trade unions, journals, invisible colleges; the working conditions of researchers (status, salaries, pay systems, evaluation systems); the role of international donors and funding agencies; the research output; scientific agreements (Mouton and Waast, 2007).

By analyzing the research and innovation system of 52 countries, Mouton and Waast (2007) created a template to gather systematically the information. They mention three different kinds of information to be collected, formal and less formal:

- Statistical indicators (Social, Demographic, Health, Educational, Science, Technology and Bibliometric).
- Descriptors: quantitative or visual descriptions that present the facts of a certain category of entities or events. They distinguish between Listing descriptors and Diagrammatic descriptors.
- Narratives: More elaborate and deep historical and contemporary descriptions of aspects of the research system in a country.

In 2001, Barré was also advocating, along similar lines as above, a 'mixed perspective' on the use of quantification as the basis of decision-making, using both quantitative data and more narrative or qualitative information: "*It is mixed in the sense that the decision-making process is* *based both on a quantitative dossier and on judgment. Judgment results largely from interactions among those concerned, and discussion and criticism of the indicators are an aspect of such interactions*".

As Daniel Villavicencio reminded in the MIRA Bondy workshop, a recent review on measuring knowledge in specific countries (Argentina, Mexico, Uruguay)[4] shows that we have to be quite modest in this quest for the right indicators, not only on methodological grounds, as is suggested in the Santiago Manual (RICYT, 2007), but also because of more structural reasons: indicators measure inputs and outputs in terms of stocks of knowledge, rather than flows of knowledge. Furthermore, we have difficulty in measuring processes in the creation and circulation of knowledge flows. Learning processes, knowledge networks performance, all kinds of 'incremental innovations', knowledge spill-overs, are left aside or quite rarely measured (Villavicencio, 2009); but more than that we have no instruments to measure:

– tacit knowledge flows –usually strong in science and technology;
– traditional, 'indigenous' and other 'non-scientific' knowledge, as well as users' knowledge;
– technological absorption capabilities –or only to a rather limited social and productive area, such as an enterprise, an industrial or productive sector, rarely a geographical region;
– social capabilities needed for knowledge generation and absorption.

Furthermore, as policy tries to promote knowledge flows, we know little about the impacts of policies on knowledge absorption. In brief, there is no instrument that measures in proper terms knowledge policies. International cooperation is part of this quest, since the hope is that by promoting more international linkages there will be more circulation of knowledge and, by way of consequence, a higher degree of knowledge creation and diffusion.

The above discussion on the methodological aspects of indicators serves the purpose of stressing that, for the specific case of cooperation, we need to *combine a quantitative and a more qualitative assessment*, apart from defining the reference framework as mentioned in section 2 above.

4. Indicators in the policy process

Indicators do not only serve as a thermometer. They are also part of the decision and evaluation process. In that sense, they allow organizations and social actors to define their position inside the science and technology scene, inside the innovation world, inside the larger globalization movement. In the MIRA Bondy workshop, Barré exposed the notion of '*positioning* indicators' (Lepori *et al.,* 2008). He and his co-authors have investigated the evolution of indicators: anyone, with a small investment in equipment and databases, can produce today do-it-yourself indicators, creating 'desktop scientometrics' tailored to his/her needs. What differentiates indicators is not so much their technical construction; it is their inclusion in a specific decision-making process, or an assessment exercise. Thus, users of the indicators can use the indicators to define their own position inside the system.

This notion of positioning is important and has both methodological and practical consequences as well as theoretical consequences. On the theory side, it is important to note that the variety of demands exerted on indicators will prove a powerful engine for producing new indicators, less based on input measurement and, probably, more linked to refined methodologies. This is so because the variety of users induces a variety of uses. A multiplication of producers with new and diverse funding will inevitably appear. What then becomes central is the issue of *reliability* of these indicators: they should be *robust, comparable, credible, and relevant*; on the other hand they need to be custom-tailored and fitting the needs of each actor.

Barré and Arvanitis (2009) explore the consequences of this evolution of indicators as far as cooperation and international scientific collaborations are concerned. Cooperation indicators need to go beyond the measures of the degree of scientific collaboration as measured by bibliometric indicators. They should tend toward some integration of actors implied in the cooperation:

- Strategic integration: between institutions, and between actors
- Scientific integration: at the level of projects, concepts, ideas, scientific objects and choices of themes
- Operational integration concerning careers, and organizational objectives.

Cooperation indicators pose a specific institutional challenge since they are not commonly used; they need to integrate the objectives of more actors than the mere public entities that are usually the producers of Frascati type indicators. To enter the challenge, a stronger relationship is needed between indicators' producers and users, between the designers of the indicators and the producers, between the producers and the users. This could be the case, for example, in assigning the indicators to the assessment of the objectives of the Cairo declaration.

Edler (2008) mentions implementing an interaction between the production of indicators and their users (see Fig. 1). It poses some specific difficulties: in our case, on the co-operation indicators, as is more generally the case, there is a growing mismatch between the analytical base that serves to produce indicators and the need for a collective intelligence toward measuring this integration at the international level.

The indicators mentioned in the above sections focus on a national base; they focus on industrial R&D, national capability in human resources, and mostly at the aggregate national level.

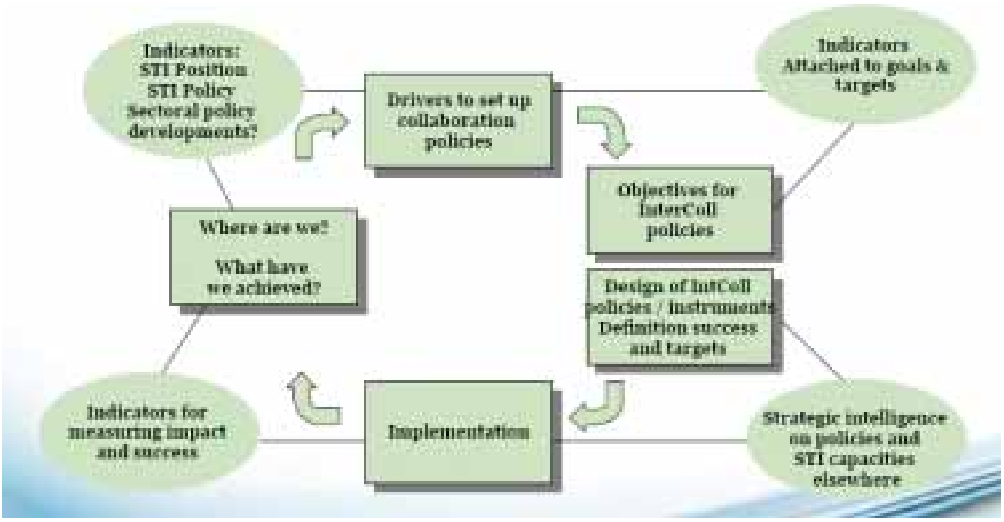

Figure 1. The use of indicators in policy for STI internationalization (Edler, 2008).

A very similar exercise, linking policy decision-making processes and indicators, has been done by WP5 in the MIRA project under the name of "stock-taking for policy makers". Results of this exercise have been circulated among members of the MoCo.

5. Indicators of research co-operations and impact assessment of programmes and policies

Contrary to collaborations, international scientific co-operations have rarely been the object of study in academic terms. Most of the work that has been published was mainly done in projects funded by the EU when the need to evaluate these programmes has risen. A body of literature has now emerged regarding the assessment of research programmes (Callon *et al.,* 1989; Callon *et al.,* 1991; Callon *et al.,* 1995; Callon *et al.,* 1997; Guy *et al.* 1995; Leopori, 2009; Mangematin and Joly, 1996; Rabeharisoa *et al.,* 1992).

As mentioned in the preceding section, the assessment of international co-operations can be done by focussing on three different levels of analysis: (1) the level of disciplines, involving collaborations between individual scientists or particular research units; (2) the programme level; (3) the higher policy level.

Usually, when addressing the evaluation or impact analysis of specific programmes, the need appears to identify:

- The underlying scientific structure of scientific disciplines;
- The relations of this scientific world with the activities funded by a specific programme.

The *research collaborations* – the Santiago Manual calls them ‘spontaneous collaborations –that take place as a consequence of research contacts between researchers in different countries out of training or curiosity-driven research - and *research cooperation* take place inside this previously set framework given by the scientific fields as well as by the framework defined by some cooperation agreements between countries and institutions (See Box 3). Collaborations are the real underlying structure of scientific co-operation. Wagner calls them ‘a dynamic ecosystem’ and they form global networks of collaborations (Wagner, 2006; Wagner, 2008).

Scientific collaborations can be (or not) the main aim of research programmes; the impact assessments of the programmes, whether this is the case or not, necessarily have to examine the underlying research collaborations. An analytical difficulty lies in the fact that the dynamic of international collaboration is related not only to the international structure of science, but also to the general environment of research in the country, the disciplinary evolution, and opportunities and policies for international collaboration, part of which are given by the co-operation framework. The context acts upon international scientific collaborations in a way that goes well beyond what the policies actually are. It is difficult to identify the relative influence of these various components influencing the research co-operations.

Cooperation with “Third countries” of the EU (that is countries other than the ones under an association agreement) has rarely been the focus of analysis. Most analysis is limited to examine the participations in Framework Programme calls for offer.

More recently, the Report for the CREST Working group on internationalization of research has identified issues, objectives and possible measures for the assessment of internationalization policies directed to Third countries.

The International Science Foundation (IFS), an international institution funding scholarships to individual researchers that come back to their home countries after they have obtained their PhD and worked abroad, devised a framework for the assessment of its activities, called MESIA framework, which combines the three levels of analysis of co-operations.

Box 3 - Forces acting on international collaboration:

- Situation of research in the country –see assessments based on a framework like the Mouton & Waast study reveal– including the need for stronger training and support in order to foster scientific research.
- Policy towards external training and cooperation.
- Fast moving disciplinary fronts (biotechnology, nanotechnology, etc…).
- Increasing need for wide international cooperation (global science). Some priorities are necessarily tackled at an international scale, very much so in 'open air research' that is research that needs fieldwork more than laboratory and experimental work inside the walls of the research institution.

Informal and formal actors

- Networks of relations, many of which date to the PhD or post-doc location.
- International institutions.
- Funding agencies – also known as donors, private foundations, public agencies working at the international level such as IDRC, SIDA, French Cooperation and the like.
- European programmes, FP7, MEDA, DG Enterprise, etc…
- Bilateral programmes of co-operation.
- Regional or national institutions promoting individual scholarships and exchanges – Marie Curie, Erasmus Mundus, AUF, etc.
- Finally research performing institutions that have also a policy toward international cooperation. Should this policy be lacking, there is an 'implicit' policy that is the result of the aggregation of individual initiatives.

Degrees of intensity of international cooperation:

- individual initiative;
- facilities, labs /teams with a regular exchange;
- policy at the level of the performing institution;
- policy at the regional or national level.

6. Building a reference framework

The usual measurement of international collaborations through co-authorship is not enough when one wants to measure the impact of cooperation programmes. It is necessary to develop a *framework* that involves a *reference* (which population is concerned?), a *metric* (which indicators?) and a *temporality* (a time frame that permits to oppose "before" and "after"). Finally the impact measurement should be discussed in such a manner that it permits to assess the meaning of a general cooperation policy[5].

A full and complete evaluation in large cooperation programmes is difficult because of the multi-level effects of programmes, the multi-actor nature of these programmes (many distinct populations are impacted by the programme) and the lack of "reference" groups, that is a sort of "control group" that is not affected by the programme[6]. Randomized impact measurement has not been used in research and innovation policy among other reasons because of the difficulty to identify “control groups”.

It is thus necessary to carefully distinguish the level addressed by the framework for indicators that should be developed, in order to permit the measurement of impacts at these different levels:

1. *national* level. The country as a whole
2. *institutional level* of the research institutions (performing institutions, like universities and public research institutes that received the funds)
3. *technological or scientific areas* (e.g. “nanotechnology” and “biotechnology” are not defined by a specific scientific discipline)
4. *programme* level.

Apart from this diversity, “impact” is a concept that has several meanings at different levels (regional, national or international level):

- achievement of the programme objectives
- implementation of national objectives/priorities
- consolidation of a research area – at the national & international level
- promotion of researchers
- strengthening of training programmes and faculty advancement
- strengthening of the national scientific community
- consolidation - or creation - of research groups
- strengthening of research performing institutions
- creation of research networks at the national level
- research networks at regional/international level.

By defining a reference framework, we also identify target actors. These should be the population to which a specific measure or a specific programme is addressing *directly* (e.g. researchers in mobility programmes, institutions in capacity building, and so on). The assessment exercise can also address *indirect* effects of the measures and programmes assessed. Indirect effects go beyond the direct linkages and far beyond the scientific networks; they need refined methodologies including the populations in which targeted populations are embedded or populations that are targeted as the ultimate effect of the programmes. This can be the case for people with specific diseases in a research programme on these diseases (instead of the effect on the research itself); another example might be companies that should benefit from technological developments directly supported by a specific R&D programme. Indirect effects are also known as “spillovers” in the economics literature; they are the kind of impacts that policy people aim at and thus those being the most directly linked to their decisions. Because of the “indirect” nature of these impacts, they are open to multiple interpretation.

To conclude, impact assessments, and sets of indicators depend upon the *objectives* announced by the programmes to be assessed. They also depend upon the *capacity to clearly identify the universe that we try to assess*. This is far from being trivial or easy. In the following Box 4, we show a list of questions that were presented in the discussions and that imply specific methodological decisions.

Box 4 - Methodological questions that need to be addressed by the Observatory

1. Since the observatory has to focus on co-operation (and not mere *collaborations* in science), how can we isolate the effect of the *programmes* (funding, institutional structure, and so on) and the *dynamic of research and scientific collaborations*?
2. Do we have to limit ourselves to the sole *areas of research* covered by the FP?
3. Do we include "strategic" or technological linkages between research areas and productive activities? How do we relate scientific collaborations and programmes oriented toward rather basic research from technologically-oriented activities?
4. Even in the case of scientific collaborations as measured by co-authorship patterns, what is the *reference population*? Do we imply the persons publishing in a determined set of journals? Or, the people belonging to a certain rank in institutions receiving funding? Or the overall FTE in research in partner countries? As defined by the area of research, the institutions?
5. Do we extend the assessments to indirect effects of policies on research, innovation, mobility and training issues, or do we limit to more direct effects measurable around specific programmes (e.g. participations in FP calls; participation in bi-lateral programmes and funded entities)?
6. What data are available for the assessment? Should they be national, regional, based in the EU, based in some international organizations?
7. How do we establish the links between data on the overall inputs and outputs of the research and technological development and cooperation indicators?
8. And, finally, do we prefer to refer to overall policies, as the Cairo declaration framework, or should we be only focusing on and identify specific objectives and translate them into impact assessments at the level of programmes?

IV – Proposals for a framework and indicators for the Euro-Mediterranean science and technology co-coperation

In using the general policy framework, one needs to translate it into specific indicators as well as into a specific interpretation of the linkages between the various areas of concern: higher education affects collaborations, mobility of researchers and students, and the overall output of research; mobility issues are both problems related to the economy and employment and to the development of research; institutional issues are related to priorities in scholarships and research. We still lack this assessment framework that needs to be built. The following are proposals in order to attain the overall objective.

1. Feeding the Cairo declaration Framework

Cairo declaration can be used as the general policy level. Following is a proposal based upon the measures identified by the Cairo declaration itself. Below we show the detail of the measures *(in italics)* and list the possible indicators that could be used in illustrating them.

Objective 6 of the Cairo Declaration. Integration of the Mediterranean Partner Countries in the European Research Area. This could be achieved through the following actions:

a. Promotion of links between centres of excellence in the Euromed region;

- Mapping of institutions having common projects on both sides of EU and MPCs
- Evolution over time
- Co-publication mapping EU-MPCs
- List of agreements at the level of institutions for research

b. Promotion of joint networks of excellence in the fields of mutual interest, e.g. renewable energy, biotechnology, environment, etc.;

- Participations in the FP projects of Med partners
- Participations in programmes under other DGs involving research and technological development
- Participations in other programmes (bilateral or international funding agencies)

c. Promotion of regional initiatives in RTDI;

- Number of SICA / ERAWIDE / FP7 participations
- Number of funds / programmes
- Specific measures, programmes (e.g. BILAT)

d. Promotion of contact points in Mediterranean Partner Countries' Universities and research institutes to disseminate information and promote participation in FP7;

- List of Technology transfer units in MCPs
- List of institutions that benefit from Technology transfer units and NCPs in MPCs
- List of already constituted networks of NCPs by domain of activity (biotechnology, energy, water, social sciences, etc.)

e. Promotion of National funds in Mediterranean Partner Countries for Scientific Research and Development;

- List of funding structures with EU support / outcome report of these funding programmes
- List of non-EU funding structures active in the region
- Compare the National funding / Non-national funds

f. Explore the possibility of co-finance by Mediterranean Partner Countries in FP7 for coordinated activities;

- Number of co-funded programmes
- Evolution over time

g. Enhance the participation of Mediterranean Partner Countries in FP7;

- Assessment of participations
- Dynamic of international collaborations; motivations, drivers, difficulties, obstacles
- List of institutions in MPCs and effort of collaboration identified through bibliometric or general purpose indicators

h. Cooperation in capacity building in:

    i. Formulating research projects;

- Capacity building projects funded by EU (ERAWIDE, others) *ii. Particular areas of mutual interest.*

- Topics/objectives with mutual interests (or thematic clusters): sustainable development, coastal areas management, marine resources, water management, forest management, waste management, farming systems, monitoring of environmental change, climate change, seismic risk and geological resources, business enhancement and entrepreneurial initiatives, innovation promotion, economic and financial risks, economic policies, industrial and agricultural policies, ICTs, nanotechnology networks, public health, endemic diseases, epidemiological networks, vaccines, genetic services, biomedical research capacities, food and agro-industry, cultural heritage, social and cultural identity, linguistic issues, science in society, scientific awareness, migration issues, legal and social gender issues, political sciences issues…
- Priority lists funded by EU multilateral, bi-lateral and non-EU programmes;
- Identification of institutions on similar topics or priorities
- General macro-indicators on collaborations (general purpose indicators)

Objective 7 of Cairo Declaration. Promote innovation, knowledge sharing and its return on the industry and economy in Mediterranean Partner Countries. This could be achieved through the following actions:

a. Promotion of the creation of national and regional innovation funds within the Mediterranean Partner Countries to support innovation and exploitation of research outputs by industry;

- Funding oriented toward innovation
- Listing of programmes promoting innovation (not *necessarily* research)

b. Implementation of the 'Euromed Innovation & Technology Programme', which aims at developing innovativeness in Business firms (esp. SMEs);

- Programmes and beneficiaries
- Mapping of innovation-related measures
- Infrastructures for monitoring of research and innovation in MPCs

c. Promote the participation of Mediterranean Partner Countries in activities related to innovation, including the EU Competitiveness and Innovation Programme (CIP);

- Med Participations to the EU CIP programme
- List of measures developed to promote R&D in the region (see *b* above)
- Economic studies specifically intended to support businesses in MPCs

d. Develop Capacity building in R&D and innovation management.

- Innovation surveys
- Information on promotion of Monitoring innovation & research (EMIS framework).

Objective 8 of Cairo Declaration. Enhance Effective Mobility in the Euromed region. This could be achieved through the following actions:

a. Establishing Mobility Centres and Portals as well as promoting mobility contact points in the Mediterranean Partner countries;

- Number of centres/portals created

b. Establishing national programmes of mobility and open access to incoming mobility from EU Member States to Mediterranean Partner Countries.

- List of programmes at national level

- Statistics on foreign research personnel from MPCs in EU Member states (students, invited researchers,…)

Objective 9 of Cairo Declaration. Attain Brain Circulation and Knowledge Dissemination. This could be achieved through the following actions:

a. Support to expatriate researchers through networking opportunities and allowing periodic research sabbaticals to countries of origin;

- List of existing opportunities for EU-Member countries + EU initiatives (eg. THETYS): programmes devoted to "return" activities
- Statistics on researchers in foreign countries / Surveys by fields of activity and countries
- Mapping of expatriate researchers
- Promotion of web-connected collaborative communities

b. Promotion of a regional network of Institutes for Advanced Studies & Research, through which European Academic Institutions cooperate with selected Mediterranean Partner Countries' Universities to form the best human capital;

- Same as 9.a
- Policy measures promoted by EU member countries / EU Commission /partner countries specifically oriented toward mobility + training between EU member countries + MPCs
- A new initiative is called in by this objective/measure.

c. Address the issues linked to brain circulation, notably through strengthening the return phase in the different mobility programmes.

- Same as 9.a
- Study the mobility issue *'brain drain'* vs. '*brain gain'*
- List of 'return' programmes: TOKTEN, national programmes…
- Study support of high-level competence diasporas by computer-mediated networking.

2. Macro-level indicators

MIRA produced a validated list of indicators that are needed in order to measure the scientific cooperation. During the workshop, a series of lectures examined different aspects and dimensions of these indicators, as well as the general context of production and use of indicators (institutions producing the data, availability, manageability of indicators, comparability, etc.). Some of the issues of debates go back to the International Conference on Science Indicators held in Paris (Arvanitis and Gaillard, 1992). Apart from listing the indicators, this session identifies potential producers of the indicators; they will be presented in the following section.

The indicators listed in Table 2 are macro-indicators that are valid for a country. They can be modified to fit a specific area in as much the data provided permit it. This list is comparable to the one produced by the 'Manual of Santiago' on the 'Internationalization of science and technology' (RICYT, 2007). The list distinguishes indicators related to financial and human resources and those related to outputs.

Table 2. List of indicators for the Observatory of EU-Med cooperation.

Type of indicator	Indicator	Source
Financial resources	Budget dedicated to I.C./GERD	Surveys/EU
	EU source budgets for R&D / Budget dedicated to I.C.	Surveys/EU
	Budget for research projects/ Budget from EU dedicated to R&D	Surveys/EU
	Budget for research equipment / EU Budget for R&D	Surveys/EU
	Research Budget to enterprises	Surveys/EU
	EU funding for research by discipline/sector/theme	Surveys/EU
	% of research funding for a specific topic or discipline as a share of overall funding for research and overall EU funding to the discipline or topic	Surveys/EU
Human Resources	Number of MPC researchers in Europe	Various
	Number of MPC doctoral students in Europe	Various
	Number of MPC students in Europe	Various
	Number of doctoral students from European universities in MPCs	Various
	Number of teaching faculty members in MPC	Various
Bibliometrics	Number of co-publications with European co-authors as share of MPC publications	THOMSON/SCOPUS/PASCAL
	Number of co-publications with European co-authors by discipline or theme	THOMSON/SCOPUS/PASCAL
	Impact factor for co-publications	THOMSON/SCOPUS
	Impact factor for co-publications by discipline or theme	THOMSON/SCOPUS
	Specialisation index by sub-disciplines and regions of MPC production	THOMSON/SCOPUS/PASCAL
	Thematic similarities between Europe and MPC	THOMSON/SCOPUS/PASCAL
Patents, designs and trademarks	Number of patents in EPO (European Patent Office / US PTO)	EPO/USPTO
	Number of designs in Europe/US	EPO/USPTO
	Number of trademarks in Europe	EPO/USPTO
	Number of European patents locally deposited	EPO/USPTO
	Number of patents as co-inventors (Med/EU)	EPO/USPTO
Others	Number of projects in FPs	Surveys/EU
	Number of projects in FPs analyzed by type/topics/countries	Surveys/EU
	Number of projects in FPs with Med partners as leaders/co-leaders	Surveys/EU
	Number of publications linked to FPs participations	Surveys/EU
	Socio-economic impacts of FPs	Surveys
	Number of research (teams, institutions, centres) participating to FPs	Surveys/EU
	Number of enterprises participating in European projects	Surveys/EU

Notes : IC = International Cooperation. GERD: Gross Expenditures on R&D. EPO : European Patent Office. USPTO : US Patent and Trademarks Office. FPs : Framework Programmes (DG Research).

3. Programme-oriented indicators

As indicated above, impact assessments should rather be oriented towards programmes. This would entail to maintain an inventory of collaborations, based on EU participations or other funding programmes where there exist available data. Indicators would be designed out of this inventory along the following possible lines (also useful for the more general assessment of Cairo declaration):

- Training (doctoral students engaged in programme)
- Creation of networks, participation into existing networks
- Mapping of publications produced by the programme
- Inventory of activities related to dissemination other than scientific publications
- Patenting and other technology related outcomes
- Assessment of the quantitative outputs in relation to participating country
- Assessment of the relative size of funding provided by the programme, relative to the funding for R&D in the participating countries
- Assessments related to the relative participation of institutions

These indicators need not only to maintain the inventory of the programmes but also to head towards a "clean" institutional database, where affiliations of researchers can be shown without the ambiguities usually encountered when dealing with the names of institutions in bibliographic or other project databases.

4. Availability of data

CREST has carried out a larger policy level exercise on the internationalisation of research (CREST Working Group, 2009, p. 6). It states that there is "insufficient ST infrastructure and expertise in Third Countries":

> *… one obstacle for international ST cooperation, especially as regards emerging or developing countries, is the non-existing or insufficient local ST infrastructure in these countries as well as a lack of human resources (e.g. because of 'brain-drain'). This comparative disadvantage is linked to the still existing deficits in the coordination of education, research and development policies at national and EU level.*

As the ESTIME project has showed, data in the MPCs do not usually correspond to Frascati Manual standards. Expenditure indicators are difficult to obtain in particular for universities where the bulk of research is performed.

The various initiatives on input indicators (financial and human resources) reviewed in this paper are based on estimates. The most recent Arab Knowledge report (2009) uses 2006 data for its 2009 report on funding coming mainly from COMSTECH sources and a study sponsor.

Bibliometric data are available but pose specific issues related to affiliations, coverage of databases and specific difficulties related to their format and use. Nonetheless, they remain the most robust data on research outcomes.

Table 3. R&D indicators availability in some Mediterranean countries (as of 2009).

Country	Human Resources	Financial Resources
Morocco	Yes	No since 2003
Algeria	Yes (2006)	No
Tunisia	Yes	Yes
Libya	No	No
Egypt	Partial data on universities	No since 2000
Syria	No	No
Jordan	Yes (2003)*	Yes (2002)
Lebanon	No - Estimates	No - Estimates

*Jordan: ESTIME data 2006 on human resources. Lebanon ESTIME offers estimates for 2006.
Sources: UIS-ALECSO and ESTIME.

V – Steps toward an Observatory for science and technology EU-Med cooperation

In spite of the obstacles previously identified, there are ways that allow to overcome these constraints. They suppose specific tailored tools, databases and instruments built to collect information, such as:

- surveys of beneficiaries;
- clean bibliometric indicators;
- database of projects/programmes/agreements;
- database of EU-Med participating institutions;
- information on measures and policies.

The ideal observatory would need to create a **reference material**. This might be true for the case of publications; the population of researchers and beneficiaries of research grants and scholarships; the list of international agreements/programmes; the listing of policy measures; the listing of institutions. No such information can be totally complete. Nonetheless, a mapping of these different objects should be the background material of the observatory. It would be renewed by periodical studies and analysis.

Databases. These tools present difficulties and are expensive not so much materially – it may be expected for some bibliometric databases- but intellectually and in terms of competencies needed to manage them:

- The first and foremost difficulty (and cost) relates to competencies needed: it is necessary to have stable competencies and trained personnel who have experience on the uses and benefits from these databases, either bibliographic or other. They also have to acquire the routines needed to interrogate and build meaningful reports. These competencies have been repeatedly addressed in the ESTIME report and presented at the MoCo meeting of Istanbul (2009).
- A second difficulty lies in the varied types of information needed: bibliographic/bibliometric; projects database; statistical information on funding, human resources and other economic information.

- A third difficulty comes from the varied sources of information: statistics from different sources, databases of different type and origin, listings from different institutions.

Maintenance of valid databases. The use of the publication output measures, in particular by measuring co-authorships**,** involves a series of technical steps in order to “clean” the data but also to maintain a validated database. The maintenance of these clean databases is not a high cost when included in a general framework. It becomes more important when the databases or the samples extracted from bibliographic databases are drawn only on the opportunity of specific case studies.

More work needs to be done both on the significance of co-authorships, involving international affiliations, which implies a better knowledge of the authoring practices in many different fields, but also the relation between the actual collaborations and the publication habits.

Surveys. A need for not exclusively quantitative skills is also a competence that should be addressed. Surveys either by questionnaire or by interviews might be sub-contracted.[7] The observatory should build on existing competencies in the region and promote interaction between specialists on these methodologies.

Sourcing of data. A closer interaction should be sought between the CORDIS and other databases (such as ERAWATCH) for sources of information on projects and activities funded by the EU.

Website. It would be necessary to develop a specific website either enhancing the MIRA website or feeding specific websites. Also the participation to the ERAWATCH is to be more actively sought.

A stable relation with users. Building the relation between the users of the data and the data producers is an ambitious goal. To this end, the observatory must be considered as a permanent structure that is fed by local units/observatories and that feeds the policy process. There are two competing views on this “observatory”. It might either be a stable unit, located in one particular country, with a specific budget; or, alternatively, a network inserted in some larger structures or projects, as is the case today of WP2 into MIRA. This second solution would be preferable for a regional unit. The Observatory needs to have a more pro-active programme of activities that is related to the needs of the stakeholders and to opportunities for actual realisation of its work programme. It needs a stakeholders’ steering committee, that will be in charge of some of its activities, its budget, and working plan. It would also need a network of working parties where the Observatory pools the existing competencies on indicators either in the European member countries or in the MPCs. As in the MIRA project, such an observatory would need a small secretariat of the steering committee and of the activities undertaken for the stakeholders.

Stakeholders. Inside the MIRA project the main stakeholders and working partners of the Observatory were the official ministries and councils in charge of the policy, as well as some agencies and the EU commission. But they have shown little if no interest in such a permanent Observatory through all sorts of arguments against such an initiative. ESCWA has also repeatedly tried to create such an Observatory in the East Mediterranean and North African countries. Until now the effort has not been successful although the objective still remains.

It should be necessary to compare the successful experience of the RICYT, the Latin American and Spanish-speaking network on science and technology indicators, and draw some indications from its success. One could consolidate the already existing indicators’ units at national level – Lebanon, Tunisia, Morocco, Jordan, Egypt, as they have expressed their needs and work programme. The national experiences could be followed by involving more stakeholders, such as NGOs and international organizations. Involving more than just governmental units seems a necessary step.

VI – Conclusions

In the light of the previous initiatives we can draw the following conclusions:

1. There is a clear willingness to shape indicators, and design indicators fitted for specific needs. The need is rather felt at the international level, mainly through multilateral organizations, and at the national level through some Ministries – usually in ST or higher education – which want to design tools that permit an evaluation of the research potential in their countries and need "positioning" indicators (Where do we stand?).
2. The need for indicators is not evenly distributed in all countries; some countries have been forging the adequate infrastructure; others have been rather unwilling to feed these indicators as well as any other data on their potential. Moreover inside countries, different public institutions have different needs. Finally, in countries with a more decentralized research system or with a research system that is more open to international competition, indicators seem to be easier to accept.
3. Reliable data are difficult to obtain. The UIS exercise clearly showed that the effort is difficult for many reasons that have to do with the inability of national statistical offices to get data for ST. Partly this has to do with the inadequacy of the statistical administration as far as research is concerned. It is also partly because of lack of experience in the field of ST statistics. Moreover, inside the same administration, one can find offices in charge of strategic studies stating the need for indicators and a rather opposite attitude from the potential suppliers of data.
4. Although bibliometrics is at the very heart of all indicators on performance, there is still a very low capability in using and creating bibliometric indicators. International organizations have favoured general statistics and economic analysis, but bibliometrics has rarely been an issue. The exceptions here are Turkey (Karasözen *et al.,* 2009), and Morocco –which created a team on bibliometrics in IMIST. Tunisia made an extensive use of bibliometrics in the 2007 report on the research system, as given to ESTIME, but no other uses were reported since then.
5. The abundance of initiatives in the last four years has created expectations that are not met and a certain dispersion of efforts. This is particularly true of the EU exercises. Too little funding has been oriented in the Mediterranean region towards the creation of an analytical capacity for indicators. As always, policy-makers want immediate results and figures they can use to feed/legitimate their own discourse and policies. The main drawbacks are known and an Observatory on science and technology will always be a difficult, although necessary, task.
6. In the case of impact measures, an analytical effort is needed that goes beyond the production of data. As has been mentioned in Europe, there is a strong analytical need that is still not covered (Edler, 2008). MIRA could partly respond to this analytical need and WP2 should really try to build bridges with other initiatives that define methodologies and look at the design, production, and use of indicators. It might also be that MIRA is not the right framework for such an analytical effort: in this case, it should be necessary that MIRA envisages the possibility to promote the formulation (and funding?) of a proposal that aims at gathering the experience in indicators design and production.
7. Creating an observatory seems to be possible only by enlarging the interested parties beyond the usual Ministries and national Councils for research.

Notes

[1] This document is the result of intensive discussions that took place among members engaged under the work package in charge of the observatory (WP2). A first outcome of this work was the organization of a Workshop on "*Scientific cooperation indicators and impact measures*" co-organized by IRD and IFRIS (Institute for Research and Innovation in Society) on March 16-17, 2009 at the premises of IRD, (Bondy), France. All Workshops may be be found on the Mira website.

[2] The EU has been pioneering this important cooperation effort, as exemplified by international research organizations. The most famous case is the CERN: as John Krige shows, the effort and enthusiasm of scientists engaged in the early years of the CERN was not only related to the increased possibilities of collaboration, or sharing costs but by the attempt to build real European institutions. The effort to create a European co-operation in high-energy physics was coincidental with Schuman's proposal of a European Coal and Steel authority. Large collaborative facilities have always been the most visible and important co-operation instruments. It is also the case of the European Molecular Biology Organization (EMBO) (Krige, 1997).

[3] A complete set of available indicators is published in Tsipouri, 2008.

[4] See Villavicencio *et al.,* 2009.

[5] See MIRA presentation in Rabat, February 23, 2009: *Measuring the impact of scientific cooperation : MIRA contribution*, by R. Arvanitis.

[6] The World Bank has been promoting this kind of randomized impact measurement of aid programmes to developing countries in schooling, nutrition, or health support programmes (World Bank, 2007).

[7] Most qualitative tools, such as interview guides, are published on the ESTIME website.

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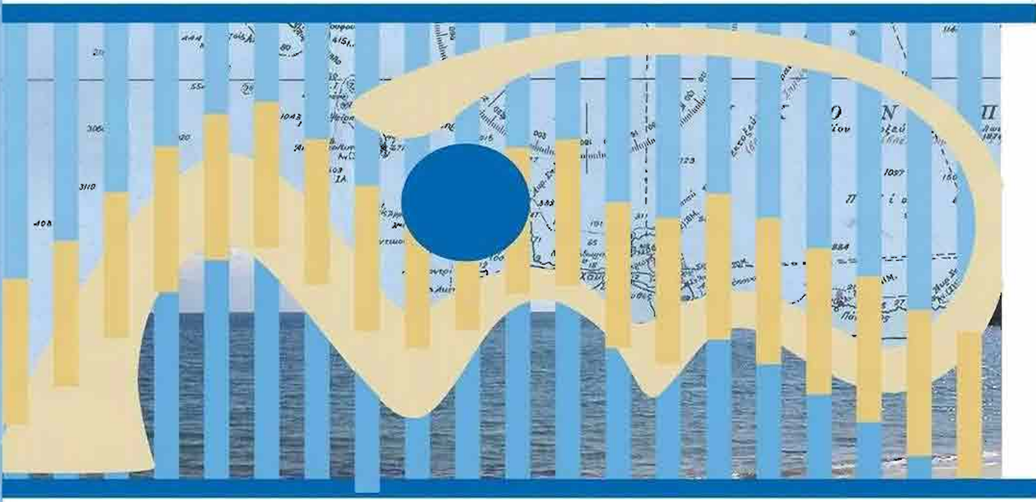

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