ERAWATCH COUNTRY REPORTS 2012: Egypt

ERAWATCH Network

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Executive Summary

Egypt covers an area of about 1 million km² on the north-east of Africa. The population is estimated at 84 million with an annual growth rate of 1.8%, living across the Nile River, the Mediterranean coast and the Suez Canal. The economy of Egypt is one of the most developed and diversified in the Middle East; the per capita GDP reached in 2011 €2,149. Egypt spent on RTD 0.21% of its GDP in 2009, which dropped from a 0.27% of previous years; it is composed of public funds only. Unofficial estimates suggest an actual ratio of 0.4% for 2012.

The public funds are allocated increasingly through programmes and schemes aiming at developing applied research and technology, innovation projects, linkages between research and business enterprises and between Egyptian researchers and international partners. S&T cooperation with the most technologically developed countries is dense and expanding. The largest European countries as well as the European Union, USA, Japan, Korea and others signed cooperation agreements with Egypt to support mobility of researchers and joint research projects. Foreign governments in cooperation with a university in their respective countries establish universities in Cairo or Alexandria, expanding this way the potential of tertiary education, reducing brain drain and transferring good management practices.

The calls for proposals for research and innovation schemes managed by the S&T Development Fund, the Ministries of Research, Industry and Foreign Trade (MIFT), Communications and Information Technology (MCIT) were mushrooming in the last years, increasing the share of project funding in the total funding of public research. These schemes were targeted on one hand to the needs of growth of the research society and on the other to national social and economic needs. They promote the development of new S&T fields in the country and select projects for funding based on peer evaluation. Institutional funding remains the basic funding mechanism of the public research, whilst agriculture, food, water and environment are the most developed fields for government research and innovation. These fields employ the largest number of researchers and have contributed to the modernisation of the primary sector. Fiscal incentives have been introduced recently, but there is no assessment of their impact.

Public policy has also promoted a large number of intermediaries for technology transfer, innovation and incubation of new technology based firms. Technology Transfer Offices, Science Cities, Incubators and technological Villages are organisational structures to accelerate the technological modernisation of the economy. Emphasis is given to the information technology penetration in all sectors. Several funding schemes are also supporting the cooperation between academia and industry and the exploitation of research results by researchers.

In the following table are presented the policy changes in the area of research and innovation in Egypt by policy field and the corresponding strengths and weaknesses. The changes have taken place mainly in the middle of the previous decade and since then the competent authorities are striving to design and implement appropriate measures. After the recent political changes the expectations for faster developments in research and technology are increased.

Knowledge Triangle

	Recent policy changes	Assessment of strengths and weaknesses
Research policy	Large increases in budget followed by stabilisation. RDI 2 Programme funded by EU and managed by the Min. of Research entered implementation phase. STDF issued new calls for proposals targeting priority issues. Some STDF research schemes are open permanently.	S: A large spectrum of measures is deployed trying to cover all the deficiencies of the research and innovation system of the country. W: These measures are of recent breed and have to mobilise a research system that remains under-financed by institutional funds and domestic industry. Business RTD is mainly subsidised through common projects with universities. S: International cooperation and participation in multinational RTD activities is an important element of the national system. W: Cooperation among researchers of different units in research entities is very limited. Quantitative objectives for RTD spending need to be operationalized.
Innovation policy	Targeted calls for proposals by STDF and ASRT are intensified. ASRT emphasises its role on commercialising research results and disseminating S&T knowledge. RDI 2 Programme is put into implementation and is progressing with evaluation and selection of new proposals and emphasis on innovation and research results exploitation	S: The measures announced in the last three years cover a large spectrum of policy areas, from applied RTD to marketing new products, acquisition of new production technologies, clustering etc. W: But the lack of systematic evaluation of the measures' effectiveness and in particular of their delivery mechanisms makes it difficult to appreciate their impact. One of the issues to be raised refers to the size of the available budgets and their leverage effect. S: ITIDA is particularly active and its experience is a valuable asset in other policy areas but the funds are extremely limited. ITIDA's cooperation with foreign organisations contributes to the acceleration of technology transfer and modernisation of the national productive fabric. W: the financial system does not seem ready to assume responsibility in the area of risk funding.
Education policy	The Higher Education Enhancement Programme (HEEP) is continuing for a third period (2013-2017) with emphasis on accreditation, international cooperation etc. Political changes may lead to wider university autonomy.	S: Education and training have been a major concern of the national government. Programmes abound and are supported by international technical assistance and funds, which are accompanying their intervention with evaluations. W: This has been a relative strength of the system up to now, despite the lack of very precise quantitative targets, leading to the increase in the numbers of tertiary students and the reduction of illiteracy rates. W: The evaluations refer to results and much less to impact, which is the final issue.
Other policies	International Fund for Agricultural Development	S: Agriculture receives due attention by the national government and international organisations. RTD has to show some important achievements in respect of social and economic development. W: Number of graduates in agricultural sciences seems disproportionally low; overwhelming number of students in humanities and social sciences.

Assessment of the national policies/measures

	Objectives	Main policy changes over the last year	Assessment of strengths and weaknesses
1	Labour market for researchers	The programmes for the higher education and vocational education are in implementation since the 2000nds. Upgrading infrastructures, curricula, management and quality are important concerns. The research programmes are open to all entities established on the national territory. The international collaboration schemes are renewed and/or expanding. But the market remain restrained mainly in universities and research centres.	S: The literacy rate is increasing both for male and female. Computer literacy is also rising and a number of measures tackle the problem from the point of view of the small firms. W: The country suffers from brain drain whilst promotes the return of distinguished researchers from developed countries' universities. S: Quality assurance is introduced in the tertiary education, but hiring follows a lifelong process. Opening to collaboration with foreign establishments is encouraged in individual measures.
2	Research infrastructures	Emphasis is given to the development of e-infrastructures, with the help of EU and USA. For the rest, researchers may benefit from appropriate infrastructures of international organisations or other countries.	S: The progress for joining the European high speed network is satisfactory. Strong interest is also shown for the American GLORIAD that is considered to offer opportunities to expand in Africa. Moreover, the participation of physicists and material scientists in the SESAME facility (Jordan) is opening an additional opportunity for basic science in Egypt.
3	Strengthening research institutions	HEEP continued its implementation, including accreditation for universities. Foreign governments in cooperation with universities in their respective countries establish universities in Egypt as private entities and introduce innovative management practices.	W: The number of researchers dropped significantly in 2009. It is expected to have risen afterwards. The number of publications is increasing annually, with great discrepancies among universities and faculties. The opening of opportunities for international cooperation is enhancing the level of Egyptian research. W: The widening of linkages between academia and industry advances at slow pace.
4	Knowledge transfer	The new STDF, RDI and ASRT Programmes are expected to continue the reinforcement of public-private cooperation. Public infrastructures in the form of incubators, technology villages are promoted to host the new high technology breed of firms. Technology centres of MIFT are offering S&T services to firms.	S: The mushrooming of measures aiming at linking public research and private industry is a positive evolution for the last half decade, W: although their visibility from the potential beneficiaries and their effectiveness in delivery have not been assessed as to their uptake and impact.
5	International R&D cooperation with EU member states	Researchers are encouraged to participate to FP7 and EUREKA (ITIDA) through the focal points. The RDI Programme and the bilateral schemes with Germany, France and other countries are supporting indirectly the efforts to join research activities at European level.	S: It is expected that the Egyptian participation in FP7 will be somewhat higher than the participation in FP6. SICA (specific actions in the FP7 Cooperation Programme) and ERANET are offering additional opportunities for cooperation on issues of regional interest such as environment, water, health etc.
6	International R&D cooperation with non-EU countries	Governments of technologically developed countries (USA, JAP, and KOR) continue active RTD and education policies and renew regularly their plans. The Egyptian government is supplying the necessary additional support for the delivery of these programmes.	S: International cooperation schemes are numerous and offer multiple opportunities for researcher mobility and for joint projects. The universities established by foreign public authorities introduce good practices particularly in IPR management that could be transferred in other organisations. W: Cooperation with USA suffered from delays due to US budget restrictions.

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1 INTRODUCTION

The main objective of the ERAWATCH International Analytical Country Reports 2012 is to characterize and assess the evolution of the national policy mixes of the 21 countries with which the EU has a Science and Technology Agreement. The reports focus on initiatives comparable to the ERA blocks (labour market for researchers; research infrastructures; strengthening research institutions; knowledge transfer; international cooperation). They include an analysis of national R&D investment targets, the efficiency and effectiveness of national policies and investments in R&D, the articulation between research, education and innovation as well as implementation and governance issues. Particular emphasis is given to international research cooperation in each country.

2 PERFORMANCE OF THE NATIONAL RESEARCH AND INNOVATION SYSTEM AND ASSESSMENT OF RECENT POLICY CHANGES

2.1 MAIN POLICY OBJECTIVES / PRIORITIES, SOCIAL AND GLOBAL CHALLENGES

A series of programmes and resources have been mobilised since the middle of the last decade to enhance the research intensity of the Egyptian economy. Despite this effort, the indicators remained stagnant at very low level; there was even a slight decrease in 2009, sending a warning signal as to the effectiveness of the policy mix. Just after the "thawra" (revolution), an important rise was noticed in some budget appropriations for research and innovation, but did not last for long due to general restrictions for limiting public deficit. The country's authorities envisioned the transition since the mid-2000s to a "knowledge based economy" and the rise of the research intensity above 1% of GDP. During the campaign for the presidential elections various candidates proposed targets from 2% to even 6%. Unfortunately, statistical data on spending, including business expenditure, after 2009 are missing. Therefore, it is not possible to assess the most recent evolution of RTD resources and their impact. In any case, awareness of the competent authorities and initiatives to assess the past policy measures are most welcome in view of eventually readjusting objectives and instruments, in the new political framework.

Most project funding is of horizontal character, but the S&T Development Fund (STDF) and the Academy for Scientific Research and Technology (ASRT) are launching calls for proposals targeted to selected national needs. Important efforts for technology development are directed to the agrofood, energy, environment and health issues. Agricultural research absorbs considerable share of the public RTD potential, in response to effective social needs, while relatively large resources are directed to the development of information society, targeted-applied RTD and science parks.
Egypt receives considerable financial support from the EU, individual EU Member States, the USA and Japan, accompanied by transfer of knowhow and networking that need to be evaluated systematically as to its relevance and effectiveness. There is limited intra MEDA cooperation, sponsored for the most part by the European instruments.

Overall, organisational structures are designed on the basis of international good practices, but policy implementation has to face on one side the deficiencies of the productive system and on the other side the limited effectiveness of the civil service. Cooperation between competent entities is rather limited, with most known examples the joint activities of the ASRT and the Agricultural Research Centre of the Ministry of Agriculture.

2.2 STRUCTURE OF THE NATIONAL RESEARCH AND INNOVATION SYSTEM AND ITS GOVERNANCE

Egypt covers an area of 1,001,450 km2[1]. It is the largest country in the Middle East in population terms, with 84 million inhabitants. The economy is also one of the most developed and diversified in the Middle East. The per capita GDP reached in 2011 €2,149 in PPP[2].

Egypt spent in 2011 0.43% of the GDP on RTD, a significant increase from the 0.23% in 2007[3]. The general feeling among competent national authorities, compatible with experiences of other countries, is that BERD and industry financed GERD are very low. The public funds are allocated increasingly through programmes and schemes aiming at the development of applied research and technology, in response to national economic and social needs, of innovation projects, of linkages between research organisations and business enterprises and of networking of the Egyptian researchers within international partnerships, independently of country or region. In 2011 the competent Minister announced a significant increase of the budget for research: research spending will rise from €312m (EP2.4b) to €390m (EP3b) in 2011-12 financial years. Similarly, the budget for education increased by 16%, to €7.2b (EL55.7b)[4][5]. President Morsi, according to his advisors, will work on a national strategy to develop mechanisms and support innovation dealing with community issues. He will also work towards boosting private sector investment in research, so that, within a decade, the private sector would provide 40% of Egypt's research funding.[6]

Nevertheless, the budget of STDF increased initially from EP100m to 500m, was reduced during implementation of last year to 400m and further shrunk for the July 2013 to June 2014 period to 300m. On the opposite, the ASRT subsidisation passed for EP15m (2010-11) to 65m (2012-13) and 100m (2013-14).

Main actors and institutions in research governance

Egypt is a centralised country and the research system follows this organisational pattern. The political turmoil since January 2011 contributed to the split of the Ministry of Higher Education and Scientific Research (MHESR) in its two components. The Cabinet is composed of more than 30 ministers, from which the **Minister of Higher Education** and **the Minister of State for Scientific Research** have central competences for research and innovation. The minister in charge of Research since December 2011 was reconfirmed in August 2012.

In the competence area of the **Ministry of Higher Education** operate the Supreme Council of Universities; while in the area of the **Ministry of Research** operate the Supreme Council for Research Centres and the Supreme Council for Coordination between Research Centres in the different ministries. The *Supreme Council of*

[1] www.indexmundi.com
[2] World Bank Doing Business 2012
[3] http://stats.uis.unesco.org
[4] Butler Declan: Egypt invest in Science, Nature Vol 474 / 16 June 2011
[5] Lawler Andrew: A new day fo Egyptian science? Science, vol 333 15 July 2011
[6] Scidev Egypt's scientists savour post-revolution year, Hazem Badr 10 July 2012

Universities (SCU) is a consultative body, presided by the Minister of HE and having as members the presidents of public universities, experts in the field of higher education and the SCU General Secretary. SCU coordinates universities in curriculum development, degrees awarded, academic promotions, examinations, equivalence to foreign degrees, effective implementation of international quality standards etc.

The Supreme Council for Research Centres aims at networking the considered research centres and integrating their research capabilities; it coordinates research activities between the researches institutes affiliated to the Ministry of Research. **The Supreme Council for Coordination between Research Centres in the different ministries** promotes the integration between research centres affiliated to the different ministries, coordinates the programmes and research plans, collects and reviews previously prepared research and knowhow and makes them available to the entities that can benefit from them, designing executive protocols for cooperation with the production and services sectors.

The **Higher Council for Science and Technology** (HCST), created in 2007, is the highest consultative body for priority setting and policy orientation. The HCST is headed by the Prime Minister and it includes ministers that have RTD as a component of their competences, renowned scientists and representatives from the private sector. It did not convene since the last elections. The **S&T Development Fund** (STDF) is implementing components of the Ministry's policy and financing programmes and schemes, including several joint funds with foreign entities. Other bodies operating in the same area are the National Committee for Education, Science and Culture, the Academy of Scientific Research and Technology (ARST), the National Research Centre, the National Institute for Standards, and the Central Administration of Al-Azhar Institutes. The *ASRT* supports strongly the commercialisation of research results, the access of researchers to international data sources and brings together outstanding Egyptian scientists from universities, research institutions, private sector, NGOs, policymakers and Egyptian scientists in Diaspora, to deliberate on the problems of the country and propose and carry out scientific studies and future strategic basic plans[7].

The ***Ministry of Industry and Foreign Trade*** (MIFT) supervises among other the Industrial Council for Technology and Innovation (ICTI), the Industrial Modernisation Centre (IMC), the Technology Transfer and Innovation Centres (ETTICs), the Organisation for Standardisation, the Accreditation Council, the Geological Survey and Mining Authority and the SMEs organisation.

The **Ministry of Agriculture** and Land Reclamation supervises the Agricultural Research Centre (ARC) and the **Ministry of Irrigation** and Water Resources the National Water Research Centre. The **Ministry of Communication and Information Technology** (MCIT) has under its authority the Information Technology Industry Development Agency (ITIDA) the Software Engineering Competence Centre, the National Telecommunications Institute and the Smart Village (incubator)[8]. The *Information and Decision Support Centre* (IDSC) is a think tank created to support the Prime Minister on economic development issues.

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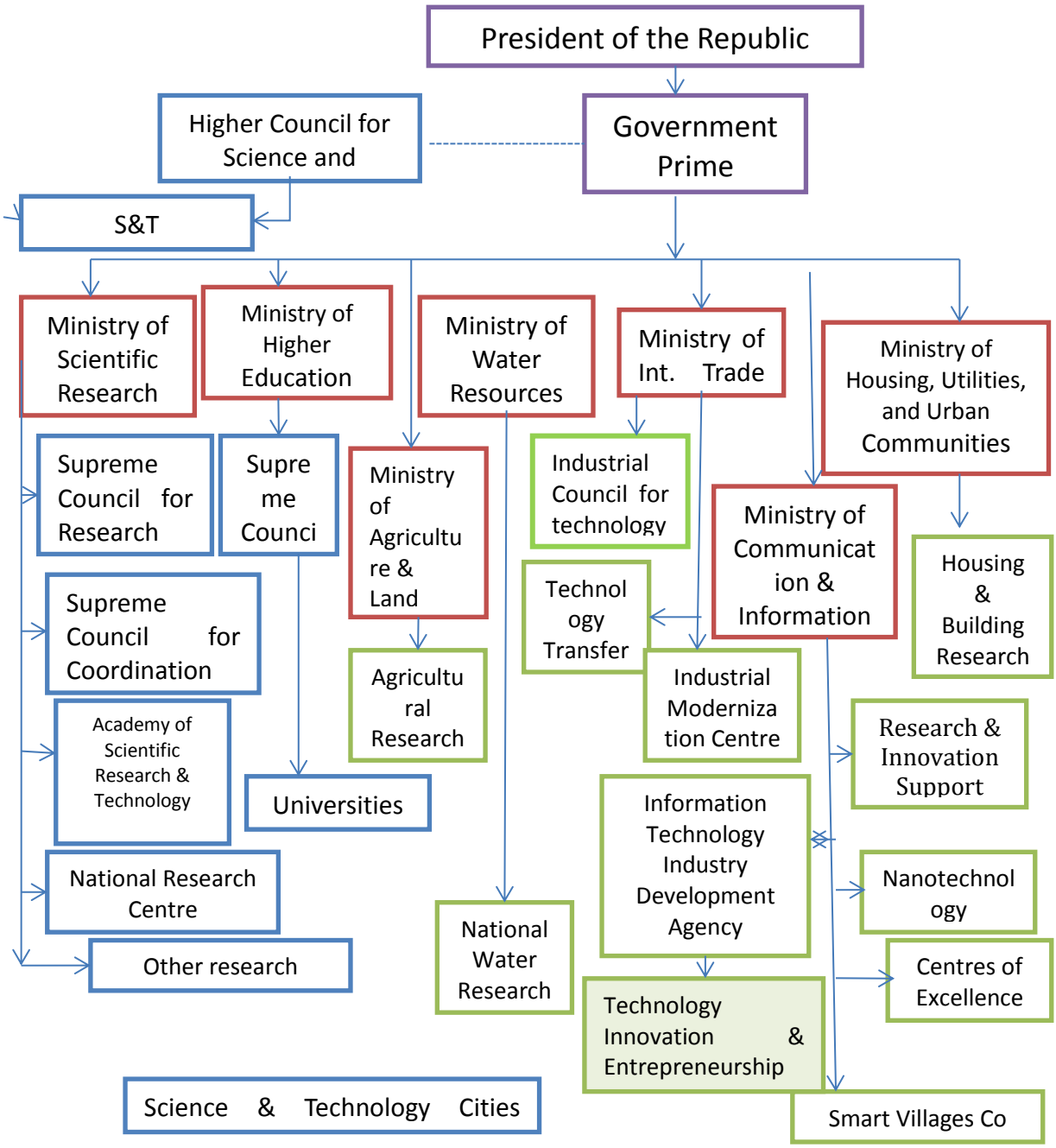
[7] Science, Technology and Innovation (STI) System in Egypt

[8] The Ministry of Housing, Utilities and Urban Communities supervises the Housing and Building Research Centre, the Ministry of Petroleum the Petroleum Research Centre and the Ministry of Culture the Mubarak Public Library, the Egyptian Museum, the National Centre for Translation etc. The Ministry of Health is responsible for the General

Figure 1: Overview of Egypt's research system governance structure

Figure 1 summarises the structure of the research system in Egypt. It is visible that there is an effort to coordinate RTD policy centrally by one public authority but at the same time, several ministries may use research directly as an instrument to support their individual policies.



Organisation for Teaching Hospitals and Institutes, the Ministry of Justice for the National Centre for Legal Studies and the Ministry for Interior Affairs for the National Centre for Social and Criminological Research.

The institutional role of regions in research governance

Egypt is divided administratively into 27 governorates, headed by a governor appointed by the President of Egypt, and into 166 administrative regions. The governorates and regions have no authority on research and science policy, although many of them host universities, technical colleges, public research centres, hospitals and research extensions of the Ministry of Agriculture.

Main research performer groups

The bulk of S&T research is carried out within the higher education system. The share of **higher education** in RTD amounts approx. 70% of the total with the remaining attributed to the research centres. There are 19 public universities, located in the main urban centres of the country, along the Nile River, the Mediterranean coast and the Suez Canal. Some important public universities are Cairo University, Alexandria University and Ain Shams University. The government supplies the largest share of funding to the public education system.

The ***National Research Centre*** (NRC) is the largest multidisciplinary R&D centre in Egypt, with many departments and labs, aiming to develop production and service sectors.[9]

The ***Agricultural Research Centre*** (ARC) includes the *Agricultural Engineering Research Institute*, the *Agricultural Extension & Rural Development Research Institute*, the *Agricultural Genetic Engineering Research Institute* Egypt, the *Animal Health Research Institute*, the Soil, Water and Environment Research Institute etc. The ***National Water Research Centre*** (NWRC) of the MWR is considered as the main research entity for policy support in the field...

The R&D **Centres of Excellence** of the MCIT are created in the form of consortia of local and multinational industrial organisations, universities and research centres. Until now there are two such centres: (a) The Data Mining and Computer Modelling Centre of Excellence; (b) The Centre of Excellence in Wireless Communication and Electronic Design (WCED).[10]

More innovation and technology transfer activities are promoted by the *Ministry of Electricity and Energy*, the *Ministry for Environment Affairs* and the corresponding Agency (EEAA), the *New and Renewable Energy Authority* (NREA). The latter operates a Testing and Certification Centre. More visible are the activities of public-private partnerships. Two of them are identified here:
(a) The **Egypt-IBM Nanotechnology Research Center** is the result of a three-year partnership agreement between the Information Technology Industry Development Agency (ITIDA), the S&T Development Fund (STDF), and IBM

[9] Several divisions of NRC developed in the past into independent research institutes: The National Institute of Standards, Petroleum Research Institute, Theodore Bilharz Institute etc.
[10] Moreover, The National Telecom Institute, the Information Technology Institute and the e-Learning Competence Centre are creating specialised training programmes in ICT. The Software Engineering Competence Centre (SECC) is providing services to local software companies, offering them support for accreditation.

Corporation. The Centre focuses on solar energy and desalination and other fields of national interest.
(b) *The **Microsoft Innovation Lab*** in Cairo, a component of Microsoft Research, covers the Middle East and Africa area. It cooperates with the Universities of Cairo, Ain Shams, Helwan, Nile, the American University of Cairo and the Bibliotheca Alexandrina.

2.3 RESOURCE MOBILISATION

2.3.1 Financial resource provision for research activities (national and regional mechanisms)

Investment in education and RTD was given a prominent position in the official policies in the ten-year programmes announced in the middle of the previous decade still in implementation. An important programme to enhance higher education *(Higher Education Reform Strategy*) was supported by the World Bank (section 2.3.2), while RTD is supported by a National Development Fund and a series of foreign institutions. Nevertheless, the GERD/GDP ratio shrunk to 0.21% in 2009, most probably victim of the more general financial restrictions.[11] Apparently, the 1% target for GERD/GDP and the long-term programmes are not operationalized adequately on annual basis and their link to the annual budgets is rather weak.

The negligible business contribution to the official GERD figures is a major issue. In this respect, the national research and innovation policies have not only to face the need to raise research funding, much faster than GDP, but also to give a strong impulse to the business funding for an even faster increase. In practice, estimations of the competent Minister raised the share of "researchers and scientists" of the business sector in the national research at 14% of the total[12]. An unpublished study of the Ministry of Research showed that BERD constitutes 11% of the GERD[13]. Moreover, the national participation in international programmes demonstrates that there are in Egypt some active business units in research and innovation, an element that has to be appreciated appropriately at policy making level.

Officially, the Government dominates RTD funding, with a contribution of 97% (incorporating foreign resources of public character). Similarly, on the side of the performers, universities and research centres seem monopolising the RTD scene. Data on the institutional funding of the universities and research centres is not available in the way it is defined by OECD for international comparability of data; assuming that from the university budget 20% is spent for RTD while from research centres 100%, we obtain that in 2006/07 €266m were spent from the budget for research and development.[14]

[11] Officials claim in May 2013 that the indicator has achieved the level of 0.6%
[12] Sustainable Development Education, Research and Innovation Vision for Knowledge Economy" Professor Maged Al-Sherbiny President of ASRT, Assistant Minister for Scientific Research, Nov. 2010
[13] Interview to Minister Maged Al-Sherbiny, June 2011
[14] Source: Treated of data of the: Ministry of Scientific Research Volume 1: S&T Indicators, 2008

The major share of the Research Ministry budget for research centres is dedicated to the National Research Centre and secondarily to ASRT and NARSS[15]. The rest is distributed rather thinly to a large number of smaller units. Among the research centres affiliated to other Ministries, the largest is the Agricultural Research Centre (given the number of employed researchers). The share of the ASRT is rising during the last years.

The **overall national strategy and general priorities**, introduced in the middle of the previous decade, are presented in the section 2.3.3. The **"thematic" priorities** set so far, for RTD by the HCST and other competent authorities are a genuine mix of areas of socio-economic needs, i.e. water and food, and of fields of advanced technologies, like ICT and space. The list of **National Priority Areas** summarises this approach and includes New and Renewable Energy, Desalination and Water resources, Life Sciences, Food and Agriculture, Space Technology and Remote Sensing, Information and Communication Technology, Social Sciences and Humanities[16]. Given the limited resources, the national authorities have established a **"phase one" S&T priority areas**, including "Energy resources-new technology for wind turbines-Innovative concentrated solar power-photovoltaic thin films with nanotechnology", Water and environment, water resources management, desalination, Food and agriculture, Increasing marine aquaculture of fish, Life sciences, Industrial biotechnology and pharmaceuticals, Space, remote sensing and ICT, etc.

Table 2.1 Basic statistical data: two sources of data have been used: UNESCO-UIS and national publications[17].

	UNESCO - UIS				National data - Min. of Research		
	2007	2008	2009	2011	2005/06	2006/07	2007/08
GERD (million) (UNESCO curent PPP$ Constant 2005 PPP$)	1,033,078 972,596	1,198,632 1,104,093	1,124,869 1,022,639	2,230,569 1,969,737	€235.5	€ 226.9	€ 264. 3
R&D intensity (GERD as % of GDP)	0.26	0.27	0.24	0.43	0.26	0.23	0.24
GERD per capita (UNESCO current PPP$ const 2005 PPP$)	13.9 13.1	15.9 14.6	14.7 13.3	28.1 24.8	3.0	2.8	3.2
GBAORD (€ million)	:	:	:		<235.5	<226.9	<264. 3
GBAORD as % of GDP	:	:	:		<0.26	<0.23	<0.24
BERD (€ million)	:	:	:		:	:	:
Business sector R&D intensity (BERD % of GDP)	:	:	:		>0.1	>0.1	>0.1
GERD financed by abroad as % of total GERD	:	:	:		:	:	:
R&D performed by HEIs (%GERD)	:	:	:		<74	<74	:

[15] National Authority for remote Sensing and Space Sciences
[16] Sustainable Development Education, Research and Innovation Vision for Knowledge Economy" Professor Maged Al-Sherbiny President of ASRT, Assistant Minister for Scientific Research
[17] The significant differences in the absolute amounts and the similarity of GERD/GDP ratios indicate that one refers to different bases for calculation or other methodological differences not explicit in the documentation

R&D performed by PROs (%GERD)	:	:	:		>26	>26	:
R&D performed by private sector	:	:	:		<1	<1	:
New doctorate graduates[18] (ISCED 6) per 1000 population aged 25-34	:	:	:		0.47	0.52	:
Exchange rate applied** (LE/€)					0.14721	0.13268	0.12295

Sources: http://stats.uis.unesco.org/unesco/ReportFolders/ReportFolders.aspx (columns 2,3,4)
Ministry of Scientific Research, Volume 1, Indicators 2008 (columns 5, 6, 7)
* based on UN estimations (esa.un.org/unpp)
** www.xe.com/currencycharts
: Not available

The implementation of the strategy is based on both institutional and project funding mechanisms. The government provides also for tax allowances (Law 91/2005) on RTD expenditures or donations for RTD spending, but there are no data available on the use of these provisions by the economic agents. Their effectiveness is strongly questioned, particularly for the commercialisation of university inventions[19]. New initiatives of the ASRT, which is managing the national Patent Office, are aiming at supporting commercialisation with both funding and consulting.

A long series of funding programmes and schemes have been announced and started implementation. The **Science and Technological Development Fund** (*STDF*) is one of the most important framework instruments for policy enforcement, allocated approx. LE400m (€ 52m) in 2012-13 and LE300m in 2013-14, composed of individual schemes, most of them being of competitive character. Until 2013 approx. 50% of the budget was allocated to the "Basic and Applied Research Programme', a share to be reduced in the following years. STDF also funds the Centres of Excellence Programme (LE60m for 2013), Capacity Building (LE40m for 2013), a series of bilateral cooperation activities (Germany, France, Japan, Korea, South Africa, USA etc.) and a small "Technological Incubators" programme (LE2m).

A second large umbrella programme for supporting research and innovation is the **Research Development and Innovation Programme** *(RDI)* funded by the EU in the frame of the **European Neighbourhood and Partnership financial cooperation with Mediterranean countries**. Initiated in 2007, it had a budget of €11m for the first three years, from which €6.8m were allocated to the EU-Egypt **Innovation Fund** (EEIF). RDI 2 (2011-2014) continues the first phase of the Programme with the aim to support the Egyptian government's reforms. The Programme will deploy its activities to the regions, allowing better networking with MPC/EU partners. It is expected, among other, to raise the commitment of the policy makers and the public in Science and Innovation policies and activities, to enhance the capacity of the Ministry of Research in innovation policy formulation and to widen

[18] The available data on the numerator refer to the "total doctor degrees obtained by Egyptians from Egyptian and foreign universities". The figure is for 2005 3676 and for 2006 4166 individuals. For comparison, the number of PhDs in ministries and their supervised organisations amounted 48,837 in 2007 and the researchers (FTE) per 1m inhabitants amounted (2007) 617
[19] Lawler Andrew: A new day for Egyptian science? Science, Vol. 333 15 July 2011

collaboration between the academia and industry. The EEIF is expected to support proposals under **Scheme 1** and **Scheme 2**. The applied research projects addressed some of Egypt's priority areas such as energy, health, ICT and agriculture. The Innovation projects promoted innovation culture i.e. introduced school students to new technologies and innovation, assisted in promoting entrepreneurship and commercialisation of products based on patents.

The RDI plays pivotal role in the implementation of capacity building and R&I initiatives in Egypt. RDI II is funded by the ENPi (€20 million). RDI II (2011-2014) has three main components:

- EU-Egypt Innovation Fund (EEIF) which provides competitive grants to innovative applied research projects. Under RDI II, EU-Egypt cooperation was pursued in the context of the EU-Egypt Innovation fund where numerous areas of common interest have been selected as a base for the funds grant programme. The fund focuses on projects in line with Egypt's innovation objectives including Energy, Water, ICT, Environment, Biotechnology, Health, Space, Manufacturing Industries, Food, Agriculture and Education. Two calls for proposals under two different schemes were launched in May and June of 2012.
- A network that is composed of a central unit in at the Ministry of Scientific Research in Cairo and extends nationwide represented by 44 RDIN Focal Points (FPs). The RDIN FPs is responsible to provide information, guidance and support to researchers in their respective organizations who wish to participate in different components of the FP7 programme.
- Support to innovation clusters and Centres of Excellence. RDI II will support the establishment of innovation clusters with the drafting of a call for proposals that would be launched in the last trimester of 2013 (EUR 4,000,000).

The ***Industrial Modernisation Centre*** (IMC) of the MIFT manages or is involved in a long list of programmes and schemes aiming at improving the competitiveness of Egyptian firms, some of which are implemented in cooperation with the STDF: Productivity Enhancement, Specialised Industrial Clusters, Intellectual Property Rights Production, Scientific Research and Development, Innovation Programme, Sustainable Products Development Programme, *Professor For Every Factory* etc. The largest part of the budget (55.4%) is allocated to training, followed by quality improvement (21.4%). RTD receives only 0.3%, but many of its activities support it indirectly[20]. The most relevant programme for RTD policy (Professors for faculty) was discontinued because of difficulties in financial coordination with the STDF, which was managing the academic part of the scheme.

The Industrial Council for Technology and Innovation is an umbrella body of the MIFT for the Technology and Innovation Centres, established in 2005-06. The centres supply services to the industry in areas such as food, textile, marble, furniture, jewellery (15 centres). Two more centres address issues of environmental technologies and productivity and quality.

[20] Industrial Modernisation Centre: Your Partner for Success, Oct. 2010

The *Information Technology Industry Development Agency* (ITIDA) of the MCIT manages RTD programmes including Product Development Projects, **Advanced Research Projects** (ARP), **Product Development Projects** (PDP), Fellowships, and Patent Filing. ITIDA's incentives include: (a) The Enterprise Capacity Building Programme "Grow IT", (b) The "RAMP" Programme on developing human resources for SMEs, (c) The support to export initiative. The Centres of Excellence Programme of ITIDA funds applied research conducted by consortia of experts from academia and industry. ITIDA prepared also the **Information Technology Academic Collaboration** (ITAC) Programme which supports university students for graduation projects as well as summer training in ICT companies. An important ITIDA's programme is TIEC, supporting innovation in ICT, through incubators, start-ups etc.

The ***Academy of Scientific Research and Technology*** (ASRT) develops in the last two years in particular an intense activity for supporting applied research, commercialisation, S&T information accessibility and dissemination, patenting and industry-research alliances.

The **Agricultural Research & Development Fund** (ARDF) provides grants for agricultural multidisciplinary research. **MEK** supports applied research in the areas of health, social sciences, and renewable energy & desalination.

Egypt is receiving strong S&T support by other countries, both at bilateral and multilateral levels. Most important partners are Germany and France, the EU, the USA and Japan.

2.3.2 Providing qualified human resources

The *UNESCO Science Report* 2010 recognises that "the Arab countries did not create a critical mass of researchers, in the majority of disciplines. Links between universities and research centres remain weak. Moreover, there is no capacity to absorb new graduates within the RTD system or even willingness on the part of senior researchers to mentor young ones". The *UNDP 2012 Human Development Index* classifies Egypt 112th among 187 countries, with an Index of 0.662, against 0.712 for Tunisia, 0,722 for Turkey, an average of 0.652 for the Arab countries and 0.694 for the world. Both primary and higher education constitute weak vectors of the competitiveness and entrepreneurship of the country (section 2.3.3, *WEF index* and *GEM*). Egypt ranks 137th in quality and 59th in enrolment of primary education, the 109th in "higher education and training", 137th in quality of (higher) education, while it is 61st in availability of scientists and engineers.

The Fraunhofer IKP study on the Egyptian universities and research centres found that 30% of the establishments have no strategy for the appropriate ratio between experienced research staff, professors and young scientists. The most common strategy for staffing is the recruitment of graduates who finished their degree in the same

university[21]. These graduates are selected internally for continuing their PhD studies and be "promoted" to the ranks of professors.

Data from the Min. of Higher Education shows that the number of **staff in the Egyptian universities** steadily increased from 2004 to 2009, while students in public universities increased by 1.5% annually and in private universities by 15%. Graduates increased by 130% in the decade 1997-2006, medical and engineering sciences marking increases above 240%[22]. UNESCO statistics indicate that 28% of the relevant age group is in tertiary education. In the total population, the enrolments in all programmes of tertiary education were estimated at 2,488,434 individuals in 2008, while the female graduates were 52% of the total. The students studying abroad amounted 8,952 in 2008. Foreign students in Egypt were 35,031 in 2007[23]. The majority of foreign students are of Palestinian origin.

Table 2.3 Human resources in higher education

thousand	2002-03	2004-05	2006-07	2007-08	2008-09
Total postgraduate 2002-2009	182	189	200	204	215
Total staff members	41	43	48	47	49
Total students	2,171	2,398	2,502	2,488	2,505

Source: UNESCO/UIS

Table 2.4 Relative distribution of graduates of Egyptian universities

Year	**Total**	Humanities	Basic sciences	**Agricultural sciences**	Medical sciences	**Engineering**
2002	**297,583**	234,696	6,564	**9,356**	21,878	**25,089**
2006	**396,240**	322,625	10,068	**6,595**	27,919	**29,033**

Source: MHESR S&T Indicators, 2008

According to the latest available national data, humanities produce the absolute majority of graduates of the public and private universities. Table 2.4 shows the concentration of graduates by field of study, that gives a slim share to sciences and engineering, in particular agricultural sciences that face a large segment of the national economy as well as the largest component of public RTD.

As far as research is concerned, the **number of researchers** per million inhabitants in Egypt amounted in 2009 420 in full time equivalent (FTE) against 1018 in head counts (HC). In terms of 1000 labour force the indicator is 1.27 for FTE and 3.07 for HC, while in terms of 1000 employed is 1.40 and 3.39 respectively for 2009[24]. These figures refer to the public sector only. Nevertheless, the Minister estimates that the business sector employs 14% of "researchers and scientists" in research, while 73% are employed in University and 13% in Institutes[25].

The government sector was employing in 2009 FTE 14,491 researchers, (a sharp drop from the 29,183 in 2007) out of a total of 33,516 researchers (the 2007 total amounted

[21] Fraunhofer IPK: Evaluation of the Egyptian Science, Research and Technology Landscape for the Design of the Egyptian Innovation Policy and Strategy, July 2009
[22] MHESR Volume 1: S&T Indicators, 2008
[23] UNESCO
[24] *UNESCO*
[25]"Sustainable Development Education, Research and Innovation Vision for Knowledge Economy" Professor Maged Al-Sherbiny President of ASRT, Assistant Minister for Scientific Research

49,363). Among the 2007 researchers, 36.2% (FTE) were graduates of level ISCED 6[26], which means that the PhD holders are a minority among the researchers[27]. These staffs are spread to a large number of centres and institutes, depending on a wide spectrum of ministries. As far research centres of the Research Ministry are concerned, 60% of the employment is concentrated in NRC (based on 2008 national data). Two different classification systems (UNESCO and MHESR S&T Indicators) confirm the **predominance of agriculture** in the national research system. The competent Minister announced in 2011 the increase of the number of government research institutes for 198 to 258 (including large centres in microelectronics and solar energy)[28].

The Government is deploying efforts to enhance the quality of higher education as well as of public research. The *Higher Education Reform Strategy* (section 3.3.1) was an effort of the last two decades to modernise the universities. The Reform was implemented through the *HEEP* and the HEEP Fund which allocated €38.5m and was matched by the national government with approx. €7.5m[29]. Moreover, the **development of human resources** is a major horizontal component of the national research strategy. The individual actions in this area provide for the (a) Expansion of Young Scientists Critical Mass, (b) Encouragement of the International Interactions, (c) Mobility Grants, (d) Brain Circulation, (e) Chairs of Excellence and (f) Capacity Development.

The ASRT manages the Transfer of Knowledge and Experience through Expatriate Nationals (TOKTEN) project of the United Nations. The STDF provides for three-year grants to expatriate researchers in order to continue their careers in Egypt and develop adequate research facilities (Reintegration Grants).

2.3.3 Evolution towards the national R&D&I targets

The basic changes of the **policy mix** were announced in the middle of the previous decade when the Egyptian research and innovation systems have undergone an overhaul. The Presidential decision to launch the Decade for Science and Technology (2007-2016), followed by the Governmental decision to implement the "**Developing Scientific Research (2007-2016) Plan**" through the Min. of Research, were determinant factors in the trajectory of the research policy in the country. A capital investment equivalent to €455m for RTD was foreseeing[30]. The Plan was composed of a series of actions:

- Re-Structuring of Science and Technology Governance.
- National Initiative for Human Resources Development.
- Priority National Projects.
- Funding of Science and Technology.
- National Initiative for Informal Education.

[26] International Standard Classification on Education. In HC the respective figure is 51%, which means that lot of researchers are part time graduates.
[27] Source UNESCO/UIS
[28] Butler Declan: Egypt invests in science, Nature Vol 474 16 June 2011
[29] http://www.heep.edu.eg/about-heep.htm
[30] Sustainable Development Education, Research and Innovation Vision for Knowledge Economy" Professor Maged Al-Sherbiny President of ASRT, Assistant Minister for Scientific Research

- National Initiative for Innovation, which provides for:
  (a) Centres of Excellence and Industry Links,
  (b) Multi-disciplinary Research Effort,
  (c) SME and Spin-off companies,
  (d) Industrial and Technological Parks,
  (e) Innovation Fund (EU) and
  (f) Support to the "4 P's Cycle" (publications, patents, prototypes, products).

The Ministry and the HCST were established to enforce this policy. New and innovative structures, such as the STDF, were introduced. The **recent developments** refer mainly to the implementation of the research and innovation policy of the country and place more emphasis to the dissemination and application of new knowledge.

The STDF[31] funds the National Research Grants (NRG) and Joint Research Grants (JRG) covering all fields of science. NRG consists of *Basic and Applied Research* (B&A), *Young Researchers* (YR), and Reintegration (Re-int) grants, implemented through continuously open calls for proposals and covering all fields of science. STDF also funds targeted calls, based on national priorities. The Fund manages the "Capacity Building Grants", "Improvement of sustainable food production", "Renewable energy" and "Health". Moreover, STDF developed a three year plan to expand its existing schemes and fund a larger number of proposals: Directed Calls, Internship Grants, Technology Commercialisation, S&T Observatory, S&T Impact Assessment, and Awareness Raising. STDF is participating in the establishment of an e-library to offer access to the latest international journals. The most recent calls for proposals are addressing the Pharmaceutical Technology and the Sustainable Development of SINAI. Moreover, open calls in mi-June 2013 address the Egypt-Korea Cooperation Programme for Scientific Research (STDF- NRF), the Technology Incubator Programme (STDF-TIP), Grant for Demand-Driven Projects (STDF-DDP), the Research Support & Technology Development Grants (STDF-RSTDG), the Young Researcher Grants and the Reintegration Grants.

The **RDI 2/EEIF** with €11m will support four schemes for 30 months, for up to 50% - 90% of total cost of projects/actions. **Scheme 1** supports applied research projects of consortia (university/research centre or large enterprise/SME or inter-governmental organisation) that contribute to the achievement of sustainable development in Egypt. **Scheme 2** aims to promote science and innovation culture, enable entrepreneurs to develop ideas with limited financing and strengthen cooperation with European and regional counterparts. Moreover, RDI 2 provides for **Innovation Clusters**. The latter is considered for merging with the corresponding programme of STDF and transferring its budget to the Clusters.

Both **STDF** and **RDI** are favourable to the participation of business firms in research projects and to the exploitation of results. In the meantime, the Technology Transfer Centres, the City for Scientific Research and Technology Applications in Alexandria as well as new Science City announced in Cairo, the Smart Village Company and the Technology Valley may supply support services and infrastructures to new technology-based firms.

[31] http://www.stdf.org.eg

The *Organisation for* ***Standardisation and Quality Control*** produces and disseminates the national standards to interested persons and has an active quality control and assurance. As to the use of the **public procurement** potential for technology transfer, it is concentrated into the defence sector with weak dissemination to the rest of the economy (section 2.4).

Fiscal policy introduced since 2005 tax allowances on RTD expenditures or donations aiming at RTD spending. The law provides for taxable commercial and industrial net profits to be determined on the basis of the gross profit after deduction of all costs and expenses linked to such profits. It also provides deduction of expenses related to donations and subsidies to Egyptian non-governmental organisations and foundations So far, there are no data available on the use of these provisions. A fatwa (Islamic religious ruling) issued by the Grand Mufti of Egypt in October 2011 determined that donations to scientific research were acceptable as a component of the obligation to give 2.5% of income to charities[32].

Despite the efforts at policy and organisational levels exerted so far and the target of the 2007-2016 Plan to raise the GERD to GDP ratio to 1%, this has stagnated around 0.21% (2009)[33]. The publication of BERD data was pre-announced in summer 2011 but not yet materialised. There is no specific quantitative target for BERD. In the field of innovativeness, only 1.2% of firms sell goods and services outside the country. Egyptian enterprises that introduced product innovation don't exceed 12.2% and those that introduced process innovation 17.8% of the total. The main type of innovation activity is the acquisition of equipment, followed by training. The percentage of firms introducing organisational innovations is higher and the main impact is the reduction of the time to respond to the customers.[34]

The *Global Competitiveness Index in 2012-13* of the WEF ranks Egypt at the 107th position among 144 countries, a significant deterioration compared to the year before; in "technological readiness" it is 91st, in the quality of the education system 139th, and in "Innovation" 109th with the "quality of scientific institutions" at 114, "company spending on RTD" at 116 and "university-industry collaboration on RTD" at 128 position. The World Bank, on its side, ranks Egypt 109th among 185 countries for the easiness *of Doing Business* in 2013 (a downfall from the 99th position of 2010), worst in dealing with construction permits, paying taxes and resolving insolvency and best in starting a business.

The latest *Global Entrepreneurship Monitor* (GEM 2012) sheds further light to the business climate in Egypt. Relevant indicators show a rather positive attitude of the population for entrepreneurship and business initiatives[35]. But relatively high necessity-driven entrepreneurship raises serious questions as to the quality of new business initiatives and, combined to the low discontinuation rate, as to the conditions of competition in the national market. The GEM Report gives the "primary and secondary education", "post-school education", and "RTD transfer" as the most

[32] Scidev Egypt's president 'to link science to society, Hazem Badr 18 January 2012
[33] According to ASRT's President Maged Al-Sherbiny it has increased to 0.6% (no published data, May2013)
[34] Ministry of Scientific research: Egyptian National Innovation Indicators Survey 2009
[35] 83% believe that Entrepreneurship as a good career choice and 87% give a High status to successful entrepreneurs, while 59% believe to have good opportunities for establishing a firm

negative conditions for entrepreneurship, while "commercial infrastructure", internal market dynamics" and "physical infrastructure" receive positive assessment.

2.4 KNOWLEDGE DEMAND

Boosting demand for new knowledge is a critical challenge for the national policy of Egypt. In the Egyptian economy the agricultural sector contributes for 13% of GDP, industry 38% and the services 49%. The **agricultural sector** employs 32% of the working population. Cotton, wheat, corn, sugarcane, fruits and vegetables, fodder and rice are the main crops produced. Irrigation, salinity and training of farmers are serious issues for agricultural productivity. In **industry**, dominate automobile manufacturing, nitrogen fertiliser production, steel, textile and clothing, consumer electronics and home appliances, cement and construction. In the **service sector**, banking and insurance, communications and transportation and tourism are dominating. ICT is an emerging service sector. Egypt participates also in the regional **oil and natural gas** production and trade.

Net foreign direct investment increased during FY 2006/07 to reach €7,9b and €9.4b in the following year. In FY 2006/07 5,958 new companies were established, with an issued stock capital of €4,883m while 1,184 companies already in operation have undergone expansion with a total issued capital of €5,652m[36]. The oil sector attracted foreign investment in the field of oil excavation and wells development amounting to nearly US$3.3b. In 2007, Egypt joined the OECD's Investment Committee. Local investments amounted €23,361m in 2007/08[37]. Such a structure of the production fabric may explain the very small participation of the business enterprises in the national GERD. It is considered that industry "has the money but is reluctant to contribute" to R&D...while it is "importing whole factories from abroad".[38]

Public procurement (section 2.3.3) is only incidentally used in Egypt for the development of new knowledge and endogenous innovation. Innovation takes place mainly at the product end use or consumption phase. Some deviation from this very general rule could happen in few areas, such as the defence sector, although there also production is concentrated in assembling lines. A specific programme, managed since 2009 by the IMC as the Industrial Vertical Integration Initiative, aims at expanding the use of local materials and maximising governmental purchase of local product. Nevertheless, there are no activities enforcing regulations to promote endogenous innovation.

The activities implemented by various ministries are scheduled in the framework of the **Economic Reform Programme**, adopted long ago. In this frame, the Ministry of Health and Population (MOHP) established a scientific committee on health research. In the field of agriculture, the ARC responds to the expressed national needs in terms of knowledge production and application. Public funding for research in agriculture amounts approximately € 3.2m per year.[39] The NWRC is considered as the main research entity for policy support in the field. The MCIT established the R&D

[36] http://www.sis.gov.eg/En/LastPage.aspx?Category_ID=353
[37] http://www.sis.gov.eg/En/Story.aspx?sid=850
[38] Lawler Andrew: A new day for Egyptian science? Science, Vol. 333 15 July 2011
[39] Prof. Sharkaway Ahmed: The agricultural research system of Egypt, University of Cairo, Faculty of Agriculture

Centres of Excellence (section 2.3.2). The *IMC* and the Industrial Council for Technology and Innovation promote research and innovation. Moreover, the Science City, the Smart Villages Company and Smart Technology Valley are enhancing the capacity of the country to create a growing market for new knowledge.

2.5 KNOWLEDGE PRODUCTION

2.5.1 Quality and excellence of knowledge production

The human resources reported to be involved in RTD are employed in the universities and the public research centres. Against these inputs, publications in international periodicals exceeded 6,000 in 2010, demonstrating a steady increase for the last decade (table 2.5a). Similarly, the patenting records are improving, although the upward trend in not clear between 2007 and 2008 (table 2.6). Table 2.5b presents data on publications by field of science from two data sources; there also the annual increase is confirmed. Nevertheless, Egypt did not succeed to increase its contribution to the world science, compared to other countries of the region, in particular Iran and Turkey (growth rate for Egypt 1, against 11 for Iran and 5.5 for Turkey).[40]

Table 2.5a Scientific output of Egypt: publications 2006-2011

database	2006	2007	2008	2009	2010	Total
WoS documents	3,844	4,278	4,717	5,725	6,281	24,845
InCites documents	3,149	3,413	4,271	4,882	5,456	21,171
Times cited (InCites)	18,097	15,354	11,947	6,964	1,415	53,777
Impact relative to world	0.58	0.58	0.57	0.60	0.55	0.53

Source: National Documentation Centre, Athens, Greece
N.B. InCites includes articles, notes and reviews. Web of Science includes in addition abstracts, proceedings, books etc.
Impact relative to world: The quotient obtained by dividing the citations per document for a selected country by the citations per document for all documents in the selected time period.

Excellence has emerged as a major criterion for project funding in the last decade, against the old tradition of promoting faculty members without clear metrics, appointing presidents upon political criteria and department chairs by seniority and scientific conferences requiring approval from security forces.[41] The involvement of several foreign institutions for technologically developed countries in cooperation programmes and the participation of Egyptian researchers in EU activities have raised further the awareness of the national actors on the importance of excellence in the effectiveness of the national research and innovation policy.

[40] Science-Metrix: 30 years in science, Secular movements in knowledge creation, www.science-metrix.com/30yearsPaper
[41] Lawler Andrew: A new day for Egyptian science? Science. Vol. 333, 15 July 2011

At the level of the individual research organisations, the *ARC*, with a little more than 5,000 researchers reaches a score of 43,553 publications and 74 projects. The 90% of these publications are credited to the *Central Laboratory for Agricultural Expert System* (CLAES), which is employing 1.2% of the researchers. The *Animal Production Research Institute* (APRI) comes second with 2% of the publications and 6.8% of the researchers. This strong imbalance shows a need for homogenisation of data for better comparability.

Table 2.5b Publications and citations by scientific field

Year		Natural sciences	Medical & Health sc.	Engineering - technology	Agricultural sciences	Social sciences	Humanities
2006	Documts	1,952	817	969	152	37	12
	Citations	11,000	6,543	3,988	685	166	27
	Imp-c	0.56	0,63	0.60	0.73	0.68	1.60
	Imp-s	0.98	1.39	0.72	0.78	0.78	0.39
2007	Documts	2,067	904	1,098	234	45	10
	Citations	9,244	5,127	4,049	833	113	9
	Imp-c	0.55	0.59	0.67	0.80	0.53	0.88
	Imp-s	0.99	1.26	0.82	0.79	0.56	0.20
2008	Documts	2,497	1,186	1,295	270	57	19
	Citations	6,852	4,341	3,465	541	101	13
	Imp-c	0.51	0.62	0.75	0.74	0.66	1.05
	Imp-s	0.98	1.31	0.96	0.71	0.63	0.24
2009	Documts	2,761	1,417	1,593	320	75	23
	Citations	3,953	2,358	2,181	320	57	6
	Imp-c	0.53	0.60	0.77	0.81	0.62	0.84
	Imp-s	1.00	1.16	0.96	0.70	0.53	0.18
2010	Documts	2,908	1,788	1,649	363	80	33
	Citations	755	562	310	57	11	4
	Imp-c	0.45	0.62	0.61	0.70	0.52	0.46
	Imp-s	1.00	1.19	0.73	0.62	0.54	
Cumulat. 2006-10	Documts	12,185	6,112	6,604	1,339	294	97
	Citations	31,804	18,931	13,993	2,436	448	59
	Imp-c	0.50	0.53	0.63	0.67	0.55	0.98
	Imp-s	1.03	1.22	0.83	0.72	0.60	0.24

Source: InCitesTM, Thomson Reuters 2011, data processed 31 Dec. 2010, National Documentation Centre, Athens
N.B. Doc.: Web of Science Documents, Citations: times cited, Impact: Impact relative to subject area
Imp-c=Impact relative to country: Impact in a particular subject area relative to the impact for the entire country in all subject areas. A value greater than 1 indicates that the impact of the Country in the selected subject area is better than the average impact of the Country across all subject areas.
Imp-s=Impact relative to subject area: Impact in a particular subject area relative to the impact for the subject area overall. A value greater than 1 indicates a better than average impact in the subject area.

Table 2.6 Ranking of total IP activity (resident activity plus activity abroad) by origin, 2011

	Patents	Trade Marks	Industrial Designs
Egypt*	47	92	55
Turkey	24	15	14
Tunisia	108	79	88
Morocco	70	47	40

* Data on trademark applications at the national IP office are not available; however, applications at regional IP offices are included. Data on industrial design applications at the national IP office are not available; however, applications at regional IP offices are included.

Table 2.7 Number of patent applications by office and origin, 2011

Country	Applications by office			Equivalent applications by origin	PCT international applications		PCT national phase entry	
	total	resident	Non resident		Receiving office	Origin	Office	Origin
Egypt	2209	618	1591	727	29	33	1537	41
Tunisia	..	..	..	15	6	8	..	2
Morocco	1049	169	880	191	18	19	857	15
Jordan	400	40	360	75	n.a.	1	..	5
Turkey	4113	3885	228	5265	279	539	157	928

www.wipo/export/sites/www/ipstats
.. n.a. not applicable, not available

In the area of intellectual property Egypt ranked 47th among 100 member states of the WIPO, 55th in industrial designs and 92nd in trade marks. Table 2.6 offers a comparison with other countries of the region. The following tables 2.7 and 2.8 offer further comparisons with other countries, from which Turkey appears stronger in technological activity.

Table 2.8 Number of industrial design applications by office and origin, 2011

Country	Application design count by office			Equivalent application design count by origin	Hague international applications	
	total	Resident	Non resident		Origin	Designated Hague member
Egypt	*1445	..	..	405	3	303
Tunisia	..	..	..	27	0	0
Morocco	5394	3457	1937	3729	4	398
Jordan	77	9	68	12	0	..
Turkey	41218	35488	5730	47699	86	1093

* Only Hague designations data
www.wipo/export/sites/www/ipstats
..not available

Stability characterises the Egyptian patenting activity for the last five years, while other counties of the sample demonstrate rising performances in the same period.

Table 2.9a Total patent applications (direct and PCT national phase entries) 2005-2011, Total count by filing office

Office	2006	2007	2008	2009	2010	2011
Egypt	1966	2105	2130	1942	2230	2209
Morocco	910	932	1011	991	1034	1049
Tunisia	456	492	548			
Turkey	1232	2021	2397	2732	3357	4113

http://ipstatsdb.wipo.org

Table 2.9b Resident applications per 100 billion USD GDP (2005 PPP) by origin, 2005 - 2011, Total count by applicant's origin

Office	2006	2007	2008	2009	2010	2011
Egypt		135	118	115	135	135
Morocco	153	125	140	102	111	118
Tunisia	101	94	90			
Turkey	146	223	274	328	379	429

http://ipstatsdb.wipo.org

2.5.2 Policy aiming at improving the quality and excellence of knowledge production

As mentioned in section 2.3.2, the previous decade started with the Higher Education Enhancement Project (HEEP). The Higher Education Reform Strategy was composed of six priority projects (section 3.3.1), one of them addressing the "*Quality Assurance and Accreditation" (QAAP)*. This project's strategic objectives provided for the creation of a competitive environment for the higher education organisations[42]. HEEPF, a competitive grant fund, was supporting the improvement of the management practices in at least 50% of universities by 2007.[43] Expert committees used a complex set of criteria in evaluating the individual proposals of the applicant university units, including academic excellence and quality. Moreover, the HEEP promoted the establishment of the National Quality Assurance and Accreditation Agency (NAQAAE), the dissemination of a quality culture among the academics, the establishment of quality assurance and accreditation centres in public universities and of academic reference standards for programmes and the development of quality assurance systems in the faculties. The Programme is continuing for the 2012-2017 period with accreditation, internationalisation and other activities.

Excellence is also promoted through the activities of the ASRT through the set of State prizes awarded to successful researchers, promotion of international cooperation, accessibility to S&T information etc. Excellence is in particular promoted by the NRC through the Centre of Excellence in Advanced Science (NRC-CEAS). Excellence and scientific merit are also the basic criteria for the evaluation of proposals to various schemes of the STDF and RDI Programme. Both institutions support a "centres of excellence" activity. So far, there is no periodic evaluation of the research centres/institutes, while most of their personnel is recruited and promoted internally. An evaluation of the participation of Egypt to the EU Framework Programme is on-going.

2.6 KNOWLEDGE CIRCULATION

2.6.1 Knowledge circulation between the universities, PROs and business sectors

The two main instruments for research policy orientation, STDF and RDI (section 2.3.1), launched several schemes involving the joint participation of public/private research teams and business firms. A recent important scheme for bringing together researchers and industry was the "*Faculty for Factory Programme*" of STDF/MCI. The scheme faces serious drawbacks in the financial coordination of the two involved organisations.

At the level of the research organisations, specific units have been established in some of them for the transfer of knowledge and technology. The NRC manages more than 70

[42] HEEPF Final Report Part 1, Executive Summary, 2003-2008
[43] HEEPF Final Report Part V Impact Evaluation, 2003-2008

"Special services" in different fields, making available specialised equipment and staff for a broad range of services to interested companies. It manages also the Businessmen & Investors Service Office (BISO) which promotes the involvement of NRC researchers in industry related activities. The ARC has established a Technology Management and Commercialisation Office (TMCO) providing legal and professional services related to IPR protection and exploitation. The University of Alexandria established three units under the "Grants, Innovation and Technology Transfer Centre" providing support for structuring ideas into budget and business plans etc.[44] Similar units have been established in many universities.

TIEC/ITIDA initiated the Collaborative Innovation Network (COIN), which is a regular gathering designed to foster innovation in the ICT Sector. TIEC also encourages innovators, SMEs, and academics to join international programmes such as the Information Technology for European Advancement (ITEA) programme. One of the main roles of the five Technology Transfer Offices (TTOs) is to establish links between the industry and the academic community for commercialising the inventions that they currently have in hand. The Virtual Incubator for Science based Business (VISB) identifies problems that face the Organisation of the Islamic Conference (OIC) industry and searches local and international scientific papers and patents of the public domain for solutions to those problems.[45]

These initiatives are deployed in an economic environment of very weak industrial research. As a consequence, the potential receivers of the new knowledge are not ready to share it with the researchers and the demand for new knowledge in general is rather feeble.

2.7 OVERALL ASSESSMENT

Egypt has introduced several reforms in the area of research, technology and innovation during the last ten years, particularly since 2007. Changes include the quality enhancement programmes, the introduction of project funding, the creation of structures for research prioritisation and technology transfer and exploitation, the reform on human resources etc. The output indicators (publications and patent applications) show a slight improvement. Authorities are at present rethinking the various characteristics of this system.

Increasing share of project funding in total funding and opening of schemes to the participation of business firms and international cooperation are positive elements of the policy implemented the last years. On the other side, most schemes have limited budgets and address tiny projects while up taking of the schemes by the industry and the research community remains limited. The lack of recent statistical data on basic parameters on the RTD policy and on the specific large programmes does not facilitate the assessment of the impact of these measures on the progress of the national RTD. Their effectiveness depends among other on the resources committed and on the

[44] GITTC: Business services supported by Alexandria University 2011 (pamphlet)
[45] Egypt's Innovation Ecosystem January 2012
http://www.stdf.org.eg/index.php?option=com_content&view=article&id=101&Itemid=71

appropriateness of the delivery processes, as well as on the absorptive capacity of the research system.

The *Egypt's Innovation Ecosystem* January 2012 (STDF) identifies a series of deficiencies and gaps of the research system that may be summarised in the following:

- The funds available for applied research are very small. Moreover, there are no grants dedicated to prototype development.
- The majority of the grant opportunities available to the researchers are restricted to individuals who are working at universities or research centres.
- Researchers do not use international patents databases in their prior art search.
- Researchers face difficulties finding lab equipment available not only outside but also inside their organisation and sometimes inside their own faculty.
- The industrial entities do not interact, evaluate, nor provide feedback throughout the innovation phases. Therefore, most of the resulting inventions don't match the industrial needs.
- There is no entity for communicating government and industry needs in each sector to research organisations in order to inform their researchers on industry needs and the business aspects that should be considered during the research.
- Most industrial entities do not have in-house R&D activity and don't trust the ability of turning research inventions into industrial innovations that can create value. They prefer to buy technologies from abroad instead of developing their own.
- Initiatives promoting the R&D and open innovation cultures in the industry are introduced in small scale and there are no success stories yet.
- There are few focal points at universities and research centres to link the industry with the academia. The TTOs are mainly the ones who perform industry academia collaboration activities.
- Finding information about innovation activities in Egypt is a very tedious job. Industrial entities cannot find information about recent inventions at universities and research centres, which ones are patented, and which ones are available to license. Information about industry needs and production facilities is not available for the research community.

A great deal of issues has to be tackled by the new government to take over after the elections of 2012. It must be added that in the last months, the ASRT and the STDF are promoting activities to face some of these issues.

3 National policies for R&D&I

3.1 LABOUR MARKET FOR RESEARCHERS

3.1.1 Stocks of researchers

The research human potential (section 2.3.2) is shared quite equally between government centres and universities when calculated in full time equivalent of researchers employed. But the 2009 drop in RTD personnel marked more strongly the research centres than the universities.

A researcher in the university or in a public research centre is hired after graduation, with the status of civil servant, and with a life long contract. He/she starts post graduate sudies and when granted the doctorate degree is nominated lecturer in the university or researcher in the research centre. If no mistake is committed throughout the career he/she exits for retirement at 60 years of age. There are no incentives for mobility.

"Nature" Review, qualifying Egypt as the powerhouse of Middle East for doctoral studies, states: "The majority (of PhD students) come through university budgets. Universities have started turning to international funding and collaborations with the private sector, but this source of funding remains very limited. The deficit translates into shortages in equipment and materials, a lack of qualified teaching staff and poor compensation for researchers.., there are many more PhD holders in Egypt than the universities can employ as researchers and academics. Egyptian PhD holders also struggle to secure international research positions...".[46]

Such findings are indicative of the imbalances of supply and demand in the national labour market for research professionals, due mainly to the job orientation of the PhD holders. Those that don't find a job inside the university system or in a public research centre are orientated towards the civil service. The business sector is not demanding PhD level qualifications, while the PhD holders are not motivated for establishing their own business ventures.

3.1.2 Providing attractive employment and working conditions

The national research system offers limited opportunities for growth and self-fulfilment, given the level of funding, the rate of annual increase compared to the GDP and the diversity of funding sources. Stability of employment is an incentive for the attraction of youth in an era of uncertainty, but low salaries repel more ambitious individuals with high expectations for living standards. The salaries start from an equivalent of €300 per month and increase through project funding and other

[46] Nature ,1 April 2011 Vol. 472|279

complementary income up to €1,200. For full professors, the corresponding figures are €1200 and €3000. After retirement, the income drops considerably.

Similarly, all social security benefits draw from the civil servant status. The situation might improve after recent increase of the annual budget appropriations by 25%, but the budget deficits are leading to new cuts, which will be expressed in the 2013-2014 budget. This situation discourages mobility inside the country but encourages brain drain, especially to the Gulf countries[47]. Several eminent Egyptian scientists from the USA and other countries offer their advisory services to the country from their actual positions.

Various schemes encourage the employment of researchers in Egypt, including the repatriation of expatriate scientists in the country (section 2.3), as well as industry/university collaboration through joint research programmes coupled with job opportunities.

3.1.3 Open recruitment and portability of grants

The recruitment of researchers follows the standard procedures of open publication of vacancies and is addressing young nationals rather than competent researchers from all over the world. Nationals that have graduated from foreign universities need the equivalence certificate granted by the SCU.

Portability of grants is a more controversial process that does not apply at present in the case of Egyptian public organisations.

Social security and pension funds function according to standard procedures of the national civil service and do not provide for special treatment of researchers. Mobility is not treated distinctively.

3.1.4 Enhancing the training, skills and experience of researchers

The UNESCO Science Report 2010 (section 2.3.2) recognises that "the Arab countries did not create a critical mass of researchers in the majority of disciplines. Links between universities and research centres remain weak. This leads to little or no coordination at national level between research communities. Moreover, there is no capacity to absorb new graduates within the RTD system or even willingness on the part of senior researchers to mentor young ones".

Since the public research system is hiring young researchers for life employment, they are expected to organise the enhancement of their knowledge and skills. The government provides for opportunities of participation to training and research activities through specific schemes funded by STDF and RDI Programme, in some cases in the frame of bilateral agreements with technologically developed countries and EU. The specific schemes of these instruments (i.e. basic and applied research,

[47] Lawler Andrew: Anew day for Egyptian science?, Science, Vol 333 15 July 2011

young researchers) may support research leading to PhDs and post docs. These schemes operate independently of the master degree programmes of the various public or private universities. Post-graduate training structures are often supported by the bilateral educational and S&T agreements with technologically developed countries. European, American and Japanese cooperation agreements provide for strong incentives to researcher mobility.

3.2 RESEARCH INFRASTRUCTURES

Egypt's research policy so far has not elaborated an explicit component for the development and utilisation of major RTD infrastructures. The STDF in 2010 called for proposals on "Capacity building grants" which provided and maintained scientific and engineering instruments for research in higher education, science centres, private sector and non-profit organisations[48]. The ASRT manages a "Services of the Scientific Instruments Centre" which include categorising, cataloguing, installing and operating scientific instruments, designing standard and specific instruments similar to the imported ones by using local materials, machine operating workshops, and designing and modifying circuits for all kinds of scientific instruments.

The main area for infrastructure building is information and communication. The ASRT manages the National Network for Information (ENSTINET), a high bandwidth and reliable information and communication network for scientific research and universities as well as for the exploitation of research results. ENSTINET provides:

- **Video conference facilities:** state-of-the-art videoconferencing equipment, four dedicated high-speed national ISDN lines (512Kpbs), high speed dedicated internet connection 2Mbps for IP Based sessions, point-to-point and multipoint conferences, etc.
- **Databases:** bibliographic databases (S&T Egyptian Bibliographic Database (STEB) containing full bibliographic data in addition to an abstract) and non-bibliographic databases
- **Internet services:** full 24/7 online and onsite access to global information resources via the INTERNET, through its own Fiber Optics leased line and providing unmatched Internet services relying on partner's experience.

ESTINET is the core router for the National Research & Education Network (NREN) which services Internet, GEANT and GLORIAD (Global Ring Network for Advanced Applications Development, based in the USA). GLORIAD is a cooperative infrastructure in the northern hemisphere linking scientists, educators and students in Russia, USA, China, Korea, the Nordic countries and other with specialised network services. GLORIAD is considered by the Egyptian authorities as an important tool for penetrating the African S&T information market.

NREN agreed with GEANT to supply advanced communication services and high-bandwidth to Egyptian research centres and universities, free of subscription charges; the Academy covers the fees of the international link to Europe. Through GEANT

[48] Lawler Andrew: Science Vol. 333 15 July 2011

Egyptian researchers access at a highly increased speed of data transfer with thousands of universities and science facilities across Europe, Middle East and southern & eastern Mediterranean through EUMEDConnect3 Project and the rest of the world.

An Egyptian Universities Network (EUN) is established to facilitate the communication between the Egyptian Universities and the scientific and academic community. It is located at the Cairo University Campus. The EUN connects the Egyptian academic community to the European Academic and Research Network (EARN) and GEANT.[49]

More recently, the Arab Scientific Research and Education Network (ASREN) was launched, as a legal entity under the auspices of the Arab League and the United Nation's Global Alliance for ICT and Development (GAID) to provide for sustainable e-Infrastructures across the Arab world.

Furthermore, the country participates in SESAME[50], a research facility located in Jordan to cover the needs for a synchrotron radiation source in Middle East (including Turkey, Pakistan, Iran, Israel, Cyprus and a dozen of observers, including USA, China, Russia and several EU member states)[51]. It is operating under the auspices of UNESCO and its main instrument is the donated by Germany and upgraded BESSY I storage ring (2.5GeV) and injector system. Specific programmes planned for SESAME include structural molecular biology, molecular environmental science, surface and interface science, microelectromechanic devices, x-ray imaging, archaeological microanalysis, materials characterisation, and clinical medical applications. SESAME has almost all the funds required for the facility to come into operation in 2015 with four 'day-one' beam lines.[52]

Egyptian researchers have also the possibility to use the facilities for space research of the EU and USA to develop land use, agricultural research, environmental protection and management, navigation, transportation and communication and other applications.

3.3 STRENGTHENING RESEARCH INSTITUTIONS

3.3.1 Quality of National Higher Education System

Egypt operates two parallel public education systems: the secular system, with 18 universities and the religious one, named Al-Azhar. In the latter system, students who successfully complete four years of secondary school can enrol at Al-Azhar University[53], which is responsible for conveying the mission of Islam[54]. There are also

[49] http://www.scu.eun.eg
[50] Synchrotron light for **E**xperimental **S**cience and its **A**pplications in the **M**iddle **E**ast
[51] http://www.sesame.org.jo/About/Description.aspx; http://www.sesame.asrt.sci.eg
[52]http://www.sesame.org.jo/sesame/news/308-the-council-of-sesame-notes-good-progress-with-construction-and-welcomes-generous-contributions-from-the-european-commission-and-italy.html
[53] Synchrotron light for **E**xperimental **S**cience and its **A**pplications in the **M**iddle **E**ast

16 private universities complementing the public education and research infrastructure and 81 accredited private institutes offering mainly training in the areas of social services, computer science, management, tourism, languages, agriculture, media and communication, and engineering; in Cairo there is some focus on aviation and space. Quantitative data on staff and student population are given in section 2.3.2.

There are three bodies for governance of higher education: the Ministry of Higher Education, the Supreme Council of Universities (*SCU*, section 2.2), and the Central Administration of Al-Azhar Institutes. The Ministry has jurisdiction over higher education, supervises and coordinates all post-secondary education institutions, plans and prepares policy and controls quality. Undergraduate students, holding the General Secondary Education Certificate or an equivalent, are admitted in the public Egyptian universities after graduating from secondary school. The admission in faculties and institutes is based on students' prior scores and taking into account the home location according to decision of the faculty councils and administrative acts of the SCU. The university high council determines the number of the Egyptian students accepted in each faculty or college. The high council of each faculty, following its qualifying conditions, can decide on the number of students accepted among the foreigners. Afterwards, a decision of the Minister of HE determines the number of students to be admitted by faculty. Some universities are taking into account for admission issues such as good health of the applicant and good reputation.

The establishment of private universities in Egypt is regulated by legislation stipulating for government control. The Minister of HE is approving the appointment of the President. The SCU supervises them indirectly and monitors the enforcement of standards in the graduation process and degrees.[55]

As mentioned above, during the previous decade, the Egyptian government designed and implemented with the assistance of the World Bank, a Higher Education Reform and a corresponding multiannual programme for upgrading higher education in the country. The ***Higher Education Enhancement Project*** (HEEP) aimed at developing human resources, utilising scientific research and development capacities, maximising the role of universities as cultural and educational centres, promoting lifelong training and administrative reform supportive to quality enhancement. HEEP includes six priority sub-projects, among which the *Quality Assurance and Accreditation Project (QAAP)*. The corresponding implementation report refers to a long list of indicators of qualitative character, among which:[56]

- Key legislative reforms enacted for the universities to become effective self-governing Institutions
- Establishing the Quality Assurance infrastructure in the Egyptian universities
- Developing the National Academic Reference Standards NARS for 10 academic sectors

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[54] The Egyptian Higher Education System: Towards Better Quality in the Future, Nahla M. El Sebai, The Egyptian Cabinet, Information and Decision Support Center Egypt
Ministry of Higher Education, Strategic Planning Unit (SPU),Higher Education in Egypt, Country Background Report, Summary, 2009
[55] http://www.wes.org/wenrarch/fall/eg_f96.htm
[56] Ministry of Higher Education, Projects Management Unit, Borrower's Report Implementation Completion and results Report (ICR) IBRD LOAN No. 4658-EGY, June 2009

- Evaluating the efficiency of the internal quality assurance systems in the Egyptian Higher Institutions
- Competitive grant fund HEEPF being utilised to support improved management practices in at least 50% of universities by 2007.

At the end of the first phase of the Project (2003-2007), financed by the World Bank, the relevant impact report[57] presented a number of outputs concerning participation to the Project, contracts, proposals submitted and projects selected for funding, direct and indirect beneficiaries, experiments, e-courses, quality assurance systems, protocols, workshops and databases established in the framework of the Project etc. The second phase ended in 2012 and provided a new **Quality Assurance system** (QAAP), which included:[58]

- An internal quality assurance system, run by the HE institution itself, resulting in an internal annual report.
- An external quality assessment and accreditation process run by the National Authority for Quality Assurance and Accreditation of Education (NAQAAE).
- An independent external quality assessment system based on peer reviewing, run by the NAQAAE.

The QAAP internal audit survey conducted in 2007 indicated that "graduates exhibited insufficient personal, subject-specific and employment-related skills, and that faculties need to organise the work more closely with their alumni to satisfy job market needs at local regional and international levels". It was also reported that the academic programmes provided insufficient employment opportunities. Results revealed that faculties had insufficient commitment in enabling students to achieve course objectives, to make course specification available regularly and to inform them of the assessment criteria (QAAP internal audit report, 2007). Among the QAAP achievements are included the design of 10 academic reference standards in various educational sectors, the establishment of 32 centres and a unit for Quality Assurance and Accreditation in the Egyptian universities and faculties.[59] An OECD assessment of the Egyptian higher education brought additional light on the relevant issues.[60] The review panel has identified ten main directions for reform of Egypt's higher education system:

1. Clarify the expected capabilities of graduates
2. Improve the balance of graduate output to fit labour market needs
3. Strengthen national steering capacity
4. Diversify the supply of higher education opportunities to meet a larger student body with varying needs, aptitudes and motivations
5. Increase institutional operating flexibility and self-management capacity
6. Share costs more equitably
7. Widen admission criteria to recognise diverse potential
8. Raise input quality and embed quality assurance as an institutional responsibility
9. Strengthen university research capacity and its links to innovation
10. Build a number of leading exemplars

[57] Higher Education Enhancement Project, Final Report, Part V, Impact Evaluation, 2003-2008
[58] Strategic Planning Unit: Higher Education in Egypt, Country Background Report Summary, 2009-10
[59] http://www.scu.eun.eg/wps/portal/
[60] HIGHER EDUCATION IN EGYPT, OECD AND IBRD/THE WORLD BANK 2010

In the new 2013-2017 period the HEEP emphasises internationalisation of higher education, development of technological colleges, accreditation and the improvement of the legal framework. A master plan is prepared for the creation of new universities and the development of mobility inside the system.

The above mentioned article of Nature Review[61] (section 3.3.1) on the global labour market of doctorate graduates identifies as endemic problem in the Egyptian educational system that "The doctorate (in Egypt) is frequently a means of climbing the civil-service hierarchy, but those in the private sector often complain that graduates are untrained in the practical skills they need, such as proposal writing and project management. Egyptian PhD holders also struggle to secure international research positions." Citing a food scientist, the article states that "the overall quality of research papers is “mediocre” and that pursuing a PhD is “worthless” except for those already working in a university."

According to the Academic Ranking of World Universities 2010[62] *(ARWU)* of the *Institute of Higher Education of Shanghai Jiao Tong University, China*, no Egyptian or other Arab university is found among the top 500 universities or among the top 100 by discipline or field of study. In the Times Higher Education World University Ranking 2010-11 Alexandria University is the only Arab university found in the 147th position[63] among the top 200. According to the Fraunhofer report, research centres appear implementing many more research projects (finished and on-going) than universities.[64]

3.3.2 Academic autonomy

The governance of the individual universities is strongly linked to ministerial decisions, mainly the Min. of Higher Education, but also the Ministry of Finance, the Ministry of Research and the Ministry of Economic Development. The SCU, the Council of Private Universities, the Council of Higher Institutes and Council of Technical Colleges are complementing the network of competent bodies for policy orientation and planning.[65]

In the area of funding, it is estimated that 95% of the university's budget is financed by the Government, and 87% of this is spend on salaries. All staff is civil servants.

[61] Nature: Struggle to survive, 1 April 2011 Vol. 472|279
[62] http://www.arwu.org/ARWU2010.jsp ARWU uses six objective indicators to rank world universities, including the number of alumni and staff winning Nobel Prizes and Fields Medals, number of highly cited researchers selected by Thomson Scientific, number of articles published in journals of *Nature* and *Science*, number of articles indexed in Science Citation Index - Expanded and Social Sciences Citation Index, and per capita performance with respect to the size of an institution.
[63] http://www.timeshighereducation.co.uk/world-university-rankings/2010-2011/top-200.html. The tables use 13 separate indicators from teaching and research to knowledge transfer, brought together into five categories: (a) Teaching, the learning environment (weighting 30% of the final ranking score); (b) Research, volume, income and reputation (30%); *(c)* Citations, research influence (32.5%); *(d)* Industry income, innovation (2.5%); *(e)* International mix, staff and students (5%). The weightings for the five categories, and the 13 indicators within them, vary considerably. High weightings are given where consultation has shown unmistakable enthusiasm for the indicator as a valuable proxy and clear confidence in the data available.
[64] Fraunhofer IPK: Evaluation of the Egyptian Science, Research and Technology Landscape for the Design of the Egyptian Innovation Policy and Strategy, July 2009
[65] Strategic Planning Unit: Higher Education in Egypt, Country Background Report Summary, 2009-10

Allocation of students to the individual state universities is a central decision. The appointment procedure for university leaders is described in the "universities bylaw"; in practice the Faculty assembly elects and proposes three candidates to the competent minister, who makes the final selection, while the President signs the appointment.

The competence for curriculum development belongs to the faculties but the SCU has to endorse each new educational programme. Universities are autonomous in selecting research activities and services to the community. Older efforts to link university development to multi-annual strategic planning did not drive to a conclusive outcome: most of them resembled to wish lists. Strategic planning at the institutional level became one of NAQAAE's requirements for accreditation. However, no mechanism exists to motivate higher education institutions at any level to focus on national or regional needs.[66]

The SCU supervises indirectly the private universities and monitors the enforcement of standards in the graduation process and degrees to assure the equivalence with the public universities' degrees.[67] In 2010, the Supreme Administrative Court in Cairo ordered an end to the three decades-long occupation of university campuses by security guards from the interior ministry. Many faculty members argue the ruling was never fully implemented.[68]

Universities can own land, buildings and equipment, but this is regarded as government property and the university cannot decide to sell or replace land or buildings without prior approval from the cabinet of ministers. Similarly, budgets are allocated to specific line items and universities' ability to shift from one budget line item to another is very limited. Universities can also employ and dismiss staff, but posts are allocated by the Ministry of Administrative Development. Decisions on setting the academic structure and courses or student enrolment are taken by the Ministry and the SCU.[69]

The majority of the establishments use a "pyramidal structure", while matrix structures are used by both research centres and universities for specialised subunits or new research teams requiring higher flexibility. As to the use of budget controlling tools, a small number of establishments have adopted centralised control by project. Some universities or university departments have contracted an external agency for this purpose. Almost 50% of the research centres chose a decentralised approach for budget control within research project teams.[70]

At the same time, public and private higher education institutions operate under different legislative and financing rules[71] which are not facilitating central monitoring and hands-on control.

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[66] *Source cited:* OECD country information comes from OECD (2003) Education Policy Analysis
[67] http://www.wes.org/wenrarch/fall/eg_f96.htm
[68] Nature Middle East Hazem Zohny Egyptian university professors threaten full strike Oct.2011
[69] *Source cited:* OECD country information comes from OECD (2003) Education Policy Analysis
[70] Fraunhofer IPK: Evaluation of the Egyptian Science, Research and Technology Landscape for the Design of the Egyptian Innovation Policy and Strategy, July 2009
[71] Strategic Planning Unit: Higher Education in Egypt, Country Background Report Summary, 2009-10

3.3.3 Academic funding

The available data indicate that the state budget is dominant in the funding of the research activity in Egypt. The universities are absorbing more than two thirds of the national spending on RTD and the research centres the remaining one third[72]. According to the Fraunhofer 2009 report, the majority of the establishments (36 out of 46) is involved in regional, national and international projects and receives funds and grants from such sources. Third parties that order RTD projects or related S&T activities make up a very small part of the overall budget.

The ministries supply the largest share of funding to the secular and religious public universities. A mere 15% of the revenue has to be generated by the universities themselves, through tuition fees, cooperation with industry, intellectual property rights, continuous education services, technical services to third parties and private donations. In the case of the *University of Cairo* 93% of the 2009-2010 institutional income, approximately €416,000, originates from the State budget, 4.7% from student tuition and fees and 2% from donations. Additionally the University raises €12,300 for research, from which 71% comes from the government budget and 29% from industry. The Central Auditing Organisation (CAO), an independent organisation that reports to the President, supervises universities' financial performance, but does not assess the overall achievement of objectives.

The way the institutions are funded is based mainly on traditional approaches, rather than on performance assessments. The widening use of project funding is contributing to the rationalisation of funding of the research organisations. International funding is also increasing, mainly from Europe, the United States and Japan. The rationalisation of institutional funding is one of the goals of the HEEP, which introduced quality assurance and accreditation that might in the future differentiate the criteria of block resource allocation.

A long series of funding programmes and schemes have been announced and started implementation, such as the STDF's schemes and the RDI Programme (section 2.2.1). Although we have no figures on the allocation to pure competitive financing compared these figures to the annual GERD of the country, give a share of "competitive funding" to the total funding well below 10%. Given the weight of the universities in the national research system, we can accept that a share of above 60% annually is feeding the university budgets. Moreover, public universities started creating recently "semi-private" units, charging higher fees and based on open selection of students: ten such departments have been created till the end of June 2013.

[72] Science and Technology Indicators: *Ministry of Scientific Research, volume 1, 2008*

3.4 KNOWLEDGE TRANSFER

3.4.1 Intellectual Property (IP) Policies

In the area of intellectual property management and protection, Egypt applies a national legal system based on the model of the United Kingdom. Egypt is a member of the World Intellectual Property Organisation (WIPO) since 1975, the PCT Treaty since 2003 and the Paris Convention of the Protection of Intellectual Property. Computer software is protected by the copyright law for 50 years. The Egyptian Patent Office (EPO) stands under the ASRT, and has been reinforced in the last decade, improving its patent management information systems. Significant progress has been made in the perception of executives for the protection of IPRs.[73] Tables 2.6-2.9 (section 2.5.1) give an idea of the patent applications activity.

Few public universities supply specialised services to inventors for developing knowledge into new products and services. Such is the case of *Assiut University*, which runs a Patent Unit. The private universities with RTD activities are more active in this field. The German University in Cairo runs an *Industry Park* which provides industry and students with training on manufacturing problems, introduces the potential Egyptian researchers to the international industries and research fund suppliers etc. Moreover, the *American University* in Cairo (AUC) is applying a fully-fledged intellectual policy charter providing for guidance to faculty, staff and students on the practices and procedures to protect the respective interests of all concerned parties. All IP conceived by members of the faculty or staff has to be disclosed to the University. Ownership of this IP resides with the creator. Creator(s), receive 50% of income, creator(s)' school(s) or centre(s): collectively 20% and the University 30%.

The large public research centres are more involved in patenting and IP protection than public universities. The *NRC* owns a Business and Investors Service Office as the link between the Centre and the production service sectors inside and outside Egypt. Moreover, a Monitoring and Evaluation Office is developing a database for all research, technical and administrative sectors relevant to the NRC, including all aspects of performance. The *ARC* runs an Office supplying legal and professional services to all staff for protecting their innovations and inventions. ARC's TMCO owns 100% of the IP generated at ARC. If any invention is commercialised successfully, the IP cost is deducted from the generated revenue and then the net revenue is divided as following: The first L.E. 5000: 80% goes to the researcher. After that: 25% goes to the researcher and 75% to TMCO[74]. The Central Metallurgical Research and Development Institute (*CMRDI*) own a Research-Industry Interaction Unit and Liaison Office to enhance cooperation between the research and industry communication.

The two main funding programmes of research, development and innovation have developed their own rules for IP protection and exploitation. The STDF developed IP rules[75] according to which knowledge resulting from the projects belongs to STDF. The revenue belongs to STDF which will grant a share of the income to contractor based on

[73] USAID Egypt Economic Performance Assessment, 2004
[74] Egypt's Innovation Ecosystem January 2012
[75] STDF annual report July 2009 http://www.stdf.org.eg/files/IPR_Rules.pdf

type of grant and shared on a case by case basis. The revenue sharing scheme will range from 2% to15% for the inventor, and will be determined on the basis of the market size (2% for sales above €12m. There is no clear IP ownership and revenue sharing policy for the "Professor for Every Factory" programme. In the Innovation Programme, IP is shared equally between STDF and IMC. The *RDI's General Conditions* applicable to Schemes 1 and 2 stipulate that the ownership of the Action's results and related IP rights, reports and other documents relating to it belong to the beneficiary. The beneficiary grants the Contracting Authority (and the EC) the right to use freely all documents deriving from the Action.

The ASRT is also supporting commercialisation of inventions: it is offering up to LE250, 000 (€30,000 approx.) to inventors for transforming their ideas to products. The Academy receives 5-10% of the benefits in case of success.

ITIDA does not own any stake in the Intellectual Property (IP) generated from its funded programmes; the researchers and their industry partners are free to agree on the commercial and IP terms of their joint projects' output. Technology & Innovation Centres (TICs) require owning any IP that results from project implementation. In case they want to implement a solution whose IP is owned by a researcher, they require an exclusive license to that IP without restrictions. Misr El Kheir (MEK) does not own any of the IP generated from the projects that they fund[76].

3.4.2 Other policy measures aiming to promote public-private knowledge transfer

Although there are no measures targeting specifically the spin off firms, any company can benefit from measures addressing all types of new firms and the cooperation between research organisations and the business sector. The *IMC* of the MIFT is funded by EU to promote research and innovation. The Technology Transfer Centres (ETTC), supply a broad range of services to business firms: transfer through patents and licensing, technical assistance in product development and production processes design, quality audits and management, human resources development, environmental and social management, outsourcing RTD and innovation projects.

Five of the 12 *Technology & Innovation Centres* (TICs) of the MIFT offer technology incubation in fashion, plastic, jewellery, engineering, and leather. The *Social Fund for Development* (SFD) funds the construction work of the incubator as well as managing and operating the incubator until it can sustain itself, assisted by the Egyptian Incubator Association (EIA).

In the research and innovation area, the Information Technology Industry Development Agency (ITIDA) promotes collaboration between business and academia through the *Research and Innovation Support* Department (RIS), *the Information Technology Academic Collaboration (ITAC)*, *the Centres of Excellence Programme* and the *Egypt-IBM Nanotechnology Research Centre*. *Technology Innovation and Entrepreneurship Centre* (TIEC) has a Technology Incubation Programme (TIP) launched by ITIDA to help entrepreneurs develop their innovative ideas and create

[76] Egypt's Innovation Ecosystem January 2012

seed companies and start-ups. There were in 2011 two technology incubators in the Smart Village and three incubators in universities.

The *"Bedaya" Centre* for SME development of GAFI initiated its "Business Clinic" programme that helps entrepreneurs develop and grow their ideas and offers mentorship through business partners who dedicate time to the programme.
Some venture capital firms provide seed funds for start-ups working in the ICT industry. An example of these firms includes Ideavelopers and Sawari Ventures that supply funds for start-ups that prove their high growth potential and that have working concepts or prototypes in place.[77]

The *City for Scientific Research and Technology Applications* (MuCSAT) in Alexandria is aiming at the development and renovation of industry based on research and technology. The City inaugurated in 2000, provides space for 12 research centres in fields such as biotechnology, information technology, advanced materials, nanotechnology (solar cells). Among the hosted organisations are the Genetic Engineering and Biotechnology Research Institute (90 persons staff, budget approx €56,000), the Informatics Research Institute (21 persons staff, budget €195,000), the Advanced Technologies and New material Research Institute (46 persons, €38,000). Moreover, the Zewail City for Science and Technology is inaugurated in Cairo, apparently on the facilities of a private university in operation.[78] Its early plans are to enroll 1,000 students in the new university in its first year.[79]

Smart Villages Company is a public-private partnership, with 80% ownership to the private sector and 20% to the MCIT. Its main objective is to offer appropriate business environment and create synergies among the participants in the Villages it is developing and managing. Teams of experts offer high quality of services. The first of the Villages was constructed in Cairo in 2003, as a CIT Cluster and Business Park. It hosts multinational and local companies, financial authorities, governmental and educational organisations and research and development centres. Sinai Technology Valley at the north-western Sinai Peninsula focuses on ICT, microelectronics, biotechnology, new materials, instrumentation and renewables.

No particular measures targeting intersectoral mobility have been identified. Life employment is preferred to short term contracts, which is a disincentive to mobility.

The Fraunhofer 2009 report identified 18 out of 46 establishments cooperating with industry for the training and qualification of staff, while 36 out of 46 establishments are cooperating with industry in joint research projects.[80]

[77] Egypt's Innovation Ecosystem January 2012
78 Nature: Universities clash by the Nile, Property dispute dogs Egypt's plans for a science city, Katharine Sanderson, Volume 485, 03 May 2012
[79] http://www.nature.com/nmiddleeast/2011/110613/full/nmiddleeast.2011.68.html
[80] Fraunhofer IPK: Evaluation of the Egyptian Science, Research and Technology Landscape for the Design of the Egyptian Innovation Policy and Strategy, July 2009

3.5 ASSESSMENT

The national policy is marked by the ambitious plans and numerous diversified programmes launched in the second part of the 2000nds, accompanied by organisational improvements that seem to have contributed to a slow increase of public spending on RTD and of research outputs, until the end of the decade. The dominance of the traditional modes of funding and staffing the research organisations, the lack of strong systems of reward/sanction of the research personnel and the assimilation of the researchers' status to civil service are contributing to the deceleration of the reform process. A critical issue is the gradual increase of the business involvement in technological development and innovation activities.

The publication *Egypt's Innovation Ecosystem* January 2012 identifies a series of deficiencies and gaps of the research system among which one can find that:

- Most entities involved in technology transfer activities work in separate islands. There is no collaboration or knowledge sharing between those entities, while the number of existing TTOs is not sufficiently effective to support the research and industrial communities in Egypt.
- Most of the established TTOs at universities do not receive support from the university's upper management.
- There are no clear guidelines and mechanisms for the commercialisation of government owned IP while many legal advisors lack knowledge and experience in IP commercialisation legal issues.
- Start-ups and SMEs are not encouraged to participate in addressing national problems.
- Most of the incubators operating in Egypt lack the required expertise, business models, and efficient networks of stakeholders. Almost all VCs do not get involved until they see a working prototype or a proof of concept.
- Most of the Egyptian inventors write weak patent applications which get rejected when their inventors try to apply for international protection.
- There are no clear IP ownership, revenue sharing, and IP commercialisation policies in most of the research institutions and funding agencies.

4 International R&D&I Cooperation

4.1 MAIN FEATURES OF INTERNATIONAL COOPERATION POLICY

The Egyptian research policy seeks systematically international cooperation in the main directions of priority, in areas responding to the most urgent societal needs: increase the quantity and improve the quality of the agricultural production and in particular food and industrial plants (i.e. cotton), fight endemic diseases such as hepatitis and diabetes, exploit mineral and renewable energy resources (oil, gas, solar). Technology offers new opportunities for the rational exploitation of these resources. More recently, social research received specific attention on the side of the cooperating countries.

EU (including individual Member States), USA and Japan are the main S&T partners for the last decade, to which are added more recently Korea, South Africa and other. The partners place the S&T cooperation in the frame of a larger policy of economic and social development with a decennial horizon. The European Neighbourhood Policy[81] is a framework for cooperation in all fields of common interest. The bilateral ENPI budget allocation for Egypt for the period 2011-2013 has amounted €449.29m, of which 23% is allocated to education and vocational training. EU has also established the *Monitoring Committee (MoCo) for Euro-Mediterranean cooperation* to promote cooperation in RTD. MoCo has a central role in stimulating Euro-Mediterranean cooperation in research and innovation and in making recommendations for the joint implementation of RTD policy priorities.

4.2 NATIONAL PARTICIPATION IN INTERGOVERNMENTAL ORGANISATIONS AND SCHEMES

Various projects funded by FP7 (i.e. MIRA) are offering a platform for continuous exchange of information and building consensus on areas of common interest. Activities that are more visible are those aiming at the development of e-science. Egypt establishes connections of the National Research and Education Network (NREN) to GEANT and GLORIAD. More recently, was launched the Arab Scientific Research and Education Network (ASREN), under the auspices of the Arab League and the United Nations' Global Alliance for ICT and Development (GAID) to help secure sustainable e-Infrastructures across the Arab world. Moreover, the country participates in *SESAME*[82] (section 3.2).

The World Bank is important for the S&T policy design and financing of Egypt, supplying in addition to funds the necessary know how to improve mainly higher education. The African Union has also some relevant research activity on issues of particular interest for the continent. Much of the broader cooperation among the Arab States is supported by the regional policies of the EU and USA. Egypt is a member of all the organisations of the United Nations network (i.e. FAO, UNIDO, and UNCTAD).

[81] European Neighbourhood and Partnership Instrument Arab Republic of Egypt National Indicative Programme 2011-2013
[82] **S**ynchrotron light for **E**xperimental **S**cience and its **A**pplications in the **M**iddle **E**ast

4.3 COOPERATION WITH THE EU

4.3.1 Participation in EU Framework Programmes

Egypt and the EU signed an S&T cooperation Agreement for the participation of Egyptian researchers and research organisations in the specific programmes of the FP7. For encouraging this, RDI has funded the RDI Network (RDIN) with more than 40 focal points in various organisations throughout Egypt, to disseminate information on FP7 calls for proposals and the terms of application and help the potential applicants to fill application forms.

At the end 2012, Egyptian researchers were participating into 87 projects of FP7, according to the data of the DG RECH database, with a total budget of €430m, from which €316m are contributed by the EU budget and €12.9m in particular to Egyptian participants. The corresponding figures for FP6 were 73 projects, of €311m total budget with €177m EU contribution. Table 4.1 presents the status of the proposals involving at least one Egyptian partner. The rate of success of these proposals (main listed and reserve listed on the total) shows an increase over the years; from 15% in 2007 to 34% in 2012; a considerable drop in the number of proposals is marked since 2011.

The dominance of PEOPLE, Environment, KBBE, ICT and Health in proposals is shown in table 4.2. Nevertheless, INCO, Africa and Eranets make up a considerable number of proposals. A large number of applications belong to the category of CSA and CA (coordination and support actions).

Table 4.1 FP7 proposals with participation of at least one Egyptian organisation, by year, status end 2012

	2007	2008	2009	2010	2011	2012	total
Main listed	8	16	32	24	20	18	108
Reserve	14	5	16	10	7	2	54
Rejected	109	68	114	111	54	44	500
Ineligible	11	11	6	11	7	4	50
Withdrawn					1	1	2
Total	142	100	168	156	89	59	714

Source: European Commission, DG RECH database

Among the main participants in FP7 are the Ministry of Research with participations in 11 projects and €1.65m of incoming budget from FP7, ASRT with nine projects and €1.2m, the National Research Centre with nine projects and €0.62m, the Cairo University with five projects and €1.5m, the MCIT, Alexandria University, Ain Shams Universities and the National Institute of Oceanography and Fisheries with six projects each, the CULTNAT, the National Authority for Remote Sensing and the Ministry of Water Resources with four projects each, the ARC and the CEDARE with three projects each and smaller amounts of income.

Egyptian research organisations succeeded in having the coordination in nine projects of FP7, against one in FP6, six of them in International Cooperation and three in Training (PEOPLE).

The linkages of the Egyptian research community are illustrated by the following tables. The EU originating applicants are dominating the landscape, followed by the Mediterranean-Arab applicants. Non-Arab African applicants and associated countries follow at a large distance.

Table 4.2 FP7 proposals with participation of at least one Egyptian organisation by field/programme, year and evaluation status, end 2012

Proposal call identifier	evaluation status	2007	2008	2009	2010	2011	2012	total
PEOPLE	TOTAL	6	25	18	29	24	19	122
	main list	1	6	3	6	6	6	28
	rejected	5	18	14	20	16	12	85
KBBE *101*	ineligible	1	2	1		2		6
	main list	1	2	5	3	1		12
	rejected	12	8	14	3	13		50
	reserve	10	3	13	4	3		33
ENV *95*	ineligible	5	2		2			9
	main list	1	2	5	3			11
	rejected	29	11	15	12	2	4	73
	reserve					1	1	2
ICT *79*	ineligible			2	1	1		4
	main list	1	2	1	1	2		7
	rejected	17	11	9	14	6	10	67
	reserve					1		1
HEALTH *53*	ineligible	3	4	1		1		9
	main list	1		4				5
	rejected	23	3	5	7			38
	reserve		1					1
SSH 50	main list			1			2	3
	rejected	7		17	4	1	16	45
	reserve						1	1
	withdrawn						1	1
AFRICA 41	ineligible				3			3
	main list				2			2
	rejected				32			32
	reserve				4			4
INCO 34	ineligible					1		1
	main list	1		3	4	6		14
	rejected	6				12		18
	reserve					1		1
ERANET 5	ineligible			1	2	1		4
	main list	1						1
REGPOT, REGIONS of K. 29	main list			2				2
	rejected			35				35
	reserve			2				2
Science in Society 21	ineligible						2	2
	main list			1	1	1		3
	rejected	1	1	1	10	1		14
ENERGY 12	main list	1	1		2			4
	rejected	1	1		2	1	1	6
	reserve	2						2
ENERGY-NMP 1	rejected		1					1
biorefinery 1	ineligible		1					1
ENV-NMP 5	rejected		1		4			5
NMP-ENV-ENERGY 1	rejected				1			1
INFRASTRUCTURE 13	ineligible				1			1
	main list			4				4

	rejected	2	3	2	1			8
NMP 10	main list			1				1
	rejected	1	6	1				8
	reserve	1						1
OCEAN 7	Ineligible					1		1
	main list					4		4
	rejected					1		1
	withdrawn					1		1
SPACE 7	main list		1	1	1			3
	rejected			1	1			2
	reserve		1	1				2
SMEs 6	ineligible							0
	main list		1					1
	rejected	3	2					5
SST 5	rejected	2	2					4
	reserve	1						1
AAT 2	main list		1		1			2
SEC 2	main list			1				1
	rejected					1		1
ERC 2	ineligible	1				1		2
GALILEO 1	ineligible		1					1
ICT-SEC 1	ineligible	1						1
total		142	100	168	155	92	57	714

Source: European Commission, DG RECH data base

Table 4.3 Distribution of the proposals and applicants by group of countries and status of evaluation 2007-2012 (proposals are counted as many times as they contain applicants from different origins)

	MAINLIST		RESERVE		REJECTED		INELIGIBLE		Undefined & withdrawn		totals	
	Appls	Props	Appls	Props	Appls	Props	Appls	Props	Appls	Props	Appls	Props
EUROPEAN UNION	893	562	416	270	2,826	1,948	173	127	410	273	4,718	3,180
ASSOCIATD COUNTRIES	52	43	25	18	136	112	10	8	14	11	237	192
Turkey	41	32	18	14	102	86	16	8	14	12	191	152
ARAB-MEDITERR.	172	135	93	74	498	417	26	18	156	117	945	761
RUSSIA & OTHER NIS	41	28	7	7	68	62	6	5	10	10	132	112
WESTERN BALKAN	19	19	9	9	60	56	0	0	16	11	104	95
USA, CAN, JAP, KOR, AUS	28	25	4	3	37	30	3	3	8	4	80	65
AFRICA	117	99	43	31	187	168	23	21	24	23	394	342
ASIA	24	20	10	9	65	57	10	10	10	9	119	105
LATIN AMERICA	35	31	8	6	64	52	14	11	15	12	136	112
OTHER	15	13	5	5	31	31	3	3	14	10	68	62

Appls: number of applicants
Props: number of proposals

Table 4.3 is more illustrative of the specific links with the most active European countries, showing distribution of the applications by the country of origin of the project coordinator. Italy is championing in linkages, including most Egyptian

researchers in its applications, followed at distance by Germany, UK, Spain Greece and France. A third group of coordinators collaborating with Egyptian researchers are originating from Austria, the Netherlands, Belgium, Sweden and Portugal.

Italy and Germany focus on Environment, Health, Agro-food and Social sciences and Humanities, the UK, Spain and France on Agro-food and ICT, Greece on Environment, Agro-food and ICT. The programmes for Regions of Knowledge and REGPOT are attracting the preference of Germany, Italy, Spain, Greece and France, while PEOPLE are serviced by Germany, UK and France.

The Egyptian organisations are present in the ITEA-2 cluster of EUREKA for the information technologies: two projects (EASI CLOUDS, Web of Objects) are bringing together five Egyptian organisations (ITWORX, NMA technologies, Smartec, Univ. of Cairo, Nile Univ.) in networks with organisations of France, Germany, Spain, Denmark, Finland and Korea.

The Egyptian universities benefit also from the actions of the TEMPUS Programme with three action lines: Joint Projects to improve individual higher education organisations, Structural Measures to improve overall higher education systems and Accompanying Measures (dissemination and information activities).

4.3.2 Bi- and multilateral agreements with EU countries

In the frame of **European Neighbourhood Policy**, EU and Egypt agreed on the allocation of €11m Community Funds initially for 2007-2010 and then an additional €20m for 2011-14, in support of Egyptian initiatives in the RDI area (section 2.3.1). The RDI Programme implements these policies in Egypt. Most of the EU Member States (19) support S&T cooperation, either through specific agreements targeting research and innovation, or more general agreements on educational and cultural cooperation or on economic and trade cooperation. A dozen of Member States is also supporting the mobility of researchers and scientists through bilateral or international programmes.[83]

The **German**-Egyptian Research Fund (*GERF*) supports joint application-oriented projects. The STDF and the German BMBF contribute up to €1m annually, offering to scientists opportunities to address jointly new fields. The German-Egyptian research long-term scholarship programme (*GERLS Fund*) is supporting doctoral candidates to enrol in doctoral programmes in German universities, while the short-term scholarship programme (*GERSS Fund*) allows doctoral and postdoctoral students to spend a six month research visit in Germany. The German Egyptian Scientific Projects (*GESP*) is a staff exchange programme promoting mobility.[84] The representation of DAAD in Cairo has managed in 2012 the exchange of 600 German researchers and 1400 Egyptians at individual or project-team levels. Furthermore, the German University in Cairo (GUC) is an Egyptian private university founded in cooperation

[83] Delegation of the European Union to Egypt RESEARCH AND INNOVATION Cooperation between Egypt and European Union Member States 2011
[84] http://www.stdf.org.eg/files/Callforproposalgesp.pdf

with the Universities of Ulm and Stuttgart, under the patronage of the Min. of Research and the Ministry of Science, Research and Arts of Baden-Wuerttemberg.

The **French**-Egyptian Research Programme (*IMHOTEP*) is a joint research scheme financed by both the French Ministry for Foreign Affairs and the *ASRT*. It is developing bilateral biannual research projects especially in life sciences, engineering, medicine and environment. The Institute de Recherché pour le Développement (*IRD*) and the *STDF* agreed on putting together €1.8m per year, equally shared, for four years to fund research projects presented by joint teams, "chairs of excellence, joint laboratories, technology platforms, mobility grants etc. The presence of the *IRD* in Egypt is based on a Framework Agreement for S&T cooperation with the Egyptian Min. of Research and on several specific research agreements. The French Embassy's *Mobility Programmes* supplies doctoral grants to PhD students in Egyptian universities, to accomplish a part of their research in a French university or grants to PhD holders who wish to complete their training in a French laboratory, as well as excellence fellowship for senior researchers. Moreover, the French University in Egypt (*UFE*) delivers both French and Egyptian diplomas.

Italy and Egypt manage an Executive Programme of S&T cooperation supporting researchers from both countries to implement joint projects (mobility for three years and research infrastructure). The Italian-Egyptian STD Programme identified five high priority projects for the continuation of bilateral S&T cooperation in renewable energies, cultural heritage, agricultural and environmental monitoring, health and telematics university development. The overall approved budget for this programme is €1.35m covered equally by the two parties.

The **United Kingdom** has also multidimensional cooperation activities with Egypt. The *Chevening* scholarship, managed by the British Council, aims at bringing future leaders to the UK for postgraduate studies. The *BP Cambridge* scholarship offers one year study opportunities at the *University of Cambridge*. Many other opportunities for scholarships are offered in the UK.[85] The British University in Egypt, involving the University of Loughborough, has been established to offer degrees in business, computer science, pharmacy and engineering.[86]

The **Spanish** Agency for International Development Cooperation (AECID) manages the Spain-Egypt Programme (Interuniversities Cooperation Programme - ICP) and funds joint research and training projects, preparatory activities and integrated actions for institutional reinforcement between universities and research centres. Furthermore, the Euro Arab Foundation for Higher Studies organises the Euro Arab Chairs Annual programme, supported by the Spanish Agency for International Development Cooperation (*AECID*) and the Euro Arab Foundation.

Greece, although has not activated the existing bilateral S&T cooperation agreement, cooperates strongly through joint participation in the European FPs and joint projects of the *Mediterranean Agronomic Institute of Chania* (Crete) with the *National Authority for Remote Sensing and Space Sciences and Arid Lands Agricultural Services and Research Centre* - *Ain Shams University*.

[85] http://www.royalsociety.org; http://www.scotlandscholarship.com; http://www.educationuk.org
[86] http://www.bue.edu.eg; http://www.lboro.ac.uk

The **Netherlands** Initiative for Capacity development in Higher Education (NICHE), administered by the Netherlands Universities Foundation for International Cooperation (NUFFIC) aims to strengthen institutional capacity in countries like Egypt for providing postsecondary education and training. The Netherlands Fellowship Programmes (NFP) provides for short courses, masters degrees and PhD studies. NUFFIC also funds Inter-University Cooperation. The Netherlands-Flemish Institute in Cairo (NVIC) aims at stimulating internationalisation of teaching and research activities in the Middle East.

The **Swedish** "Research Links Programme" supports the International Research Grant (up to three years) and the International Planning Grant (one year) in cooperation with the ASRT.[87] The "Institutional Grant" programme of the Swedish Foundation for International Cooperation in Research and Higher Education (*STINT*) finances long-term exchange and research collaboration between Swedish and foreign universities.

The Academy of **Finland** and the ASRT support joint research projects in the field of environmental research. The Academy of Finland provides funding also for Finnish scientific research in Egypt. A new Finnish Development Cooperation financing instrument for capacity building projects between Finnish universities and partner country universities aims at strengthening the skills and capacity of partner institutions in the developing countries. The Finnish Centre for International Mobility (*CIMO*) offers additional opportunities for cooperation between universities in Finland and in the developing countries.[88]

The **Danish**-Egyptian Dialogue Institute (DEDI) is established in Cairo in 2004 under the "Partnership for Dialogue and Reform" programme funded by the Danish Development Agency (DANIDA) with the aim to promote mutual understanding and dismantle stereotypes between culture and people, as well as strengthen relations between Denmark and Egypt and the Arab World. DEDI has facilitated partnerships and joint research collaborations between a number of Danish and Egyptian independent researchers and academics.

4.4 COOPERATION WITH NON EU COUNTRIES OR REGIONS

4.4.1 Main Countries

The Governments of **USA** and Egypt signed an S&T Agreement which was followed by the establishment of the US-Egypt S&T Joint Fund under the umbrella of the U.S.-Egypt Partnership for Economic Growth and Development. The fund is governed by a *Joint Board* of 12 members. The total budget for the 2011 was US$8m paid equally by the two sides. The launching of the programme was delayed due to the US budgetary restrictions since 2012. Emphasis has been given to entrepreneurship, business RTD

[87] http://www.vr.se
[88] http://www.northsouthsouth.fi

and cyber security. A Junior Scientist Exchange Visits programme is offering grants for short-term (less than six months) non-academic training for Egyptian researchers in U.S. institutions, and for U.S. researchers in Egyptian institutions. The main components of the Joint Fund are the Junior Scientist scheme (a new Ph.D. holder is granted up to $15,000), the Research Planning and Development Grants, the Collaborative Research Grants and the Integrated Science Grants.[89]

The Egyptian Ministry of Research and the **Japan** Society for the Promotion of Science (JSPS) signed a MoU. The joint fund supports both mobility and seminars with a budget of €60,000 by 2009. The Egypt-Japan University of Science and Technology (*E-JUST*) started operations in 2010 in Alexandria. E-JUST cooperates with universities as well as with multinational companies in priority fields.

At regional level, STDF signed a MoU with the **Arab Science and Technology Foundation** (ASTF), aiming to benefit from local and expatriate expertise in S&T for the advancement of research in Arab countries. Egypt participates also to the activities of the **African Union Commission**, which has established an Africa's Science and Technology Consolidated Plan of Action (CPA) to secure the competitive advantage and to leverage the capabilities and capacities by focusing on research and development to respond to challenges and needs. The CPA gave birth to the African Union *Research Grant Programme*. The second call for proposals is focusing on post-harvest and agriculture, renewable and sustainable energy and water and sanitation. More recently, a joint call for proposals in high technology fields was published by the Min. of Research and the National Research Foundation in **South Africa**. In mid-2012, the science ministries of Egypt and Tunisia are collaborating on a project to use the results of scientific research to develop small enterprises in rural areas.[90]

A number other initiatives have also been undertaken at the regional level (for example the **Middle East Science Fund**, the International **Centre for Biosaline Agriculture**, the **Regional Centre for Renewable Energy and Energy Efficiency**, **SESAME** International Synchrotron presented in section 3.4). The **World Bank** is supplying in addition to funds the necessary know how to improve mainly higher education.

From the point of view of scientific fields, the joint activities follow the general pattern of investing on one side in the traditional sectors, such as agriculture, husbandry, water, food, health, energy, and on the other side to the creation of nucleus of excellence in advanced S&T fields, such as ICT, biotechnology and nanotechnology.

4.4.2 Main instruments

The main instruments for international cooperation and the corresponding financial resources are presented in previous sections of this chapter. The *RDI Programme* is one of the most important in size. The STDF supports the implementation of the

[89] The Research Planning and Development Grants (up to a $60,000 for one year), the Collaborative Research Grants (up to $200,000, for 2- 3 years), the Integrated Science Grants (up to $50 0,000 for 3 years) and the Science and Technology Innovation Grants (up to $250,000 for 2 years).
[90] Scidev: Egypt and Tunisia collaborate on rural enterprise scheme Hazem Badr 30 July 2012

bilateral agreements with Germany and France, USA, Japan and other countries, usually through open calls for proposals or expressions of interest.

At regional level, the *Middle East Science Fund* (MESF) was launched in Jordan in 2009 with an initial capital of $10m to support regional research projects and young scientists pursuing a master's degree. Support will foster multinational cooperation and facilitate cooperation and collaboration among scientists from universities throughout the Middle East.

In addition to the cooperation agreements and programmes managed at national level, the research organisations develop their own international networking and joint programmes. I.e. Alexandria University cooperates with VirginiaTech in launching a new graduate programme in Egypt. The *VT-MOHE* (Virginia Tech - Ministry Of Higher Education) Partnership aims to establish Centres of Academic Excellence (CAEs) for Research & Graduate Studies and resident Collaborative Degree Programmes.

4.5 OPENING UP OF NATIONAL R&D PROGRAMMES

Since the status of researchers in universities and research centres is that of civil servants, hired just after graduation, it is difficult to conceive a research career for a foreigner in Egypt except in non-public Universities, such as the German, American and French universities which hire quite a considerable number of expats. Nevertheless, non-nationals can work in projects on temporary and fixed term basis. The larger research schemes, such as those of *STDF* and *RDI* are open to the participation of foreign organisations established in Egypt, provided that research activity is performed in the country. This has a rather very limited impact on the participation of foreigners in national programmes.

Moreover, STDF finances activities and schemes of bilateral cooperation. The RDI Programme provides for the cooperation with organisations in the EU. Grant schemes address collaborative applied research projects implemented by consortia in which participate enterprises from Egypt, EU Member States and Mediterranean countries.

4.6 RESEARCHER MOBILITY

4.6.1 Mobility schemes for researchers from abroad

Egypt benefits from the mobility schemes provided by the EU FP7 (IRSES) and the bilateral agreements mentioned above (section 4.3.1). The national policy puts great emphasis on the return and reintegration of expatriate Egyptian researchers in the national research system. A specific scheme of the STDF provides for funding the integration of returning scientists in university laboratories. Furthermore, the Heads of Arab States in March 2010 mandated the Secretariat of the League of Arab States to

develop an S&T strategy for the Arab region, aiming to facilitate the mobility of scientists. This strategy shall be discussed in an Arab Summit for adoption.[91]

4.6.2 Mobility schemes for national researches

Cooperation between research organisations is encouraged by the various schemes financed nationally or internationally. But there is no specific scheme targeting mobility alone.

The European, American and other joint programmes support strongly international mobility for the purposes of education and training in a large spectrum of S&T fields (see sections 4.3, 4.4). The "spontaneous" flow of national scientists to technologically developed countries for graduate and post-graduate studies does not need specific measures for further reinforcement. Many successful Egyptian scientists abroad make their residence in the host country, worsening the brain drain problem of Egypt. Therefore, the national policy has to strive to create conditions for repatriating these researchers in appropriate working positions in the country, preferably in creating high added value activities.

[91]UNESCO Science Report 2010

5 CONCLUSIONS

The Egyptian research system is very small in size but provides for capabilities to bring together the knowledge producers and the users. Numerous research units are attached to most ministries, offering potentially long term support to decision making of the parent civil services. But these units are small and their effectiveness is questionable. Nevertheless, there are some sectors of the traditional public policy, such as agriculture and water that are quite active in the creation of new knowledge and its dissemination throughout the economy. The relatively large spending in agricultural research contradicts with the very small share of graduates in agricultural sciences. In the areas of industry and ICT the competent public authorities are active in supporting research and innovation through a multiplicity of schemes. Very significant is also the contribution of many developed countries and the EU in planning and supporting research policy with considerable budget appropriations.

The deficiencies of the business sector are a serious constraint both in knowledge supply and demand, for which the available data and indicators in the RTD and innovation are rather scarce. The actual structure of the national economy is not particularly favourable to a rapid increase of the research expenditure; from this point of view it is encouraging that the national Government, as well as various important international partners, are introducing measures to favour stronger and more effective links between the public research system and the production sector.

The main schemes of the STDF "encourage" the cooperation of the business firms with universities and public research centres, as it is notified in all the calls for proposals. The RDI Programme introduces the mandatory cooperation between research entities and business firms in its main scheme. These schemes and programmes also introduced project funding as a new mode for financing RTD as well as evaluation of applications based on excellence criteria and preselected national socio-economic and technological priorities. Project funding remains still a small share of total funding of the public research organisations, but this share is expected to increase in the coming years. At the same time project funding contributes to the dissemination of the evaluation culture throughout the research organisations. To this effect the HEEP, with its components for the establishment of a quality assurance and accreditation infrastructure in the academic sector shall pay a major role.

These instruments have not yet been capable in mobilising the research potential; they only add up to a rather thin institutional funding for RTD which might secure continuity in effort and long term goals. The mushrooming schemes of the last years for project funding generate much hope for change but have not yet created the necessary managerial tradition whilst they lack predictability. Funding increases of the two last years is at risk because of the budgetary difficulties of the national economy.

The HEEP aims to introduce entrepreneurship and innovativeness in the curricula. But universities need not only more funding but also better management techniques that enable at the same time the autonomy of internal decisions and the accountability to the general interest. The development of institutions such as: the Technology Transfer Centres, IMC, ITIDA, the S&T City and the Technology Valleys and other institutions of this type aim at increasing innovation and technological modernisation.

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7 LIST OF ABBREVIATIONS

BERD	Business Expenditures for Research and Development
CERN	European Organisation for Nuclear Research
ERA	European Research Area
COST	European Cooperation in Science and Technology
ERA-NET	European Research Area Network
ERP Fund	European Recovery Programme Fund
ESA	European Space Agency
ESFRI	European Strategy Forum on Research Infrastructures
FP	European Framework Programme for Research and Technology Development
EU	European Union
EU-27	European Union including 27 Member States
FDI	Foreign Direct Investments
FP	Framework Programme
FP7	7th Framework Programme
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
GUF	General University Funds
HEI	Higher education institutions
HERD	Higher Education Expenditure on R&D
HES	Higher education sector
IP	Intellectual Property
ITIDA	Information Technology Industry Development Agency
MENA	Middle East and North Africa
OECD	Organisation for Economic Co-operation and Development
PRO	Public Research Organisations
R&D	Research and development
RDI	Research, Development and Innovation
RI	Research Infrastructures
RTDI	Research Technological Development and Innovation
SF	Structural Funds
SME	Small and Medium Sized Enterprise
S&T	Science and technology
STDF	Science and Technology Development Fund
VC	Venture Capital