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ERAWATCH COUNTRY REPORTS 2011: MOROCCO

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Author(s) Ilyas AZZIOUI

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Executive Summary

Morocco [1] (المملكة المغربية, *al-Mamlakah al-Maġribiyya*), is a country located in North West Africa 14 km from Europe. It has a population of 32 m and a GDP of € 64 bn (€ 1,967 per capita). Since the publication of the 2025 vision and the 2006-2010 action plan in 2006, it was frequently reported in official documents that GERD represented 0.8% of the national GDP, and it was expected to reach 1% by the year 2010. However, According to the latest data of the *Ministry of Higher Education, Scientific Research and Professional Training* (MHESRPT) (March, 2012) Morocco's GERD was about €560 m (Dh 5.6 bn) and represented 0.73% of GDP in 2010, a significant improvement from 2006 GERD of €560 m (Dh 5.6 bn) and GERD/GDP ratio of 0.64%. GERD remains mainly of public origin although public expenditure contribution to GERD has dropped from 82% in 2003 to 68% in 2010, whereas the private sector's share has increased from 12% to almost 30% in the same period. In the absence of independent and systematic evaluation and monitoring tools, these numbers need to be interpreted with caution.

The Moroccan economy resisted quite well the financial crisis for the last couple of years but a slow down started to be felt across the productive sectors in the Moroccan economy due to the combined negative effects of: the Arab spring on social stability and tourism in MENA region; the financial crisis on Diaspora remittances; and last but not least of drought in 2011 on agriculture -a strategic sector for Morocco. This increased significantly the budget deficit for 2012. It is difficult to assess at this stage to what extent research and innovation policies will be affected. Both the "Emergency Programme" targeting education and research as well as the Moroccan innovation strategy "Morocco Innovation Initiative" that were launched in 2009 mobilising important financial resources and giving multiannual visibility for the stakeholders are still operating more or less normally till the end of this year. The most urgent concern in the higher education sector is to create enough places for the sharply increasing number of high school graduates.

Last year was a year of a political transition; a new constitution that gives the president of the government and the parliament unprecedented powers was voted and adopted. Hence, at strategic level not much happened in the fields of research and innovation. The Strategy and Vision 2025 continues to serve as the reference for the implementation of policies and measures related to R&D; especially those launched by the *Ministry of Higher Education, Scientific Research and Professional Training* (MHESRPT). However, the ministry focuses on teaching and education rather than on R&D within the framework of the Emergency Programme launched in 2009. The most relevant policy changes that could have a significant impact on innovation and R&D activities - especially in the private sector - are related to the innovation strategy (2009-2014) led by the *Ministry of Industry, Trade and New Technologies* (*MITNT*) called "Morocco Innovation Initiative" and to a second degree the new work plan (2013-2016) of the *MHESRPT*.

"Morocco Innovation Initiative" has brought significant changes in the RTDI landscape by implementing a mix of measures to bridge the gaps and remedy some of the failures in the innovation system in Morocco. The level of support of the new instruments to private R&D, innovative start-ups as well as to collaborative projects through the implementation of new structures (clusters and innovation cities) is unprecedented. Changes are expected at the legal level as well, to provide a legal framework more conducive to innovation in Morocco. Yet, this major leap forward at the level of policy design and the introduction of new instruments might not be followed by the required cultural, behavioural and absorptive capacity changes at the same pace among SMEs. The level of skills and the structure of the production sector might put significant constraints on the outcomes sought by this new innovation policy.

The work plan (2013-2016) of the *Ministry of Higher Education, Scientific Research and Professional Training* has devised tens of measures and actions to support and promote RDI activities including updating the national strategy, human resources mobilisation and motivation, funding, consolidation of innovation infrastructure, restructuration of scientific research, developing partnerships with private sector and last but not least a new vision for the promotion of international cooperation.

The Knowledge triangle is not fully integrated in Morocco. The major focus of public authorities for decades has been education; research gained momentum since the late 90's and innovation several years later with a major leap forward (at least at policy level) after the launching in 2009 of the new innovation strategy "Morocco Innovation initiative".

Dialogue and cooperation exist at senior level of policymaking between the two major governmental operators in this field, namely the *Ministry of Industry, Trade and New Technologies* (*MITNT*) and *Ministry of Higher Education, Scientific Research and Professional Training* (*MHESRPT*); business representatives are regularly invited to contribute to the RTDI agenda but this political consensus is not necessarily reflected at operational level between the real actors on the ground.

The education sector has deployed considerable efforts lately to support socio-development plans to supply businesses with their needs in terms of skills and well-trained human resources. In this respect, results have been quantitatively positive but qualitatively insufficient.

Currently, there are some concerns with regard to providing well-trained professors-researchers to face the research quality requirements, the increasing number of students (deemed insufficient currently) and retirement departures.

Knowledge Triangle

	Recent policy changes	**Assessment of strengths and weaknesses**
Research policy	- Split of the previous very large Ministry of National Education, Higher Education, Professional Training and Scientific Research (MENESFCRS) into two. - Following the appointment of a New government, a new work plan for higher education and research has been elaborated for the period (2013-2016). The plan is rich of tens of measures addressing issues related to Human resources management and motivation , funding increase, consolidation of innovation infrastructure, restructuration of scientific research, developing partnerships with private sector and last but not least a new vision for the promotion of international cooperation.	(+) Increased public funding is expected after 2013 (+) More comprehensive and detailed than the previous Emergency Plan with regard to RDI activities and addresses much more loopholes in the R&D system (+) Provisions for addressing identified gaps in technology and knowledge transfer to the private sector;+ more contribution to the "Morocco Innovation Initiative" (-) It is not an evidence-based plan, no evaluation has been carried out to allow for policy learning before the elaboration of the plan (-) Absence of rationales for the measures taken in the plan (-) Insufficient administrative capability to deliver and implement the plan is not addressed (-) Need for narrowing priorities and vertical measures to limit fragmentation of R&D efforts and focus on sectors of future growth
Innovation policy	Implementation of "Morocco Innovation Initiative" (2009-2014) provisions:	(+) Increased availability of funds for private RDTI and entrepreneurship.

	- An Innovation bill (law) to encourage start-ups, spin-offs, to recruit researchers in the private sector has been drafted - 4 Clusters were formed - Financial instruments to fund new innovative start-ups (Intilak) and RTDI projects in the private sectors (Tatwir) were launched	(-) Insufficient deal flow of good innovative projects due to the failure to recognise of the vital importance of learning and innovation capabilities building in the context of a developing country (-)The policy needs more integration with other policies to multiply the entry points towards foreign knowledge such as policies addressing FDI, Diaspora, exportation, international cooperation in RDTI (-)Universities cannot play to their full potential role in supporting the innovation policy unless the identified gaps hindering technology and/or knowledge transfer and weaknesses in terms of administrative and financial procedures, legal framework, promotion system, and skills are addressed.
Education policy	- Important means were devoted to the education sector to diversify its offer and increase its capacity within the framework of the "Emergency Programme" - A special focus on the promotion of S&T as well as engineering disciplines to satisfy the needs of socio-economic development programmes. - Elaboration of (2013-2016) work plan. The plan is rich of tens of measures addressing issues related to higher education governance and human resources management, the quality of education, legal framework and international cooperation	(+) Good results in terms of the increase of the enrolment of new students in S&T and engineering disciplines. (+)Satisfaction of the needs of key economic sectors in terms of managers and engineers (post-graduates). (-)Deficit persists for middle management and technicians- (-) The quality of the education needs further improvement both in quantitative and qualitative terms (- +) It is too early to assess the measures of (2013-2016) work plan, more information is needed on the rationales, availability of means to achieve the objectives, adherence of other stakeholders, etc.
Other policies	- Sectoral policies including "The National Pact for Industrial Emergence" for industrial development, "Digital Morocco" for IT or "Green Plan" for agriculture and the very ambitious project "Morocco Solar plan" continue to nurture demand for knowledge especially trained engineers and technicians to support FDI investments in targeted sectors	(+) Megaprojects of multinational companies such as RENAULT will help Morocco acquiring the managerial skills and routines required for engineering and innovation in the Automotive sector. (-) More integration and coordination with the innovation, education and research policies is needed to allow a maximum impact on innovation capabilities building.

Assessment of the national policies/measures

	Objectives	**Main national policy changes over the last year**	**Assessment of strengths and weaknesses**
1	Labour market for researchers	Not much happened last year with the exception of the elaboration of the (2013-2016) work plan with an objective of 8230 recruitments in the higher education and research sector	- Too early and not enough information is available to make an assessment (-) The labour market for researchers in the private sector is still very weak
2	Research infrastructures	Important investments were allocated to support MASCIR foundation for applied research in nanotechnology,	(+) Reinforces Morocco's capabilities in cutting edge scientific and technological fields

		microelectronics and biotechnology	(-) Not very supportive environment and a weak demand in the local market for such a specialised knowledge
3	Strengthening research institutions	No significant changes; Provisions of the work plan (2013-2016) regarding quality enhancement and governance improvement need more information for fair assessment	(-) Poor ranking in international classification of universities (-) More autonomy and flexibility in the financial and administrative management is needed
4	Knowledge transfer	- Implementation of innovation cities in four universities within the framework of "Morocco Innovation Initiative"	(-) Lack of skills specific to knowledge transfer and supportive legal as well as administrative framework. (-) Globally the intensity of public-private cooperation is still weak
5	International R&D cooperation with EU member states	- Negotiations are going on between Morocco and the EU to reflect the advanced status granted to Morocco by EU in 2008 on the level of RDI cooperation - Within the framework of European Neighbourhood Policy Instruments (ENPI) a project of institutional twining to support the Moroccan National Research System	(+)The most important challenge for researchers capacity building and access to networks of excellence has a positive evolution (-) Need for new STI framework cooperation to upgrade the level of cooperation from knowledge exchange schemes towards knowledge clustering schemes
6	International R&D cooperation with non-EU countries	- Evidences at the level of political speech as well as the work plan (2013-2016) towards more partnerships with emerging countries and countries in the region.	(+) Opportunity for learning from catch-up economies that are more relevant to the Moroccan context (-) The rationales and objectives of these cooperation initiatives are not sufficiently grounded and explained.

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1 INTRODUCTION

The main objective of the ERAWATCH International Analytical Country Reports 2011 is to characterise 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

In the absence of any more published strategy papers, the 2025 Research Strategy document published in 2006 continues to provide a long-term policy context for grand challenges and priorities that should be driving Moroccan scientific research. It also stresses the importance of a multidisciplinary approach to R&D as well as international cooperation in R&D to address societal challenges and to support socio-economic development programmes in Morocco.
According to the vision 2025, the main societal challenges that should drive Moroccan research in the future are:

1. Education and training
2. Access to basic services (infrastructure, potable water, electricity, health, etc.)
3. Fight against poverty and social exclusion
4. Other challenges: fight against the effects of drought, environmental degradation, slums and diseases (AIDS, Malaria, etc.)

The major thrusts of the strategy revolve around the governance and funding of the national research system, mobilising human resources, dissemination of research findings, and international cooperation. The strategy development process has provided an opportunity to update the national research priorities. Some of those already set forth were retained, including improving quality of life, knowledge, preservation and enhancement of natural resources, socioeconomic and cultural development, information science and technology, agriculture in difficult conditions, business competitiveness and innovation, and basic research. New priorities include risk management and biotechnologies.

However, these challenges and priorities are too broad and need more focus to limit the fragmentation of research efforts and reach the critical mass required to contribute effectively to the sustainable socio-economic development of Morocco. There is a little evidence of the reflection of the political consensus mentioned earlier on the operational ground.

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

Morocco [1] (المملكة المغربية, *al-Mamlakah al-Maġribiyya*), is a country located in the North West of Africa at 14 km from Europe. Morocco is a constitutional monarchy with an elected parliament. It is divided into 16 regions and subdivided into 62 prefectures and provinces. It has a population of 32 m and a GDP of €80 bn. According to the World Bank, with a GDP/per capita of € 2,442 the country belongs to the lower middle-income group, which is lower than the records of other countries in its region such as Algeria and Tunisia. Morocco had an average GDP growth rate per annum over the last decade of 4.64%.

Since the publication of the 2025 vision and the 2006-2010 action plan in 2006, it was frequently reported in official documents that GERD represented 0.8% of the national GDP, and it was forecasted to reach 1% by the year 2010. However, According to the latest estimates of the *Ministry of Higher Education, Scientific Research and Professional Training* (March, 2012) Morocco's GERD was about €560 m (Dh5.6 bn) and represented 0.73% of GDP in 2010, a significant improvement from 2006 GERD of €369 m (Dh5.6 bn) and GERD/GDP ratio of 0.64%.

GERD remains mainly of public origin although public expenditure contribution to GERD has dropped from 82% in 2003 to 68% in 2010, whereas the private sector's share has increased from 12% to almost 30% in the same period. When examined carefully we realised that this significant increase is partially explained by the inclusion into BERD of the national *Moroccan phosphates* company(OCP) R&D budget (€36 m in 2010) since 2008 when OCP changed its legal status from a public office to become a public limited liability company (Société Anonyme: SA).

EU countries represent the main research partners of Morocco with France and Spain occupying the leading position. Cooperation with non EU countries is marginal at this stage (Tunisia and Egypt most significant) but expected to gain momentum in the near future as the new work plan of the *Ministry of Higher Education, Scientific Research and Professional Training* puts strong emphasis on developing new partnerships with emerging countries, Arab countries and African countries.

Main actors and institutions in research governance

Currently the research system is composed of the following bodies and structures:

Political level:

The public authorities elaborate the national research policy and regulate this policy through a set of legislations and regulations, and through coordination, orientation, planning, programming and financing research activities. They include the Moroccan Government, the Permanent Inter-ministerial Committee for Scientific Research and Technological Development (PICSRTD) and Hassan II Academy of Science and Technology. The PICSRTD, which had played a key role in the identification of Moroccan research priorities, has not convened since 2007.

The process for the implementation of a National Committee of Innovation has been launched within the framework of the Moroccan Innovation strategy called "Maroc Innovation Initiative".

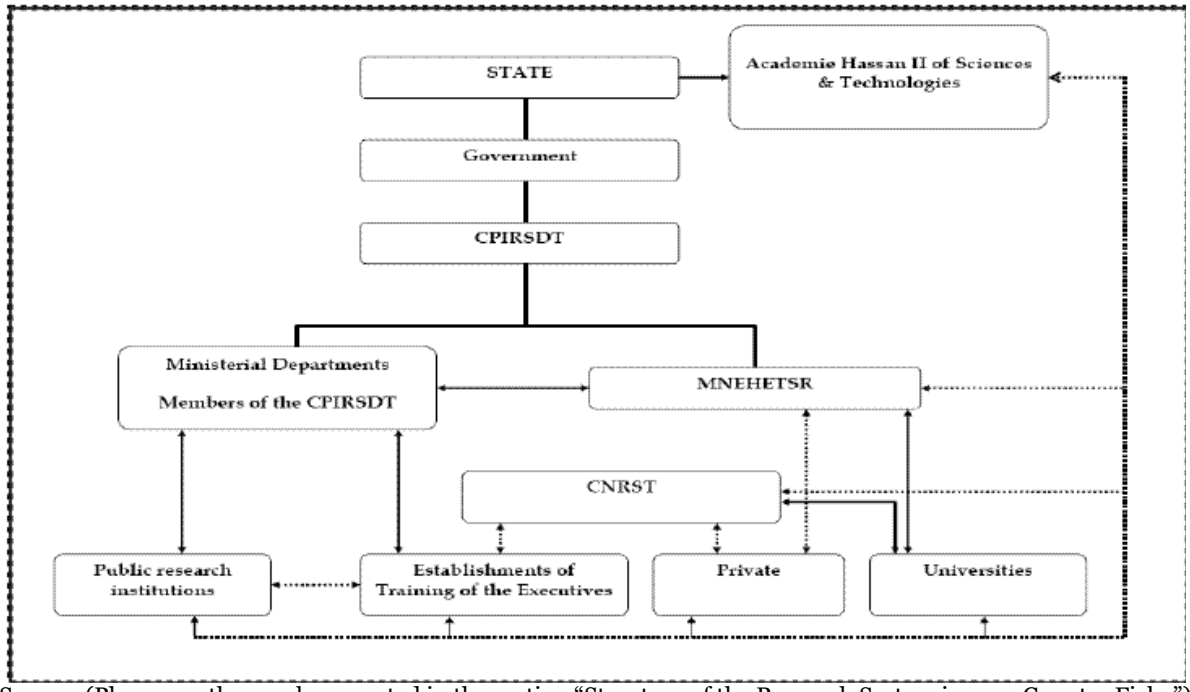
Operational level:

The *Ministry of Higher Education, Scientific Research and Professional Training* is the major player in the field of science and technology policy, the Directorate of Science and the Directorate of technology ensures the implementation of the Ministry's policy in their respective fields. Other technical ministries play a more or less important role in their respective sectors such as agriculture, energy, health, water and environment.

Several governmental stakeholders are involved in shaping Morocco's innovation policy, in particular, the MITNT and the MHESRPT. Both ministries launched for the first time in 2002 an integrated programme to support innovation and technology transfer activities that was followed by the launching of a more ambitious national innovation strategy led by the *MITNT* "Morocco Innovation Initiative" in 2009. This was done in coordination with the "Emergency Plan" addressing education and to a second-degree research issues launched by MHESRPT the same year.

These ministries are supported at the operational level by several agencies and intermediary organisations with the National Centre for Scientific and Technical Research (CNRST), R&D Maroc Association, The Moroccan Office for Industrial and Commercial Property (OMPIC) and the National Agency for SME's (ANPME) playing a leading role in this regard.

Figure 1: Overview of the Morocco's research system governance structure



Source: (Please use the graph presented in the section "Structure of the Research System in your Country Fiche")

Hierarchal Relationship

Collaborative Relationship

CPIRSDT: Permanent Inter-ministerial committee for Scientific Research and Technological Development
MNEHETR: Ministry of National Education, Higher Education, Professional Training and Scientific Research
CNRST: National Centre for Scientific and Technical Research

Main research performers

Key Research performers are public higher education institutions (HEIs) comprising 16 universities, 1 of which is private and 63 higher education schools and colleges, followed by 22 public research organisations (PROs) and 239 private sector enterprises.
In terms of funding HEIs accounted for €253.8 m of the R&D budget, having a share of 45.28% of the total GERD in 2010 followed by the private sector with a budget of €167.8 m (29.23% of GERD) and PROs with a budget of €192.3 m (23.06% of GERD).

The institutional role of regions in research governance

Research and innovation policies in Morocco are still fully centralised and managed by the relevant national ministries, intermediary organisations and agencies mentioned in the previous paragraph. Regional organisations (universities, research centres and incubators) are responsible for local management but are accountable to the national institutional set up.

The main active regions in terms of research and knowledge production are Rabat, Casablanca and Marrakech.

2.3 RESOURCE MOBILISATION

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

Since the publication of the 2025 vision and the 2006-2010 action plan in 2006, it was frequently reported in official documents that GERD represented 0.8% of the national GDP, and was expected to reach 1% by the year 2010. However, during the implementation of the action plan 2006-2010 the ministry in charge of research carried out another exercise in 2008 to assess R&D expenditure in 2006. The study concluded that GERD was 0,64% of GDP with salaries representing 87% of R&D expenditure. Several reasons were presented to explain this gap: the decrease of the salaries paid to researchers because of the early retirement scheme for government employees that affected 1014 professors-researchers, an exceptional growth in the GDP of 2006 (10,1%), the late allocation of expected funds to the national fund to support scientific research and technological development (about € 24 m), and last but not least a change in the calculation method. The latest available data from the MESFCRS on R&D funding in 2010 show that GERD represents only 0.73% of GDP. Data about GBOARD are not available.

It seems that there are still unsolved issues related to the calculation of GERD in Morocco. Data is still difficult to obtain and to interpret to make a meaningful international benchmark. For example, even when it is possible to have a good estimation of budget allocated to R&D it might be misleading to rely on this indicator only. Empirical evidences confirm that research institutions are unable to consume significant amount of allocated budgets because of managerial and bureaucratic malfunctioning.

Although there are no official statistical data, it can be concluded from different sources and discussions with relevant actors that institutional funding covers the lion's share of R&D expenditure (salaries, infrastructure, capacity building) but competitive funding is gaining momentum and expected to be in an upward trend in the future.

Since 2009, most of the funds were allocated through the "Emergency Programme" (2009-2012). Teaching and education are the main focus of the programme. However, Project n°14 called "Promotion of Scientific Research" which falls under the second area of intervention of this Programme "to stimulate initiative and excellence in high school and university" is expected to absorb € 72 m (Dh 720 m) of a total budget of € 4.7 bn (Dh 47 bn). Funds were allocated initially according to the needs and objectives of the projects submitted by universities but in the following years funds were supposed[1] to be distributed according to the rate of achievement of these objectives. The aggregated objectives of the projects submitted by different universities were :

- 92% of research structures within universities shall be accredited by 2012 against 69% in 2008;
- To increase Moroccan publications in scientific journals included in the science citation index (SCI) and the social sciences citation index (SSCI) by 70%, from 1991 in 2008 to 3500 in 2012;
- To increase the number of PhD theses from 820 in 2009 to 2300 in 2012;

[1] There is no evidence of progress towards this direction

- To register 330 patents by Moroccan universities in the period of 2009-2012

Competitive funding is mainly given through call for proposals launched by R&D actors in Morocco to support research projects. In this regard, the most active programmes in the last five years are: The National Support Programme to Sectoral Research (CNRST), CNRST associated research units, INNOV'ACT Programme (R&D Maroc Association), HASSAN II Academy of Sciences and Technology call for proposals, Poles of Competences (MENESFCRS).

Overall, research did not receive much attention at policy level during the former government mandate (2007-2011) and was diluted in the huge Ministry of National Education, Higher Education, Professional Training and Scientific Research for which the primary focus was the improvement of education at all levels from primary school to university through the "Emergency programme" (2009-2012). In contrast, innovation was strongly promoted by the *Ministry of Industry, Trade and New Technologies* through a national innovation strategy (2009-2014) "Morocco Innovation Initiative".

In the wake of the Arab spring, Moroccans approved a new constitution on July 1st, 2011. This new constitution gives the parliament and the Prime Minister unprecedented powers. The new government is expected to give higher priority to research. The first indication in this regard was the split of the previous very large *Ministry of National Education, Higher Education, Professional Training and Scientific Research* (MENESFCRS) into two Ministries: the *Ministry of National Education* (MNE) dealing with primary and secondary education and the *Ministry of Higher Education, Scientific Research and Professional Training* (*MHESRPT*) addressing higher education and research issues.

The most relevant policy changes that could have a significant impact on RDI activities in the near future are related to the national innovation strategy (2009-2014) "Morocco Innovation Initiative" and the elaboration of the new four-year work plan (2013-2016) by the *MHESRPT* . On the one hand, within the framework of "Morocco Innovation Initiative", the *MITNT* has set up an innovation fund of €38 m (Dh380 m) and a funding programme of €5 m (Dh50 m) to support financially 800 innovation projects and 50 R&D project in advanced technologies respectively. On the other hand, the *MHESRPT* has allocated a budget of €170 m (Dh1.7 b) to support activities related to the third area of action in the work plan called "Developing scientific and technological research system and innovation".

Main societal challenges

The strategy and Vision 2025 draws, largely, on the results and the recommendations of the evaluation of the national research system in the fields of exact sciences, life sciences and engineering sciences in 2003. It also takes into account the economic, social and cultural data describing where Morocco stood in 2006, and where it is likely to be in 20 years time. According to the vision 2025, the main societal challenges that should drive Moroccan research in the future are:

- Education and training
- Access to basic services (infrastructure, potable water, electricity, health, etc.)
- Fight against poverty and social exclusion
- Other challenges: fight against drought's effects, environment degradation, slums and diseases (AIDS, Malaria, etc.)

The major thrusts of the strategy revolve around the governance and funding of the national research system, mobilisation of human resources, dissemination of research findings, and

international cooperation. The strategy development process has provided an opportunity to update the national research priorities. Some of old ones were retained, including improving quality of life, knowledge, preservation and enhancement of natural resources, socioeconomic and cultural development, information science and technology, agriculture in difficult conditions, business competitiveness and innovation, and basic research. New priorities include risk management, and biotechnologies.

All the calls for proposals launched within competitive funding schemes take the national R&D priorities deriving from the grand societal challenges mentioned earlier into consideration. However, these priorities remain very broad and need further precision to allow for the selection of research proposals that would effectively tackle clearly identified relevant problems. So far, no evaluation of the socio-economic impacts of these calls has been conducted to assess their contribution to socio-economic development of the country and consequently addressing issues related to societal challenges.

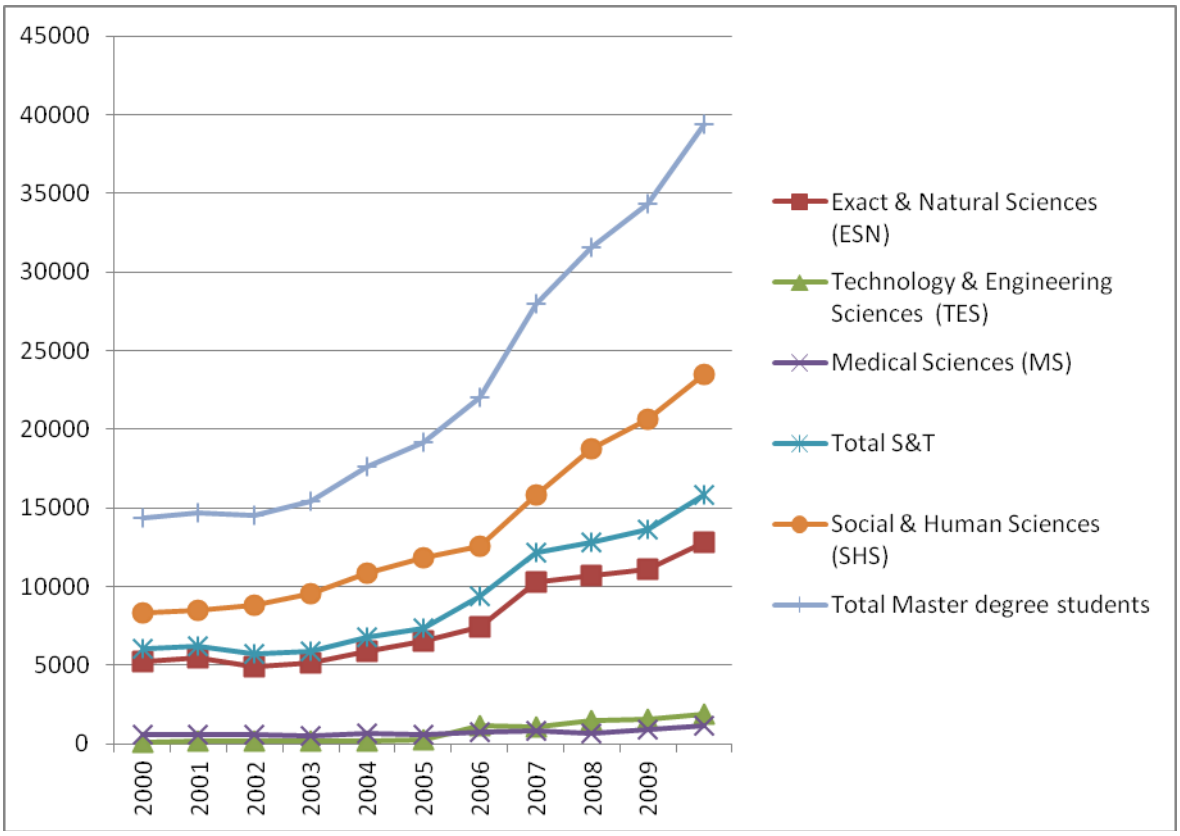
There is no long-term strategy to build mutual trust between science and society. There are only some initiatives including the support of *MHESRPT* for the organisation of "The Week of Sciences" by universities in partnership with high and primary schools in their respective regions. They aim at promoting science culture among future candidates to the higher education system. There are also some sporadic events and actions organised by the CNRST and some NGOs in this respect.

2.3.2 Providing qualified human resources

Education absorbs an average of 5.5% of Moroccan GDP. The higher education sector is currently facing a strong demand given the sharp increase in the number of high school graduates, which has reached 177,499 in 2011 (70% increase in comparison with 2009 numbers). This increase in demand was stronger for study courses in science, technology, engineering and business administration (+92% between 2007/08 and 2010/11). This year, the situation is even more critical to the point that several actions will take place to encourage PhDs working in administration to teach in universities.

There were 447,800 students in the higher education system in Morocco in 2010 including 39,381 that were following Master degree courses. About 40% of master degree students were following S&T courses; their number has increased sharply by +264% between 2000 and 2010 to reach 15,857 students while the number of master degree students in social and human sciences has increased by +283% in the same period to reach 23508.

Figure 2 Progress of Master degree students across disciplines between 2000 and 2010



The average students/permanent teacher ratio in the higher education system is 35, 38 in universities, 12 in non-university higher education institutions and 60 in private institutions.

The public and private research system in Morocco counted 37,246 R&D personnel in 2010 including 12,166 of academics in colleges and universities and 17,686 PhD students. 60% of academics are in the fields of sciences, technology and engineering while 40% are in the files of human and social sciences. Data regarding the profile of R&D personnel, their number and distribution across disciplines, gender, research structures is reported in section (3.1.1 stock of researchers).

According to the advisory report published by the Hassan II Academy of science and technology in 2009, Morocco has to train about 15000 (professors-researchers or full time researchers) over the next decade to face the research quality requirements (deemed insufficient currently), the increasing number of students and retirement departures. Using data from various resources (UNESCO, EUROSTAT, OCDE) the advisory report claims that researchers represented a share of $1{,}89/10^3$ of the economically active population in the age group 25-64 in 2005 but in 2008 they were $1.83/10^3$ ((FTE).

However, these numbers should be considered with caution for the following reasons:

- According to findings of the 2003 evaluation of the Moroccan research system by European experts, a large number of university teachers do no conduct any research at all.
- Because of the meagre career prospects for researchers in Morocco, the majority of PhD students drop out from the research system when they find a job in the public administration. In 2009, 15,097 PhD Students were registered but only 676 PhD diplomas delivered.

- For macro-economic purposes recruitment in public administration, including universities, was very tight in the 90s and 2000s. This situation has led to a generational gap in the demographic pyramid of researchers in Morocco and an aging population, which reflects in the decline in the number of publications in the concerned fields. The phenomenon was aggravated by the early retirement scheme for public administration employees and affected more than 1014 researchers (usually the most experienced ones). Cherkaoui (2009) in his study about Social and Human Sciences in Morocco qualified the population of researchers-professors of a Mexican army (army of generals) where 64% of the professors-researchers belong to the two highest ranks of the academic ladder.

A profiling of the human resources needs of each sector for the whole period of the programme (2009-2015) was carried out to support the National Pact for Industrial Emergence (2009-2015). The main results are summarised in the following table:

Sectors	Managers	Engineers	Technicians	Operators	Total
Off shoring[2]	1 000	3000	10500	55000	70000
Automotive	1500	7000	9000	32500	70000
Aeronautics	300	1900	3000	9800	15000
Electronics	200	1400	2700	4700	9000
textiles and leather	300	2000	7500	24000	32000
Agro-food	500	500	8500	14500	24000
Total	3800	15800	39400	141000	220000

Universities were invited to support this industrial strategy and provide the adequate profiles in qualitative and quantitative terms. The first follow up report of the Emergency Programme (2010) addressed this matter and came up with the following results:

- 100% of the needs for managers and engineers are covered (postgraduates)
- Only 60% of the middle management needs are satisfied (graduates, 3 years after high school)
- Only 35% of the needs in terms of technicians are covered

In addition, public universities are becoming increasingly active in designing and providing lifelong and vocational training programmes for the production sector. These programmes represent an interesting source of revenue for universities as well as academics. Through the National Office of Vocational Training, the state covers up to 70% of training costs.

To limit the effects of brain drain, the Moroccan Government launched FINCOME programme targeting highly skilled Diaspora that brings together several stakeholders to propose practical programmes and actions that will allow the application of Moroccan capital, knowledge and skills abroad to contribute to development efforts in Morocco. Indeed, the most successful tool put in place under the heading of FINCOME is the call for proposal launched jointly by CNRST and R&D Maroc Association that financially supports short term visits (transportation fees & per diems) of eminent Moroccan experts to transfer their knowledge and skills to their Moroccan counterparts mainly in academic and research institutions. So far. more than 280 Moroccan experts have participated in the program.

In the past higher education policy makers have focused on the quantitative challenges while neglecting the qualitative aspects. The pedagogical methods used particularly in open access public universities do not encourage problem solving, critical thinking or communication and do not provide managerial skills needed for a successful career in professional life. Higher education institutions with regulated access and some prominent private universities and

[2] client relationship management, banking and insurance, management of payments, help desks and infrastructure management

colleges face this problem less. In this regard, one common complaint across the business community, for instance, is the lack of communication skills in foreign languages among public university graduates despite the huge amount of time and resources invested in teaching foreign languages from primary school all the way to university.

Courses and other initiatives to promote entrepreneurship are becoming increasingly popular in the higher education curricula but there is no evidence of their relevance and impact on the entrepreneurial drive of students after graduation.

Aware of the aforementioned gaps, the *MHESRPT* devised several measures to remedy this situation and improve the employability of graduates. These include: the creation of an observatory for the adequacy of higher education to the economic and professional needs; the orientation of 35% of new students into professional licenses and 60% toward the specialised Master (against 17 % in professional licenses and 36% in Masters in 2011); the training of 2000 PhD students per annum by 2016; the consolidation of scholarships at all levels including PhD; the creation of more than 8000 budget items to recruit staff for higher education; consolidation of technology transfer and innovation infrastructure; promotion of partnership with the private sector and last but not least the creation of a national evaluation agency.

2.3.3 Evolution towards the national R&D&I targets

The total sum of R&D spending reached € 314,4 m (Dh3144 m) in 2003 which represented 0.8% of the national GDP at the time, the private sector contribution to R&D expenditure was estimated around 12%. In 2010, Morocco's GERD was about €560 m (Dh5.6 bn) and represented 0.73% of GDP in 2010, a significant improvement from 2006 GERD of €560 m (Dh5.6 bn) and GERD/GDP ratio of 0.64%. GERD remains mainly of public origin although public expenditure contribution to GERD has dropped from 82% in 2003 to 68% in 2010, whereas the private sector's share has increased from 12% to almost 30% in the same period.

To develop a first understanding of RDTI activities in the Moroccan private sector, two extensive innovation surveys were launched by the Ministry in charge of industry in 1999-2000 and by the R&D Maroc Association in 2005. The results of these surveys showed that the most dynamic sectors in RTDI activities were agro-food, ITC, textile and leather and electric-electronic industries. Cost of RTDI projects, lack of skills and lack of supporting mechanisms and schemes were the most frequently cited constraints faced by enterprises to engage in RTDI activity. More than 50% of RTDI projects were targeting product innovation; process innovation and organisational innovation were ranked second and third respectively. In 2000, 57% of enterprises outsourced compared to only 35% in 2005. The most frequently cited outsourcing partners are suppliers, Moroccan and foreign experts; universities and engineering schools were cited in less than 5% of cases. Self-financing and loans are by far the most important sources for funding RTDI projects. R&D Maroc Association launched a less extensive survey targeting a representative sample of 300 industrial enterprises in 2009. The findings of this survey show that 55% of the targeted enterprises have an internal intelligence/technological watch structure, 29% only declare carrying out RTDI activities. Regarding R&D personnel, they represent 0.21 of the total number of personnel, which corresponds to a number of 1053 distributed as follows: 0.03% of managers (151 engineers and PhDs), 0.08% of technicians (402) and 0.10% of supporting agent (503).

To bridge some of the gaps and to remedy the failures in the "innovation world" and maybe not yet a fully operational "Innovation system" as suggested in the final report of ESTIME, the government research and innovation authority devised a policy mix comprising a series of incentives to encourage investment in RDTI activities. Most of these incentives are direct support measures that provide grants or zero interest reimbursable loans in case of success.

For example, Programme INNOV' Act is the oldest scheme that provides a direct support to private companies to carry out R&D projects (between €20,000 and €50,000). The first version of this programme was launched in 1999 and it was structured in a way that would favour university-industry cooperation. On the other hand, TATWIR was launched only last year within the framework of "Morocco Innovation Initiative". It provides zero interest loans reimbursable in case of success to support innovative R&D projects of enterprises (up to € 400,000). Both products have multiple objectives including promoting greater R&D investments in R&D performing firms and stimulating R&D by non-R&D performing firms.

The two major measures that are particularly relevant the promotion of the estabishement of new indigenous R&D performing firms are zero interest loans reimbursable in case of success provided by the Morocco Spin-off/Spin-out and Incubation Network (RMIE) (€23,000) and INTILAK (€100,000) to cover respectively pre-incubation and incubation expenses of innovative and research-based start-ups.

With respect to the incentives targeting foreign R&D performing firms, a national plan has been drawn up, revolving around three main kinds of incentives: tax relief, assistance for skills' recruitment, and aid to settling. In this regard, Hassan II Fund for economic and social development provide support to land acquisition, buildings construction for R&D, new capital goods acquisition and technological projects particularly in the fields of microelectronics, nanotechnologies, biotechnologies, aeronautics and automotive. In return for tax and land-related benefits, several companies have signed agreements such as STMicroelectronics, Matra Automobile, Lead Design, Teuchos (Safran group).

To encourage public-private R&D cooperation "Morocco Innovation Initiative" promoted the creation of four clusters in the fields of IT, electronics, microelectronics and provided technical as well as financial support to the creation of three Innovation Cities (Cités d'Innovation) in collaboration with Three Universities. This structure will ensure technology transfer activities, pre-incubation and incubation services and training in innovation and entrepreneurship.

Hence, one may conclude that the policy mix is balanced and addresses all areas, namely: stimulating greater R&D investment in R&D performing firms; promoting the establishment of new indigenous R&D performing firms; stimulating firms that do not perform R&D yet; attracting R&D-performing firms from abroad; increasing extramural R&D carried out in cooperation with the public sector and increasing R&D in the public sector. The latter has received more funds in the past.

The usefulness of all the mentioned measures and instruments has not been subject to a strong debate so far, their implementation, however, raises more questions because of the administrative and bureaucratic hurdles.

When fully operational, other measures that will be implemented within the framework of the (2013-2016) work plan of the MHESRPT are expected to have a positive impact on the environment of RTDI in Morocco, especially, the ones mentioned in the third area of intervention of this work plan called "Developing scientific and technological research system and innovation" such as the creation of grants to develop researches between enterprise and university, the financial motivation of researchers to bring in projects from private sector, encouraging of researchers mobility, creation of a public interest grouping (legal entity) to support universities incubation programmes and university spin-offs.

2.4 KNOWLEDGE DEMAND

The primary sector (agriculture, fisheries and related services) accounts for an average of 15% of total GDP, the second sector 30% (half of it belongs to the industry excluding oil refining) and the third sector 55%. Inside industry the leading sector is chemistry and para-chemistry (42%) followed by agro-food (27%), mechanics and metallurgy (15%), textile and leather (9%) and electric and electronics (7%). According to the 2005 R&D Maroc survey, the most active sectors in R&D are textile and leather, agro-food and electric and electronics.

The economic development strategy of Morocco is based on 3 provisions: comprehensive reforms aimed at improving the business climate; monitoring and improvement of macro-economic indicators (inflation, budget deficit, growth rate, etc..); and the establishment of sectoral strategies, especially in industry, tourism and agriculture.

Maybe the most relevant sectoral strategy for the RDI future of Morocco is "The National Pact for Industrial Emergence (2009-2015)". Launched by the Ministry of Industry, Trade and New Technologies, with a total budget of €1.2 bn, it focuses on export oriented economic sectors where Morocco could obtain a sustainable advantage and has high potential for growth. Competitive areas for growth include off shoring (client relationship management, banking and insurance, management of payments, help desks and infrastructure management), textiles and clothing, automobile and aeronautics, electronics, agro-food, exploitation of marine resources and industrial crafts. These sectors should represent 70% of industrial growth by 2015. Education and training of human resources were considered as key to the success of this programme and will absorb 34% of the budget. A profiling of the human resources needs of each sector for the whole period of the programme (2009-2015) has been carried out as mentioned in the previous section (2.3.2). The programme is expected to generate 220,000 jobs by 2015.

However, there is no evidence about the research demand generated by the Moroccan industrial policy. The only indications regarding this issue are the results of the innovation surveys presented in section (2.3.3) according to which the most dynamic sectors in RTDI were agro-food, ITC, textile and leather and electric-electronic industries.

These societal challenges have been translated into national research priorities (section 2.3.1) and calls for proposals were launched. However, given the weak linkages between academia and business and the broad nature of these priorities, research projects submitted within these calls for proposals remain to a large extent academic in nature and there is no evidence on the socio-economic impact of research activities and their contribution in addressing societal challenges.

2.5 KNOWLEDGE PRODUCTION

2.5.1 Quality and excellence of knowledge production

In a study using Scopus database and published by the Moroccan Scientific and Technical Information Institute (IMIST) in 2010, it was found that the Moroccan scientific production numbered 16120 publications between 1999 (1200 publications) and 2009 (2117 publications) distributed across scientific disciplines as follows: 52% in Physical Sciences, Health Sciences 24%, Life Sciences 20%, and 4% only for Social Sciences. The decade could be divided into two periods:

- 1999-2004: with an average annual growth of 3% and an average production of 1279 publications
- 2005-2009: with an average annual growth of 12% and an average production of 1688 publications

Moroccan scientific production numbered 2377 publications in 2010 (Scopus) while Algerian, Tunisian and Egyptian scientific production reached 2998, 4547 and 8894 publications respectively.

In the country leaflet report of ESTIME project (Laville et al., 2007) investigating Thomson database it was found that the total number of publications was 666 in 2004. The two disciplines for which the world share was the highest were mathematics (2,78‰) and chemistry (1,21‰). The specialisation index for Morocco were, in 2004, mathematics (3.21), chemistry (1.39) and astro and geo-sciences (1.13). The best world share of citations were in mathematics (0,91 ‰) and engineering (0,66‰). The average impact index for Morocco was 0.28. The highest impact rates were registered in engineering (0.78) followed by chemistry (0.51), while medical research had the lowest one (0,12).

The Moroccan Industrial and Commercial Property Office received 1022 applications in 2011 against 1007 applications in 2010. 167 were filed by nationals and the rest by foreigners. In 2011, Moroccan universities applied for 37 patents and research institutions for 8 patents, 6 applications were from the Moroccan Science, Innovation & Research Foundation (MASCIR). 10 applicants from the world of research are going international following PCT procedure. There is no evidence on the socio-economic impacts of university patents. EPO and US PTO patenting is marginal.

As far as Social and Human Sciences are concerned, the study conducted by Cherkaoui (2009) showed that 55% of the professors-researchers have never published. The Early Retirement Scheme had a negative impact on scientific production in this field after 2005.

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

According to the reports of European experts in 2003, the lack of evaluation is one of the main weaknesses of the national research system. Although singled out as one of the responsibilities of the government research authority — and part of the remit of The National Centre for Scientific and Technological Research (CNRST) — not a single institutional structure has as yet been set up to undertake a systematic evaluation of the research system. Efforts are made to fill the gap as far as peer evaluation is concerned. Ad hoc assessment committees and procedures are adopted for all competitive grants. Ex post evaluations are organised occasionally (INNOV'ACT programme, PROTARS) but an evaluation culture is not yet well embedded in the national culture. Evaluations often take the form of short assessments. Laws and regulations governing the functioning of regulatory bodies for scientific research (either *MHESRPT* or the *CNRST*) consider research policy and programmes assessment as one of the missions of these bodies. However, the structure of self-assessment under Article 77 of Law 01-00, adopted in year 2000, is not yet in place. Pending the establishment of such a structure, ad hoc national evaluation committees were occasionally established by decision of the Government authority responsible for scientific research to assess the various programmes and projects for the promotion and development of scientific research provided under the national policy on research. The CNRST managed to implement the CNRST scientific committees according to law no. 80-00 governing the institution. The scientific board assists the director of CNRST in decision-making. CNRST also has specialised-discipline and field-specific scientific committees, whose assigned tasks include the evaluation of CNRST-funded projects and programmes managed by the CNRST such as CNRST Associated Units Programme or the National Support Programme to Sectoral Research. These scientific evaluation committees contribute to the improvement of the quality and excellence of the programmes managed by the CNRST.

The *MHESRPT* launched an accreditation programme for university research structures. As of April 2008, 982 research structures were accredited within universities (minimum of three professors-researchers for a research team and a minimum of three teams for a research laboratory). In addition, about 60 accredited research laboratories were selected following a call for proposals to benefit from financial support within the framework of CNRST Associated Units Programme.

Last but not least, research fellowships for PhD students as well as prizes to reward outstanding work in research or innovation and academics lifetime achievements are frequently cited as a mean to promote excellence in science.

The most relevant measures in the (2013-2016) work plan of the *MHESRPT* aiming at improving the quality and excellence of knowledge production are as follows: the consolidation of scholarships to PhD students, incentives and rewards to active researchers in scientific publications, the elaboration of favourable legal framework to PhD students, post-docs and visiting professors, encouraging the participation of Moroccan researchers to international research and conferences and the creation of a national evaluation agency.

A major obstacle is that many highly skilled Moroccan researchers living abroad willing to come back to work in Morocco face problems with the validation process of foreign degrees, which is burdensome. It takes months, in some cases even years to validate degrees that are being validated for the first time.

2.6 KNOWLEDGE CIRCULATION

2.6.1 Knowledge circulation between the universities, PROs and business sectors

Law (No 01-00) which came into effect in 2000 to reorganise the higher education system recognises the third mission of universities and the key role they should play in the regional and national socio-economic development of the country. It includes several measures for the promotion of technology transfer activities. In 2002, the MITNT and MHESRPT launched with CNRST, OMPIC, R&D Maroc and other stakeholders an integrated policy to support innovation and to promote Knowledge, Know-how and Technology Transfer. The key components of the programme were the:

- Technology Dissemination Network (RDT) – Réseau de Diffusion de Technologie –. This initiative is notable for its attention to matching needs in the enterprise sphere with competencies based at universities and public research centres. The approach is to establish a lasting relationship with the client companies and to accompany them in all stages of implementation of a technology strategy.
- The Moroccan Institute for Scientific and Technological Information (IMIST) – Institut Marocain de l'information Scientifique et Technique– leads efforts to improve links between industry and academia by providing online access to catalogues of research results and databases of competencies available in the universities and research organisations and carrying out technology watch activities mainly in the field of agro-food.
- Morocco Spin-off/Spin-out and Incubation Network (RMIE) – Réseau Maroc Incubation et Essaimage –The RMIE supports a network of mainly "university based incubators" that have been established in several Moroccan cities. It focuses on providing technical as well as financial support (Pre-seed capital to enable the development of the business idea into a credible business plan) to new technology based start-ups through a pre-incubation and incubation process.

In addition, to these knowledge transfer tools and agencies a *university-enterprise interface system* (Technology transfer office) has been introduced more or less successfully in Moroccan universities. Similarly, the INNOV'ACT programme of R&D Maroc Association is considered as an important measure linking public research with business.

All these components, which are still operating today, have contributed to the diffusion of the culture of innovation and entrepreneurship bringing them into the heart of the universities' and government's concerns and have allowed some universities to play a more active role in pursuing their third mission by increasingly taking into account in their plans technology transfer activities. However, their socio-economic impact is yet to be proven. But more importantly, the launching of these pilot programmes was very useful for all the stakeholders to identify in practical terms (by doing) the challenges faced by technology transfer in the Moroccan environment; most of these technology transfer programmes were not able to fully meet their initial objectives. In 2006, public-private partnerships represented 1% of R&D expenditure in Morocco. Innovation surveys launched by the Ministry of Industry and R&D Maroc association show that universities represent less than 5% of the outsourcing partners. The ex-post evaluation of the incubation programme pinpointed some shortcomings that are common to a large extent to all programmes. The weaknesses could be summarised as follows (Bruhat, 2006):

1. The incubation mechanisms have been launched before setting all the components for technology transfer from research (legal, administrative, financial).
2. The incubation policy provides substantial funds to incubated projects for the development phase of the project idea (pre-incubation); however, the funds arrive late due to the procedures which are criticised as heavy and inadequate.
3. With regard to intellectual property, the main deficits were at the level of awareness of the importance of patents, the absence of IP professionals at the level of university as well as national level. This refers mainly those who are able to clearly identify the owners of the idea, to estimate their contribution to its implementation, to assess the business value of the idea and see the different ways of protecting it by a patent, to look for partners and/or negotiate license agreements. The lack of expertise and financial resources results in a low involvement of universities in patent protection, which they perceive as a burden rather than a business opportunity. This situation obliges the few researchers interested in this type of protection to do so privately.
4. The universities did not show a strategic commitment toward the incubation programme,
5. The rigidity of the administrative and legal status of Moroccan researchers makes it difficult for them to engage in public-private mobility activity. In addition, researchers' promotion criteria do not take technology transfer activities into account.
6. Regarding the evaluation, selection and the incubation of projects, the process remains too close to a feasibility study of a technology project and quite distant from an application in a market context. There are no pre-market studies or market research for incubated projects.
7. The incubatees most of the times have neither the experience of the business they wish to pursue nor sufficient knowledge of market conditions. This lack of experience combined with the lack of business angels/mentors makes it difficult to make up for the entrepreneurial experience gap among young entrepreneurs.
8. The weaknesses at the level of university incubators include: lack of autonomy regarding the culture and organisation of host institutions (universities mainly), which makes it difficult to purchase equipment or expertise for projects, particularly from abroad; the high turnover of incubators' managers and lack of motivation of the management board of the incubators don't help the capitalisation of experiences and practices, the lack of resourceful persons with experience in business creation for the management of incubators and the business assistance of incubatees in building up their start-ups.
9. Last but not least, lack or shortage in funds suitable for incubated projects at different stages of maturity.

These weaknesses in the legal and administrative framework, adequate financial resources and tools, skills and absorptive capacity are not specific to incubation. Several meetings,

conferences and seminars highlighted the same drawbacks for other technology transfer mechanisms. The launching of "Morocco Innovation Initiative" represents indeed a major step forward towards addressing significantly some of the weaknesses mentioned above. Considerable financial resources and tools will be mobilised to address financing gaps and to support the creation of public-private structures (clusters, innovation cities) to promote collaborative projects between research and business. Amendments to the Moroccan laws are expected to make the legal framework more conducive to innovation. In addition, the MHESRPT (2013-2016) work plan intends to increase the responsiveness of the public research system to the socio-economic needs by removing some bureaucratic and legal barriers, consolidating technology transfer and incubation infrastructure and supporting as well as funding public private partnerships.

2.7 OVERALL ASSESSMENT

Indeed, in absolute terms the last fifteen years have witnessed important developments in the 'RTDI world" in Morocco. A considerable amount of legislative work to regulate the higher education and research sectors has been adopted and several mechanisms and tools to support the autonomy of university and its three missions have been introduced. Morocco was able to develop some scientific capacity in research and even excellence in some niches. The trend of scientific production has been positive for many years, and pilot mechanisms to encourage knowledge circulation were implemented. But this alone is not sufficient, RTDI activity needs to be organised into a focused and fully operational and interlinked "RTDI system".

GERD has increased in absolute terms but the objective of 1%of GDP by 2010 was not attained. Despite the increase in the private share of R&D expenditure from 12% in 2003 to almost 30% in 2010, R&D expenditure is still dominated by public funds where salaries represent the lion's share. Important financial resources were allocated in the context of the "Emergency Programme" (2009-2012) to support the higher education and research system. On the one hand, results in education were satisfying and the supply of graduates in S&T disciplines increased dramatically (+264%) between 2000 and 2010. On the other hand, the Emergency Programme failed to achieve its objectives with regard to publications and patenting. Morocco dropped from the 3rd to the 6th position in Africa in terms of publications. Patents filed by universities increased from an average of 10 to an average of 40 per year but remain far below the objective of the Emergency Programme (300 patents by 2012) and PhD students continued to drop out heavily from the research system. This is threatening the ability of the education system to face the challenge stemming from growing high schools graduates. Policymakers should put more emphasis on human resources

Regarding RDI in the private sector, several instruments and measures were launched within the framework of Morocco Innovation Initiative and previous RDI policies but their impact continues to be hindered by the weak demand from the indigenous productive system and the limited absorptive capacity of Moroccan SMEs. As far as knowledge circulation is concerned, new instruments were introduced through the "Morocco Innovation initiative" to bridge the financial and structural gaps in the technology transfer system and promote collaborative private-public partnerships. However, their success will depend on addressing the weaknesses of the legal and administrative framework of technology transfer activities and the shortage of relevant skills and absorptive capacity.

In this regard, the (2013-2016) work plan intends to increase the responsiveness of the public research system to the socio-economic needs by removing some bureaucratic and legal barriers, consolidating technology transfer and incubation infrastructure and supporting as well as funding public private partnerships.

3 National policies for R&D&I

3.1 LABOUR MARKET FOR RESEARCHERS

3.1.1 Stocks of researchers

In 2008, Morocco had a share of 661 (FTE) researchers per million inhabitants, corresponding to 1.83 FTE researcher/10^3 of active population (UNESCO, 2010). In terms of employment, the sector of higher education employed 95.5% of FTE researchers followed by government 5.7% and business enterprise 0.7%. According to the advisory report published by the Hassan II Academy of science and technology in 2009, Morocco has to train about 15000 (professors-researchers or full time researchers) over the next decade to face the research quality requirements (deemed insufficient currently), the increasing number of students and retirement departures.

Based on the latest available statistics provided by MHESRPT, Morocco R&D personnel counted 37,246 in 2010 distributed across 618 institutions as follows:

- 16 Universities: 27,953 (10,267 professors-researchers and 17,686 PhD students)
- 63 Higher education schools (mainly engineering and management schools): 3,967 professors- researchers
- 192 Private higher education establishments: 4,274professors (most of them are visitors only 512 are permanent)
- 17 Public Research organisations: 4,122 researchers, engineers, technicians and supporting personnel.
- 239 Private enterprises: 2,633 R&D personnel.

Professors-researchers represent 32,66%, 47,48% are PhD students and 9,66% are engineers. Full time researchers represent slightly over 1%.

The following table gives more details on the distribution of researchers across disciplines and genders. 40% of researchers are in the field of social sciences and humanities followed by exact & natural sciences (32%), technology and engineering sciences 21% and medical sciences 5%. Women represent 31% of the labour force in R&D, they are better represented in the fields of exact and natural sciences followed by technology and engineering sciences and social sciences and humanities.

Distribution of researchers across disciplines and genders

Domains	Number			Percentage			
	M+F	F	M	M+F	F	M	F/M ratio
Exact & Natural Sciences (ESN)	11954	4 439	7 515	32%	12%	20%	0,59
Technology & Engineering Sciences (TES)	7919	2 482	5 437	21%	7%	15%	0,46
Medical Sciences (MS)	2001	502	1 499	5%	1%	4%	0,33
Social Sciences and humanities	14984	4 157	10	40%	11%	29%	0,38

(SSH)			827				
Others	388	-		1%			
Total	37 246	11 580	25 666	100%	31%	69%	0,45
Source : MENESFCRS – DEP – DFC - Ministères techniques – EPR							

With respect to the distribution across disciplines, 40% of the R&D personnel in academic institutions belong to the field of Social, Human Sciences, 32% are in Natural, and Exact Sciences, 21% operate in Technology & Engineering Sciences and 5% in Medical Sciences.

The legal framework related to human resources management currently in force makes it extremely difficult to recruit postdoctoral researchers and pay them competitive salaries.

The (2013-2016) work plan has set an objective of 8230 recruitments in the higher education sector to cover education, research and administrative needs during the whole period of its implementation.

3.1.2 Providing attractive employment and working conditions

The net monthly salary of researchers-professors in public universities and higher education schools (engineering and business schools) ranges approximately between €1,200 and €2,500 (Dh12,000 and Dh25,000) which is 5.5 to 12 times the net minimum salary in Morocco and significantly higher than the salaries of professors-researchers in other countries with comparable level of development in North Africa. Full Time researchers in public research organisations perceive slightly lower salaries. Salaries are paid directly from the relevant ministry and not the universities and are negotiated at national level with relevant unions. In theory, the law allows for sabbatical leaves but few (or more likely no one) take advantage of it. There are no specific gender policies to promote female researchers, maternal leave cannot exceed 14 weeks and in theory, it does not jeopardise women carriers.

For promotions, peer review committees use the following criteria:

- Teaching activities (pedagogical material, administrative duties, courses, etc.)
- Research activities (publications, theses and dissertations' supervision)
- Outreach and communication activities (innovation and technology transfer, patents, NGOs, unions, socio-cultural, etc.)

Coefficients of 1, 2 and 3 are attributed to each kind of activity according to the wish expressed by the professor-researcher. Professors-researchers thus can advance in their career without publishing research papers as they can attribute a coefficient of 1 to research activities which will impact only one sixth of the final mark.

Moroccan researchers living abroad are estimated at over 15000. To limit the effects of brain drain, the Moroccan Government launched the FINCOME programme targeting highly skilled Diaspora that brings together several stakeholders to propose practical programmes and actions that will allow the contribution of Moroccan capital, knowledge and skills abroad to the development of Morocco. Indeed, the most successful tool put in place under the heading of FINCOME is the call for proposal launched jointly by CNRST and R&D Maroc Association that support financially short term visits (transportation fees & Per diems) of eminent Moroccan experts to transfer their knowledge and skills to their Moroccan counterparts mainly in academic and research institutions. So far more than 280 Moroccan experts (mainly professors, researchers and engineers) participated in the programme since its launching in 2006 with a significant increase in the last couple of years. This mobility scheme allowed some of the researchers to establish fruitful professional contacts back in

their country of origin and find part-time or full time-job opportunities in some private organisations like MASCIR or the International University of Rabat.

In a survey targeting professors-researchers in the field of social and human sciences (Cherkaoui, 2009) 30% of the respondents said that they are satisfied with their job. , More than one third would consider quitting university if they were offered the opportunity of an early retirement scheme (like the one launched in 2005), 46% would consider a liberal profession and 40% would choose commercial or entrepreneurial activity.

3.1.3 Open recruitment and portability of grants

Permanent research and academic positions in the public sector in Morocco are normally open to Moroccans only; exceptional cases exist but are negligible. Recruitment rules require presence on site for an oral interview. The law in force in public administrations does not take into consideration previous experience of the researcher; each new recruit starts from the bottom of the career ladder regardless of its previous experience. This situation is considered a major obstacle by many highly skilled Moroccan researchers living abroad willing to come back to work in Morocco. In addition, the validation process of foreign degrees is burdensome. It takes months, sometimes even years to validate degrees that are being validated for the first time.

Research grants in Morocco are not portable because they are linked to the institution and not to the researcher.

3.1.4 Enhancing the training, skills and experience of researchers

There are no specific policies or measures in force targeting these aspects but the Emergency Programme supported in broad terms the implementation of a life-long training system within universities for academic as well as the administrative personnel. In this regard, the Emergency Programme set the following objectives for the period 2009-2012:

- To provide trainings abroad for 11 100 professors-researchers;
- To provide 30 days training in pedagogy for 2 804 newly recruited professors-researchers;
- To provide life-long training for 10.459 administrative and technical personnel.

Progress reports show that these objectives were not met; the achievement rates vary across universities but range in average between 20% to 50%.

The enhancement of Master and PhD trainings mentioned above is also enhancing the training of researchers.

3.2 RESEARCH INFRASTRUCTURES

Currently there is no explicit roadmap for research infrastructure in Morocco. The three major components and achievements of the last explicit plan regarding infrastructures and technological platforms are the establishment by the CNRST of
UATRS: technical support units boast a collection of modern, heavy-duty scientific measurement and analysis equipment. These Units serve the private as well as the public sectors.

The MARWAN network: MARWAN serves to connect 85 higher education institutions. It has also been linked to the European GEANT (Gigabit European Academic Network) network. The Network as well as the "Computing GRID" – which is connected to more than 400 European servers - managed by the CNRST.

IMIST: It provides users with access to a database on national expertise, and publishes specialised newsletters that enable users to keep track of the latest scientific and technological developments. It provides access to all universities to online sources of scientific and technical literature like Science Direct.

These components still receive support from the Ministry in charge of research for their functioning.

Morocco Innovation Initiative as well as other socio-economic development programmes (The National Pact for Industrial Emergence, Green Plan) include infrastructure components that might be geared to supporting R&D activities such as clusters, agro-poles, technoparks, and innovation cities.

MASCIR - which is a new non-profit foundation for the development of a competitive and innovative pole based and market-oriented research in advanced technological sectors- as a component of the national RDI strategy has acquired state of the art technological platforms to support advanced applied research in the fields of nanotechnology, microelectronics and biotechnology. Investment in this foundation has totalled more than €50m so far since the launching of the foundation five years ago.

3.3 STRENGTHENING RESEARCH INSTITUTIONS

3.3.1 Quality of National Higher Education System

Higher education in Morocco is composed of three subsystems: the university system, the non-university one and the private one comprising the following bodies:

- The university system is comprised of 15 public universities and one private not for profit University, comprising 119 institutions (faculties, schools, etc.). For the first time, last year two private (for profit) universities were recognised as universities by public authorities but data about their personnel is not sufficiently detailed in the public documents of the Ministry.

- The non-university system comprising 55 institutions, which enrol approximately 15 percent of all students, is under the direct control of ministerial departments dealing with some technical fields such as agriculture, equipment, civil engineering, mining and energy that provide specialised training for high level personnel in science and technology, engineering, business, law, economics, administration, social sciences and teachers training. The non-university system includes vocational, educational and training institutions, and engineering schools (Etablissements de Formation des cadres).

- The private sector comprises 187 institutions offering degrees in various fields of knowledge (computer sciences, management, etc.).

The number of students has increased by 6.7% between 2009 and 2010 to reach 478,000 distributed as follows: 420,000 in the university system, 22,000 in the non-university system and 36,000 in the private system. About 40% of master degree students were following S&T courses, their number increased sharply by +264% between 2000 and 2010 to reach 15,857

while the number of master degree students in social and human sciences has increased by +283% in the same period to reach 23508. 81% of S&T postgraduate students in 2010 were in exact and natural sciences, 12% in medical sciences and 7% in engineering sciences. In the same year, Morocco had counted 17,686 PhD students of those 38,1% were in exact and natural sciences, 0,2% in medical sciences, 4% in engineering sciences and 57,7% in medical sciences.

All Baccalauréat holders (i.e. secondary school graduates) are eligible to enter university. No applications are required, but students are not always enrolled in their chosen field of study due to space limitations and entrance examinations in some faculties. University institutions are divided into: (1) limited access institutions, which offer courses in medicine, pharmacy, dentistry, trade and management, technology, translation and interpreting, and engineering and (2) free access institutions, which offer courses in law, economics, humanities and social sciences.

A broad description of the reform at the higher education level is outlined in the National Charter for Education and Formation; however, Law 01-00 on the organisation of tertiary education passed in 2000 constitutes a more detailed description of the reform effort. In addition to the two traditional missions of production and dissemination of knowledge, the Law 01-00 recognised the third mission of the university and provided a legal framework to allow it to contribute to the socio-economic development of the country.

On another note, the law was an ambitious effort to transform the sector pedagogically, financially and organisationally (at the governance level). At the pedagogical level, the higher education pedagogical system was moved from the traditional continental (European) system to a modularised degree system (LMD) that offers three main cycles: the undergraduate cycle leading to a Licence in 3 years; the Master's cycle leading to a degree in two years; and a Doctoral cycle leading to a doctorate in three to five years. University curricula were enhanced based on directives of the new reform. In terms of financial reforms, there is a strategy to promote alternative sources of finance. The Law 01-00 clarifies and acknowledges the relevance of the private sector to be accredited and join the public sector in promoting the quality of higher education.

As far as international cooperation is concerned, 63,9% of the articles published by Moroccan researchers in 2008 were co-authored with researchers from France, 13% Spain, 7,2% USA, 6,4% Italy, 5,5% Germany, 5,2% Canada. HEIs are the main players in research. They account for more than 80% of R&D personnel (headcounts) and absorbed more than 45% of GERD in 2010. Overall, compared to other Southern Mediterranean countries Morocco actively participates in the Framework Programmes with remarkable growth in both the number of projects and participants. Regarding FP7, for instance, Morocco applied in 473 projects and until mid-2012 was main listed in 92 projects.

Moroccan south-south cooperation focuses on the higher education sector more than on research. Morocco counted 9000 foreign students in 2010, 78% of them had Moroccan scholarships. 26% of the new enrolments of foreign students in 2011 were for postgraduate studies. 60% of foreign students are from Sub-Saharan Africa, 32% are from the Arab world, 3% are from Asia and 3% from the rest of the world. Hence, Morocco is a net exporter of students because statistics from UNESCO (2010) show that the country had 41,254 students abroad in 2008, the top five destinations were France (26,998), Germany (3,699), Spain (2,735), Canada (2,652) and U.S.A. (1,133).

According to the law, the higher education system is under the responsibility of the supervising ministry (*MHESRPT*) and all curricula leading to a state-recognised degree has to go through a process of accreditation. That said, quality assurance mechanisms are almost inexistent in the Moroccan education system; this might be explained by the quantitative challenge that is still very high on the agenda of policymakers. However, enhancing the

quality of higher education is one of the key strategic objectives of (2013-2016) work plan. On multiple occasions, the new Minister in charge of higher education and research, Pr Lahcen Daoudi, has declared that he wants to make Morocco a knowledge hub for Africa and the Arab world. To this end he has started contacting some leading European and Canadian universities in the fields of engineering, medicine, architecture and business administration to open branches in Morocco.

3.3.2 Academic autonomy

Autonomy

The Law 01-00 regulating higher education in Morocco has been in force since 2000. It provides universities with pedagogical, scientific and cultural autonomy. From the governance perspective, universities are headed by a President. The management board of the university brings together academia with socio-economic players and makes decisions with regard to strategic orientations of the university. The functioning of the management board is left to the internal regulations of each University. The universities' managerial autonomy is significantly constrained by the procedures in force regulating public money and controls by the Ministry of Finances. These procedures are frequently reported as one of the obstacles to research and technology transfer activities in Morocco.

Professors-researchers and researchers in public universities and organisations receive their salary from the government and not from the organisations they work for. Firing R&D personnel is extremely difficult and rare in public organisations.

Governance

According to the Law 01-00 regulating higher education and research in Morocco universities' management board should comprise 7 representatives of the socio-economic sectors. For smaller institutions not belonging to the university system, the management board must include 3 representatives of the socio-economic sector. The functioning of management board is left to the internal regulations of each PRO. Deans and rectors are recruited following a call for tenders.

3.3.3 Academic funding

Public money remains the main source of funding for Moroccan public universities. The innovation with regard to academic funding came with the Emergency Programme. Funds were allocated to universities according to the needs and objectives of the submitted projects. In the following years funding is expected to be linked to the rate of achievement of these objectives. Data on the share of institutional versus competitive funding are not available, but overall, from discussions with relevant individuals it seems that the lion's share of funding is institutional.

3.4 KNOWLEDGE TRANSFER

3.4.1 Intellectual Property (IP) Policies

In Morocco, Intellectual Property (IP) policy and IP management are still in their embryonic stage. The situation was very well illustrated in the conclusion of diagnosis study of the Moroccan incubation system (Bruhat et al., 2006). The main deficits can be summarised as follows:
- Knowledge and awareness of the importance of patents: Although, one of three basic principles underlying patent protection is novelty, there are still researchers who think they can protect their research results by patents after publishing them.
- The absence of IP professionals at the level of university, mainly those who are able to clearly identify the owners of the idea, to estimate their contribution to its implementation, to assess the business value of the idea and see the different ways of protecting it by a patent, to look for partners and/or negotiate license agreements.
-The lack of expertise and financial resources results in a low involvement of universities in the patent protection, which they perceive as a burden rather than a business opportunity. This situation led some of the few researchers interested in this type of protection to do so privately and at a national level.
- The absence of patent professional lawyers/engineers in Morocco.
- The absence of a legal procedure concerning the sharing of royalties among researchers and their institutions and the lack of guidelines for recognised good practices.

A study to enhance the legal framework of innovation within the framework of Morocco Innovation Initiative is currently being conducted and will try to address some of the IP issues identified above, at least from a legal perspective.

The Emergency Programme has as an objective of 300 university patents between 2009 and 2012. Based on data from progress reports, there has been a significant progress in patenting activity in the higher education sector (an average of 40 patent application per annum) but the objective of 300 patents by 2012 is far from being achieved.

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

Spinoffs

Morocco Spin-off/Spin-out and Incubation Network (RMIE) – Réseau Maroc Incubation et Essaimage: the network supports business incubation in general and technology transfer through university spin-offs in particular. It provides, among other services, pre-seed capital (up to €23,000) to cover pre-incubation costs. The network was launched officially in 2002 but started effectively in 2004 with the support of French cooperation. A diagnosis study of the incubation system has been carried out in 2007. The results showed that the incubation system lacks the necessary skills, means and legal as well as administrative environment to be effective and provide significant results. The recommendations of this study have not been fully implemented so far, most of the gaps and weaknesses identified five years ago are still valid.

INTILAK: Intilak is a part of portfolio of financial products developed within “Morocco Innovation Initiative” launched for the first time on July 2011. The support could reach €100,000 capped at 90% of the innovative project cost. The management at operational level of this measure is mainly carried out and coordinated by the *Moroccan Centre of Innovation* (CMI).

For early stage investment, there are three seed capitals that are operating in Morocco. Maroc Numeric fund is a new Seed capital endowed with € 10 m (Dh 100 m) launched in 2010. It is

hosted at Casablanca Technopark and managed by MITC CAPITAL, targeting exclusively IT start-ups at an early stage. This fund benefitted from the explicit support of the Ministry of Industry, Trade and New Technologies within the framework of its Morocco Innovation Initiative and Digital Morocco strategies. DAYAM Fund is a seed capital endowed with an envelope of € 5 m (Dh 50 m) was initiated by a private group called "Saham" in 2008 to support both financially and managerially (through Sherpa club) at an early stage innovative entrepreneurs. Dayam covers all the branches of industry. The OCP Innovation Fund for Agriculture is an Investment Fund of €20m created in 2010 by the worldwide leading phosphate company called OCP tasked with the mission of promoting innovation and entrepreneurship in the agriculture and agro-industry sectors.

Inter-sectoral mobility

Although highlighted positively by the *National Charter of Training and Education*, as a wishful component for the development of a national innovation system, in practical terms mobility of researchers is rather rare or inexistent.

Promoting research institutions - SME interactions

In broad terms, linkages between research and academic institutions and the business sector are still very modest. The first integrated programme to foster linkages between academia and business was launched in 2002 by the Ministry in charge of higher education and research and the Ministry in charge of Industry with the support of French cooperation. . The programme helped in many ways university transfer units, incubators, technology networks, technology dissemination, information diffusion and finally yet importantly networking. Although, the administrative, cultural, financial and legal frameworks were not conducive to innovation and technology transfer activities the programme helped set the first pillars for technology transfer and innovation policy in Morocco.

Morocco Innovation initiative launched in 2009 devised strong measures and financial Schemes (4 Innovations cities, clusters, grants for start-ups and applied R&D) to address the deficits of innovation system and to stimulate interaction between business and academia. Parts of these measures were implemented last year namely the launching of grants to support innovative start-ups and applied market-oriented research in companies (Intilak and Tatwir) and the creation of 4 clusters.

Involvement of private sector in the governance bodies of HEIs and PROs

As mentioned earlier, the Law 01-00 regulating higher education and research in Morocco universities' management board should comprise representatives of the socio-economic sectors. But from discussions with several stakeholders it seems that the effective commitment, contributions and impact on decisions making of these socio-economic actors raise some concerns sometimes.

Regional Development policy

As pointed out in Section 2.2 there is no regional development policy linked to RTDI, since research and innovation policies in Morocco are still fully centralised and managed by the relevant national ministries, intermediary organisations and agencies.

3.5 ASSESSMENT

The stock of researchers (37,246 in 2010) in Morocco is insufficient to face the steady increasing demand for higher education from high school graduates. This situation is

aggravated by the brain drain and the massive dropout rate of PhD students. Employment conditions in the public sector are globally favourable in terms of salary and stability but unsatisfying for mobility and openness to foreign researchers. Demand for researchers in the private sector remains marginal (less than 10% headcounts and FTE). Women represent 31% of the R&D labour force but there are no specific gender policies. Following the reform of the higher education system embodied in the adoption of the Law 01-00 in 2000 universities enjoyed more autonomy at the managerial and pedagogical level but this autonomy is heavily affected by the public control system at the operational level. The private sector was integrated more or less successfully in the governance of universities.

Higher education counted 478,000 students in 2010 distributed as follows: 420,000 in the university system, 22,000 in the non-university system and 36,000 in the private system. Morocco is a net exporter of students; it had 9,000 foreign students (2010) and sent 41,254 students to study abroad. According to policymakers and Emergency programme progress reports the results of the HE system were globally satisfying but in the quasi-absence of quality assurance mechanisms and relevant evaluation exercises it is difficult to tell to what extent the product of the HE system fits really with the requirements of a strong sustainable socio-economic development of the country.

HE is the main player of research, it counted more than 80% of R&D personnel (headcounts) and absorbed more than 45% of GERD in 2010. It is participation to FP programme is satisfying in comparison with other Southern Mediterranean countries. EU countries are the most important partners of Moroccan researchers. For historical, cultural and geo-political reasons France and Spain are the leading partners of Moroccan researchers.

In addition to the two traditional missions of production and dissemination of knowledge, the Law 01-00 recognised the third mission of the university and provided a legal framework to allow it contributing to the socio-economic development of the country. In this regard, several measures were devised since then to promote public-private knowledge transfer through technology dissemination, information diffusion, collaborative projects and university spin-offs. However, the unfavourable administrative, cultural, financial and legal frameworks combined with lack of technology transfer skills in the university and absorptive capacity in SMEs are still not conducive to innovation and technology transfer activities.

4 International R&D&I Cooperation

4.1 MAIN FEATURES OF INTERNATIONAL COOPERATION POLICY

There are no official documents that elaborate clearly on the rationales for international S&T cooperation and explicitly identify S&T priorities and target countries. For a long time, the S&T policy seemed to be more "de facto policy" than the result of a deliberate and evidence based policy. However, Morocco is aware of the importance of international cooperation especially with EU countries as source of funding and a mean for capacity building and excellence. The strategic vision of 2025 (Ministère de l'Education Nationale, de l'Enseignement Supérieur, de la Formation des Cadres et de la Rechercher Scientifique, « Vision et Stratégie de la recherche Horizon 2025, March 2006 ») stresses the importance of international cooperation and considers it as an under-exploited opportunity to diversify funding sources. However, the vision emphasises that the international openness of the Moroccan research system should be conceived in a way that serves the socio-economic needs of the country. Otherwise, Moroccan research will be reduced to doing outsourcing or off shoring research activities that are disconnected from the Moroccan reality, which was a common feature of a considerable number of research projects. International cooperation played an important role in the emergence of research activities within universities. About 75 % of references recorded by SCI (1998-2002), were co-authored by Moroccans and authors from a variety of countries. Hence, international cooperation was also a mean for capacity building and for many researchers the only way to access research platforms that are not available in the country. Others factors played an important role in shaping the S&T international cooperation of Morocco including the cultural and historical heritage (Strongly biased towards France and Spain the former colonial powers), the diplomatic agenda of the government and bottom-up forces from researchers. Morocco is currently seeking to expand and deepen its cooperation with other partners in the EU as well as promoting south-south cooperation and solidarity with emerging countries Arab countries and Sub-Saharan Africa (Work plan 2013-2016). The new (2013-2016) work plan of the MHESRPT insists on increasing south-south cooperation and establishing new partnerships with Maghreb, Arab and African countries.

S&T priorities are mentioned in some cooperation agreements but they are usually very broad and need more precision to serve effectively the interests of the country.

At the Mediterranean level, the Union for the Mediterranean (UfM) identified six concrete projects that reflect regional challenges of the Euro-Mediterranean region and should require trans-border cooperation as the UfM progresses in the following areas. They include: De-pollution of the Mediterranean, Maritime and land highways, Civil, Alternative energies: Mediterranean solar plan, Higher education and research: Euro-Mediterranean University, The Mediterranean business development initiative.

4.2 NATIONAL PARTICIPATION IN INTERGOVERNMENTAL ORGANISATIONS AND SCHEMES

Although not clearly stated in official documents various rationales ranging from political and diplomatic reasons to capacity building and access to networks of excellences could explain the participation to intergovernmental R&D organisations and schemes. The most important ones are as follows:

- African Regional Centre for Space Science and Technology

- The European Organization for Nuclear Research (CERN)
- The Organisation of Islamic Conference (OIC) Standing Committee on Scientific and Technological Cooperation for the promotion and cooperation of science and technology activities among the OIC member states (COMSTECH)
- United Nations Educational, Scientific and Cultural Organization (UNESCO),
- The Arab League Educational, Cultural and Scientific Organization ALESCO;
- Islamic Educational, Scientific and Cultural Organization (ISESCO);

4.3 COOPERATION WITH THE EU

4.3.1 Participation in EU Framework Programmes

FP7

Moroccan participation to FP7 is summarised in the following table. So far, 588 Moroccan applicants have co-submitted 475 proposals but only 125 applicants and 92 proposals survived the selection process and were mainlisted. The average success rate is 21,26%. 62% of successful proposals are under cooperation programme while 20% and 18% of the proposals belong respectively to people and capacities programmes. The total value of the projects is €333 m while the total Moroccan share of EC contribution was around €11 m until March 2012.

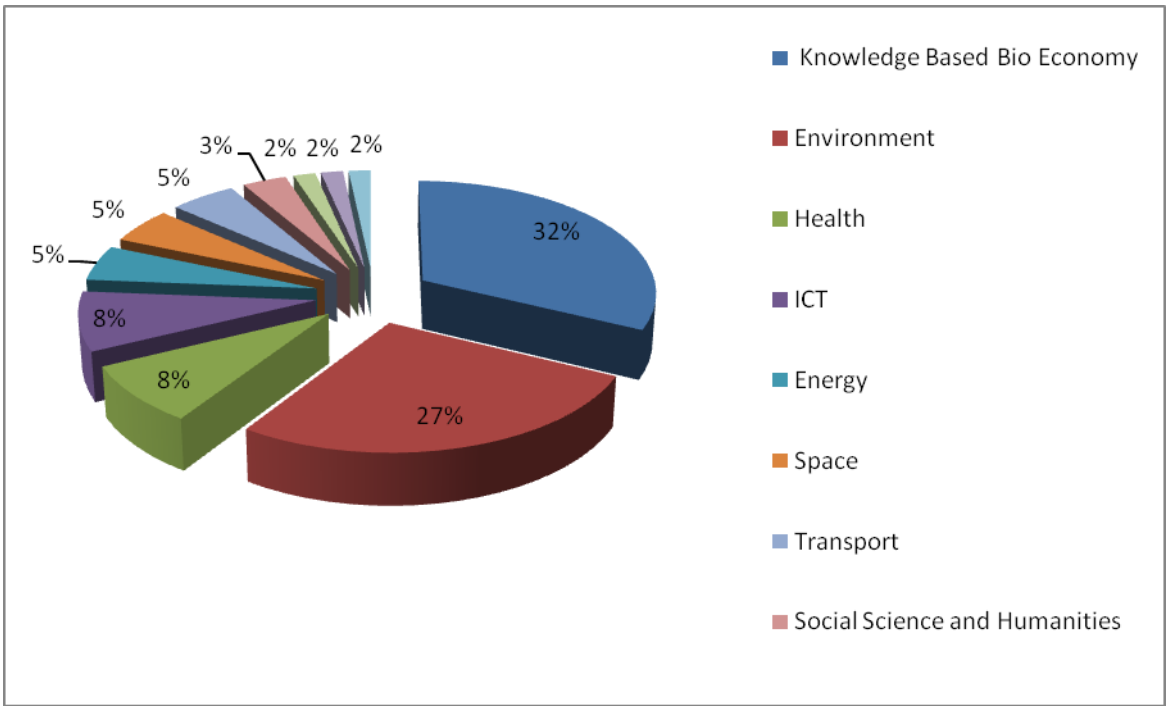
In terms of relative success, INCO was the most successful area in terms of success rates followed by People and Infrastructures. In the cooperation area Space, Energy, Health and Transport had a higher success rate indicating that this is the relative strength of the country. Conversely, Social Sciences and Humanities and New Materials demonstrate the lowest success rates.

Table 2 Characteristics of the Moroccan participation in FP7

		All submitted		Mainlisted			Success Rate: applicants in mainlisted proposal/ applicants in all submitted proposals - applicants from Morocco
Proposal SP Description2	Proposal Program	Number of Proposals	Number of Applicants	Number of Proposals	Number of Applicants	Total budget of the successful proposals	
SP1-Cooperation	ENERGY	20	28	3	7	11 146 104	25,00%
SP1-Cooperation	ENV	98	125	16	19	82 998 384	15,20%
SP1-Cooperation	GA	1	1				
SP1-Cooperation	HEALTH	19	23	5	5	18 130 659	21,74%
SP1-Cooperation	ICT	34	40	5	6	12 530 894	15,00%
SP1-Cooperation	KBBE	91	112	19	22	59 567 137	19,64%
SP1-Cooperation	NMP	10	11	1	1	4 264 323	9,09%
SP1-Cooperation	SEC	2	2				
SP1-Cooperation	SPA	8	10	3	3	97 478 193	30,00%
SP1-Cooperation	SSH	47	50	2	2	4 338 545	4,00%
SP1-Cooperation	TPT	13	19	3	4	722 877	21,05%
SP2-Ideas	ERC	2	2				
SP3-People	PEOPLE	50	71	18	32	6 812 577	45,07%
SP4-Capacities	INCO	20	30	9	16	19 310 387	53,33%
SP4-Capacities	INFRA	6	6	2	2	8 439 104	33,33%
SP4-Capacities	REGPOT	35	40	4	4	4 458 942	10,00%
SP4-Capacities	SiS	12	12	1	1	2 372 195	8,33%
SP4-Capacities	SME	5	6	1	1	1 306 250	16,67%
	Sum:	**473**	**588**	**92**	**125**	**333 876 572**	**21,26%**

The analysis of Moroccan participation across FP7 research fields shows a strong dominance of Knowledge Based Bio Economy (32%), Environment (27%) followed by Health and ICT with 8% each. These numbers confirm the trends of Moroccan participation in previous FPs as well as the relative importance of these themes for the EU.

Figure 3 Moroccan participation in FP7 across research fields



It seems that Morocco is reaching a ceiling with regard to FP participation. FP7 numbers are not very different from those of FP6. The National Information point sent a questionnaire to the Moroccan participants to FPs projects. 66% of those who filled out the questionnaire confirmed that the scientific content and networking are the main motivators behind their participation in one of the FPs (*http://www.pin.edunet.ma/default.php?p=bilan_pcrd*). However, 58% of interviewees judged the administrative procedures in general and the incompatibilities between the Moroccan administrative system and that of the EC administrative system as the main obstacles for higher success rates. In terms of funding, FP7 comes first compared to other international cooperation research programmes.

COST programme

As far as COST concerned, Moroccan participation is very new. Only 7 participations have been counted so far in the fields of natural and exact sciences. The average value of each project is €200,000

EUREKA programme

Morocco joined EUREKA for three years only (2003 – 2006). During that period, Morocco benefited from only 4 participations in EUREKA projects.

Twining Project

Within the framework of European Neighbourhood Policy Instruments (ENPI) a two-year project of institutional twining to support the Moroccan National Research System was launched on May 2011. The project has a budget of €1.35 m and brings together institutions from Morocco, France and Spain. An official presentation reporting the progress made so far

and detailing challenges ahead has been carried out and presented to the major players of the research system in Morocco on February the 14th, 2012.

The project consists of five major components namely:

- The approximation of the Moroccan legislative and regulatory framework with the "acquis communautaire" and EU standards;
- Strengthening organisational and institutional capacity of the Research Department;
- The development of an information and communication system for research;
- Strengthening the transfer of know-how, best practices and methodological tools associated with Scientific and Technological Research (STR);
- The approximation of the management methodology as well as programming, promotion and valorisation mechanisms of Moroccan STR to EU practices.

4.3.2 Bi- and multilateral agreements with EU countries

The Barcelona process signed in 1995 provides the political framework for Morocco-EU partnership. Within this framework, an S&T cooperation agreement was signed in 2003. The agreement promotes the opening of ERA and European Research programmes to the Moroccan participation. At a regional level, Morocco is a member of the MOCO (Monitoring Committee) which brings together representatives from EU member states and South Mediterranean countries to define the strategic orientations for Euro-Med S&T collaboration.

It was at the beginning of the '80s that scientific research became established as part of co-operation on higher education. The CNRST signed the first cooperation agreement with the French National Centre for Scientific Research (CNRS) in 1982. From the 90's and onwards, new scientific links were established between Morocco and its European neighbours. ASBIMED identified about 31 bilateral programmes between Morocco and EU member (France 14, Spain 6, Belgium 6, Germany 2, Portugal 2 and Italy 1).

Major bi-multilateral & programmes:

At ministerial level:

The most active ones are:

- Three (3) agreements were signed within the framework of Integrated Actions with EU countries. An integrated action is a project, which contributes to the development of training by research, which benefits the science communities in the two countries. It gathers one (or many) Moroccan research laboratory and another (one or more) from a foreign country to work on a definite research theme. This form of cooperation was started with France in 1982, and has grown to include a host of other countries, notably Spain, Italy, Belgium and non-EU countries Tunisia and Egypt. In 2010, Morocco has allocated a budget of € 250,000 to fund 201 selected projects: France (84), Spain (117).

- S&T Programme with Germany (2010). No thematic focus.

- FRAB (Fonds Maroco-Belge pour la recherche appliquée) programme with Belgium. A budget of €1.2 m to support 5 projects in different areas of R&D.

- PRAD (Programme de recherche agronomique pour le développement) programme with IRD (France). In 2011 about 10 projects were selected average funding is around €10,000 by project. The programme focuses on agriculture.

At CNRST level:

As a major operator of research, the CNRST signed several cooperation agreements between CNRST and other international research institutions for the benefit of Moroccan researchers. Putting aside some exception, the agreements covers mainly transportation fees and per diems. In 2012, the CNRST allocated € 255,000 to support collaboration with French institutions (CNRS, INSERM, INRIA) and € 49,000 to support collaboration with institutions from other EU countries, CNRi (Italie), DFG (Germany), FCT (Portugal), KOSEF (South Korea), ONRT (Hungary). CSIC stopped cooperation with the CNRST for 2012 most probably because of budget constraints in Spain.

INRIA: (€65,000 in 2012) it is a multilateral agreement that brings together researchers from three countries from the south of the Mediterranean (Morocco, Algeria and Tunisia) and three countries from the north of the Mediterranean (Spain, France and Italy. Thematic focus is ICT.
INSERM: (€8,100 in 2012). Focus on health sciences
CNRS: (€182,000 in 2012).No thematic focus
CNRi: (€20,000 in 2012). No thematic focus
ONRT: (€23,500 in 2012). No thematic focus
DFG: (€6,500 in 2012). No thematic focus

These bilateral agreements are usually managed through a joint committee that gather on regular basis to assess the achievements and select new projects for funding. As mentioned earlier, these bilateral programmes mostly support mobility costs.

4.4 COOPERATION WITH NON EU COUNTRIES OR REGIONS

4.4.1 Main Countries

Morocco has signed agreements with non-EU countries, with which it has strong diplomatic ties and usually cooperation in R&D was driven by a broader agenda at the political and diplomatic levels. These agreements are open to all fields of research and are not directed towards any particular grand challenge, the most important ones were with the following countries:

- Tunisia including a programme of integrated actions;
- Egypt including a programme of integrated actions;
- USA signed in 2006 but ratified by the American congress more than four years later

Since last year, the Ministry has been exploring or negotiating agreements in higher education and research with many nn EU countries such as Malaysia, Turkey, Ukraine, Japan, Oman, Saudi Arabia, United Arab Emirates. In this regard, the new (2013-2016) work plan of the Ministry of Higher Education, Scientific Research and Professional Training put a strong emphasis on expanding partnership to emerging countries such as BRICS countries, Argentina, Turkey, Malaysia. The successful catch-up experience of these increasingly knowledge-based economies is regarded as a model to emulate.

4.4.2 Main instruments

The agreements are managed by joint committees that convene on a regular basis to assess the progress made and select new projects.

In 2011, Morocco has allocated a budget of €140,000 to support 113 integrated actions with Tunisia (103) and Egypt (10).

4.5 OPENING UP OF NATIONAL R&D PROGRAMMES

National R&D programmes have first and foremost national focus and are not open to foreign countries.

4.6 RESEARCHER MOBILITY

4.6.1 Mobility schemes for researchers from abroad

With the exception of FINCOME programme (see section 2.2.3) targeting highly skilled Moroccans abroad (mainly researchers) to mitigate the effects of brain drain There are no schemes targeting researchers from third countries.

4.6.2 Mobility schemes for national researchers

Beside the bilateral programmes mentioned in Section 4 there are no other mobility schemes.

5 CONCLUSIONS

Morocco's R&D profile resembles in many aspects the R&D profile of other low and middle-income countries with visible features of rapid recent progress. Based on the findings of this report its main features could be summarised as follows:

- ✓ Morocco is making progress in the field of RDTI policy and increasingly diversifying support measures to RDTI activities but not fast and efficient enough to allow RDTI to drive effectively the sustainable growth of the Moroccan economy;

- ✓ RDTI priorities are too broad. A better definition of RDTI priorities is required to allow for better allocation of the rather constrained resources. In this regard, GERD represented only 0.73% of Moroccan GDP in 2010 and unless proper urgent measures are taken the higher education sector cannot meet the growing public's demand for higher education;

- ✓ Funding is mostly of public origin. The private sector does a little research, companies in the mining sector are the most active while most SMEs are behind the technological frontier, lack the absorptive capacity and suffer from the non-conducive environment (less competitive domestic market, low supply of highly qualified human resources, high cost of capital, etc.);

- ✓ Regarding the production of knowledge, the number of scientific publications is not increasing sufficiently fast to catch up with other African countries. Morocco is currently ranked 6th in Africa after being in the 3rd in the beginning of the last decades. Patenting activity in the sector of public research is still weak despite the slight increase in the last couples of years thanks to the Emergency Programme. The last three years were marked by major investments in higher education; the supply in terms of S&T graduates has more than doubled in the last decade. These numbers might outstrip the ability of the economy to provide jobs, which will aggravate the increasingly persistent phenomenon of unemployment or underemployment of university postgraduates. Conversely, given the quasi-absence of quality assurance mechanisms, the higher education system struggles to satisfy the demand for high quality degree required by the private sector. Many of prominent private firms turn graduates holding foreign degrees to satisfy their needs;

- ✓ Even when new relevant knowledge is created in pubic research, it is not commercialised most of the time because of lack of proper infrastructure and appropriate skills, the low demand from domestic market and the unfavourable administrative, cultural, financial and legal frameworks. Some relevant measures were taken to bridge some gaps in knowledge transfer and circulation within the framework of Morocco Innovation Initiative but it is a long term process and it is too early to expect a significant impact in this regard;

- ✓ The public sector is by far the major employer of researchers. Conditions of employment are satisfactory in terms of salary and stability but unfavourable towards cross border or public-private mobility;

- ✓ The higher education system has gained in terms of autonomy and openness of its governance to the private sector after the adoption of the Law 01-00 but this autonomy is heavily constrained by the public funding control system at operational level which put strong limits on its efficiency and responsiveness;

- ✓ Moroccan R&D is quite open to International cooperation. EU countries, especially, France and Spain are the major partners of Morocco. This cooperation is dominated by mobility schemes for knowledge exchange and does not provide for effective access and clustering of knowledge and innovation in identified and prioritised fields of interest to the Moroccan economy.

- ✓ Last but not least, the allocation of limited public resources and the effectiveness of their use is still a critical and unresolved policy issue in the absence of a sound and adequate evaluation mechanisms of the variety of STI policy measures undertaken so far and the needed administrative capabilities to deliver them effectively.

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7 List of Abbreviations

BERD	Business Expenditures for Research and Development
CERN	European Organisation for Nuclear Research
CNRST	National Centre for Scientific and Technical Research
COST	European Cooperation in Science and Technology
CPIRSDT	Permanent Inter-ministerial committee for Scientific Research and Technological Development
ERA	European Research Area
ERA-NET	European Research Area Network
ERP Fund	European Recovery Programme Fund
ESA	European Space Agency
ESFRI	European Strategy Forum on Research Infrastructures
EU	European Union
EU-27	European Union including 27 Member States
FDI	Foreign Direct Investments
FP	European Framework Programme for Research and Technology Development
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
IMIST	The Moroccan Institute for Scientific and Technological Information
IP	Intellectual Property
MASCIR	Moroccan Science, Innovation & Research Foundation
MCINT	Ministry of Commerce Industry and New Technologies
MENESFCRS	the Ministry of National Education, Higher Education, Professional Training and Scientific Research
MHESRPT	The Ministry of Higher Education, Scientific Research and Professional Training
MITNT	Ministry of Industry, Trade and New Technologies
OECD	Organisation for Economic Co-operation and Development
OMPIC	Moroccan Office for Industrial and Commercial Property
PARS	Scientific Research Support Programme
PRO	Public Research Organisations
PROTARS	Thematic Scientific Research Support Programmes
R&D	Research and development
RDI	Research, development and Innovation

RDT	Technology Dissemination Network
RMIE	Morocco Spin-off/Spin-out and Incubation Network
RTDI	Research Technological Development and Innovation
S&T	Science and technology
STI	Science technology and innovation
SME	Small and Medium Sized Enterprise
UfM	Union for the Mediterranean