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**PERSPECTIVES AND POLICIES FOR  
INNOVATION IN EGYPT**

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*To Dimitrios Anagnostopoulos*

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## ABBREVIATIONS

<b>ARTI</b>	Agenzia Regionale per la tecnologia e l'innovazione
<b>ASRT</b>	Academy of Scientific Research and Technology
<b>CIA</b>	Central Intelligence Agency
<b>DFG</b>	German Finance Association
<b>EIMP</b>	Environmental Information and Monitoring Program
<b>ESCWA</b>	Economic and Social Commission for Western Asia
<b>ETTIC</b>	Egypt Technology Transfer and Innovation Center
<b>EU</b>	European Union
<b>FDI</b>	Foreign Direct Investments
<b>FP7</b>	Seventh Framework Program
<b>GDP</b>	Gross Domestic Product
<b>HCST</b>	Higher Council of Science and Technology
<b>HLPD</b>	High Level Policy Dialogue
<b>IBM</b>	International Business Machines
<b>ICT</b>	Innovation and Communication Technology
<b>IP</b>	Intellectual Properties
<b>IS</b>	Innovation System
<b>IT</b>	Innovation and Technology
<b>MEDA</b>	Mediterranean countries
<b>MOHE</b>	Ministry of Higher Education and Scientific Research
<b>MOSR</b>	Ministry of Scientific Research
<b>MTI</b>	Microelectronics Technology Inc.
<b>NGOs</b>	Non-Governmental Organizations
<b>OECD</b>	Organization for Economic Co-operation and Development
<b>RDI</b>	Research, Development and Innovation
<b>RIS</b>	Regional Innovation System
<b>R&amp;D</b>	Research & Development
<b>SMEs</b>	Small and Medium-sized Enterprises
<b>STDF</b>	Science and Technology Development Fund
<b>S&amp;T</b>	Science and Technology
<b>STI</b>	Science, Technology and Innovation
<b>TIEC</b>	Technology, Innovation and Entrepreneurship Center
<b>TTOs</b>	Technology Transfer Organisations

<b>UK</b>	United Kingdom
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>USA</b>	United States of America
<b>VC</b>	Venture Capital
<b>WIPO</b>	World Intellectual Property Indicators
<b>WTI</b>	West Texas Intermediate

## **Abstract**

Innovation, high technology, research and education are key factors for increasing productivity, competitiveness and openness of an economy. The main question that will occupy us in this article is whether Egypt is able to assimilate practices with a basic direction of progress and development in the field of innovation. Specifically we seek if there are prospects for the development of society in the field of innovation and the policies that must be exercised to achieve the above objective. Critical issues to be examined are the conditions in areas such as human capital, business, culture, partnerships, entrepreneurship and the education system as well as whether they are suitable for the acceptance and promotion of technological changes and innovative actions. Moreover, a subject of research is the role of the European Union that actively supports Egypt during the recent years. In this effort to better understand the conditions it is necessary to look at the role played by knowledge, learning, and the absorptive capacity. In addition, information is given on the existing innovation system. With the process of SWOT analysis features that have a catalytic role in the development of society will be presented as well as the ones that hinder the advancement of society.

**Key words:** innovation, Egypt, Knowledge, learning, absorptive capacity, innovation system

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## **1. Introduction**

This paper deals with the issue of innovation in the country of Egypt. The survey aims to highlight the current situation in the country, and based on the findings a discussion will be held whether there are prospects for the country's innovation and the proper way of shaping policies will be researched.

The task consists of three chapters. The first chapter investigates the components of society in order to have a clear picture of the philosophy and culture of society. In the course, these elements will be part of SWOT Analysis. The second chapter is a discussion of issues highlighted by the bibliography as key factors influencing innovation activity. The concepts discussed relate to the transition process, the innovation system, the concepts of knowledge, learning and absorption capacity and finally the European Union's presence in the country of Egypt. Important is the process of SWOT Analysis in this chapter because through it, significant conclusions are exported that will lead us to answers about the basic question of the project on the prospects of the country. The purpose of the second chapter is to identify the factors which hinder and those that act as catalysts for the development of the country in innovation. In the third and final chapter is a discussion takes place on how to design the policies targeted at developing countries and on the specifics of these countries that must be taken into account.

Egypt is a developing country with a significant geographical location, a large population and size. Research on innovative activity in such a country is a challenge because it can give answers or to export generalized conclusions on innovation in such cases of countries. This is the reason for the choice of the specific topic.

The usefulness of this paper could be great since, if taken seriously, statistics, knowledge of the current situation and the proposals will be based on the true possibilities of the country and they could benefit the entire country significantly. This research will highlight the problems that exist and the positive elements that can be used to lead in a direction where knowledge acquired at the universities in technology fields can be implemented in industry.

Therefore policy makers will be benefited in order to create policies that give the green light to the development of the innovation sector. If the proposal on activities involving innovative procedures is accepted by all the people, businesses are benefited that will use a highly trained workforce that is able to innovate, resulting in increased productivity and industrial efficiency significantly. Benefits will also be available to universities and research centres to create a respectable image so that they can compete foreign universities and seek students from around the world. Finally, through this research overall the state could benefit since the economic development of a country is closely connected with the education and training levels as well as entrepreneurial activity.

The methodology used during the writing is to utilize sizes in the areas of industry, education and figures concerning the economy. The sources from which these elements are derived are the World Bank, OECD, UNESCO, ASRT etc. In addition considerable literature articles published in scientific journals have been utilized. Finally, there was an attempt to communicate with universities' research centres which did not work because there was no response from their side This in my opinion is one of the most important findings of this research because it exports directly to the conclusion that the country is closed and the mentality of the people leaves no room for communication Based on the above, research proceeded based on bibliographic sources and on the Internet.

## **2. The current situation in Egypt**

In the first chapter, the country of Egypt is introduced attempting to highlight the important aspects that influenced and contributed to the development of this project. Initially, some important data on population, geography, economy and the political situation of the country will be presented in order to better understand Egypt and put it in context.

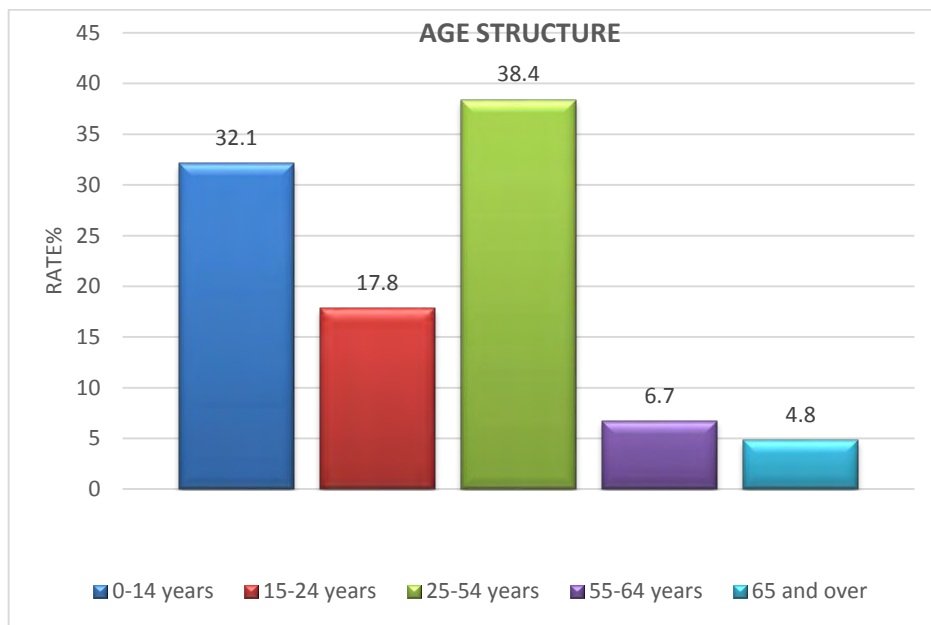
In addition, this chapter will examine the key areas that require further attention as they constitute an important source for answering the basic questions that trouble us about innovation and the future of the country. Particular reference to research and education is made, with a view to understanding the importance they have in changing the future of the country. Special attention is given to human resources; a sector of paramount importance because in reality it is a key factor of management which can be easily influenced. Moreover, we could not leave out entrepreneurship because it is the main objective when striving for development and a driving force of innovation. Furthermore particular emphasis is given to the field of ICT (Innovation and Communication Technology) which is the most successful story so far. Understandably particular focus is given to the universities and research centres especially focusing on their financing. We could not leave out the culture of the people who are closely intertwined with religion that significantly affects the lifestyle and behaviour of the Egyptian people. Finally, before summarizing, a presentation of the current situation of the country is taking place, referring to sustainability and whether there is an interest on the part of the Egyptian people for this. Closing reference is made to partnerships with other countries that might help Egypt take a leap of faith and enter a new era.

The conclusions from the above analysis give us the image of an intensive effort of a country in transition that is trying to comprehend and overcome the existing problems in order to strive for innovation and technology.

## 2.1. Key elements for Egypt

Egypt, with a population of 86, 9 million people, is the most multitudinous country of the Arab world. Its formal name is the Arab Republic of Egypt and Cairo is its capital city. The main religion is Islam (mostly Sunni) accounting for up to 90% of the country's population. What is extremely interesting is the age structure of the population with the 25-54 age group being the most numerous while the 65 plus age group accounts for only 4.8% of the population. In figure 2.1 the age structure of the country is presented in detail allowing the production of assumptions concerning the political and social stability as well as the economic growth of Egypt (CIA, 2010).

Figure 2.1: Age structure in Egypt



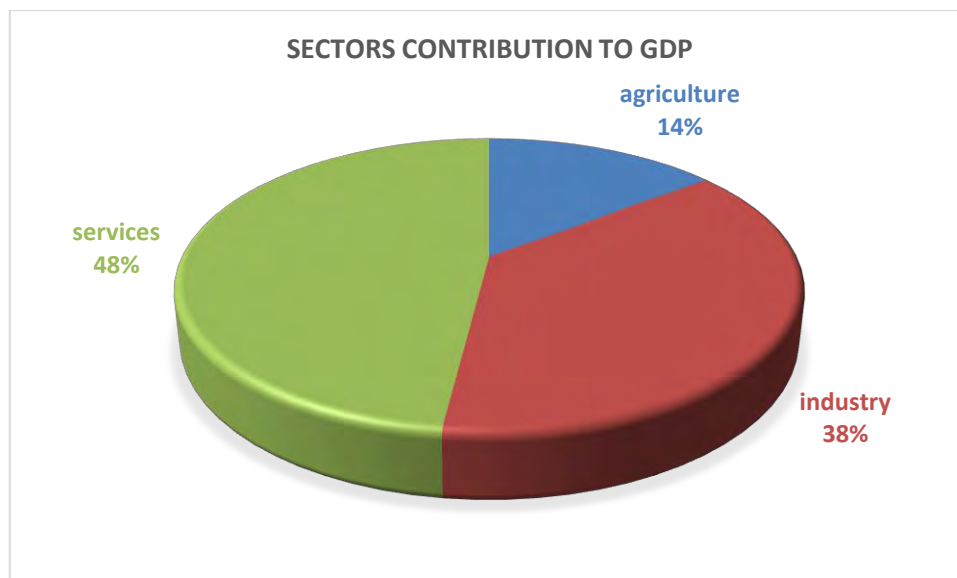
Source: (CIA, 2010)

The urban population is 43.5% of the total population (2011) with an annual rate of urbanization close to 2.04%. The official language is Arabic, while English and French are widely used and understood by the educated social classes. It is worth noting that 73.9% of the population is literate, out of which men account for 81.7% while women for 65.8% according to 2012 data (CIA, 2010).

As far as the geography of the country is concerned, Egypt occupies 1,001,405 km of land out of which 995,450 km are land and only 6,000 km are water, therefore the cultivated land is only 2.87%. It is divided by the extremely prosperous valley of the Nile, around which most of the financial activities take place. The natural resources of the country consist of oil, natural gas, iron ore, phosphorus, manganese, limestone, plaster, talc, asbestos, lead, rare earth elements and mercury.

The economy of Egypt has been significantly influenced by the political developments of the past years. The economic growth is slow but stable. The country's GDP is \$272 billion derived from agriculture by 14.5%, industry by 37.5% and from services by 48% according to 2013 data (Figure 2.2) while GDP per capita is \$6,600 (www.Egypt.gov.eg). The economic growth index reached 1.84% for 2014 whereas it is worth noting that inflation is 9%. (World Bank, 2014). Egypt exports oil, cotton, textile products, metal and chemical products mostly to Italy (8%), India (7%), the United States (7%), Saudi Arabia (6%), Turkey (5%) and Libya (5%) (Figure 2.3). Imports mostly concern vehicles and equipment, food, chemical products, timber products and fuel (CIA, 2010).

Figure 2.2: Sectors contribution to Egypt's GDP



Source: (CIA, 2010)

Figure 1.3: Egyptians Exports and Partners



Source: (CIA, 2010)

In our effort to outline the current situation in Egypt it is essential to acknowledge as a turning point the resignation of President Mubarak on February 11<sup>th</sup> 2011. This resignation was the outcome and a direct consequence of the turmoil and uprisings that took place earlier in Algeria and Tunis. After 30 years in power it took only 18 days of unrest for the fall of the Mubarak regime and the transfer of power to the army (Sigmalive, 2011). This uprising paved the way for the first free elections in the country during which Mohamed Morsi was elected as President. Following the protests against Morsi's authoritarianism and military coup took place in 2013 and Abdel Fattah el – Sisi won the presidential elections of June 2014 with a remarkable 96.1% (New York Times, 2014).

As time went by, it became clear that the revolution of the Egyptian people against the regime that was enforced on them was something more than simple, political reaction. It underlined the need of evolution on matters concerning innovation and technology that were virtually inaccessible for the Egyptian people in the past. Today, one could say, that the three decades of the former President's reign kept in darkness every effort for innovation thus the country's global innovation rating remained very low. Egypt is in the 113<sup>th</sup> place out of 142 countries concerning quality of its scientific research

institutions (Schwab, 2010). Hassan Azzazy, Professor of Chemistry and Associate Dean for graduate studies and research at the American University in Cairo, states about the political unrest: «*It was a business revolution*» (Bond, et al., 2012). Later, in order to keep his students interest on entrepreneurship and despite the lack of funding and the ineffective education system, he launched a campaign promoting entrepreneurship through teaching at universities.

## 2.2 Research and Education

There is no doubt that the country possesses a rich heritage concerning human resources, energy and intellectuals that can be trained so that the first indications of success towards the right direction can be spotted. That depends significantly on the degree of trust towards the new political order in the country and on the belief that research and science can truly become the driving forces of development and growth.

According to Dr Ismail Serageldin, the Director of Bibliotheca Alexandria, the country cannot achieve the desired results if it doesn't first ensure the expertise and accommodation of research (Serageldin, 2008).

It is therefore essential to explore the part of funding for research. At this point we should acknowledge the important bond R & D investment and economic growth to track down the evolutionary course of the country concerning research. So far, public funding for universities has been scarce and largely incapable of fully equipping university laboratories. In particular, in 2010 funding reached LE 2.4 billion while in 2011 it rose to LE 3 billion which represents 0.4% of GDP. What is hopeful is that the new President Mohamed Morsi promised a gradual increase in funding. Participation of the private sector is equally minimal reaching only 5% and as far as non-government institutions are concerned there are limited, individual funds available mostly for bachelor's programs and PhD scholarships (Bond, et al., 2012).

Nowadays, in Egypt there are 28 Government universities, 36 private universities and 187 research centres and institutes, with 11 of them affiliated with the Ministry of



Scientific Research and Technology (Table 2.4) (Deutsches Wissenschaftszentrum Kairo, 2014).

At this point, it is deemed necessary to shift attention to the presence of the Academy of Scientific Research and Technology (ASRT), which was founded in 1972 and that is essentially responsible for the country's science and innovation system. Its main aim and ambition is the promotion of innovation and the creation of a competitive business environment. Up until 2007 ASRT has been a financial provider and since 2007 its role has been converted to a political advisor and a think tank as well. In addition the Ministry of Scientific Research (MOSR) recently acquired a complete set of new responsibilities and is now the main supervisor of the Ministry of Higher Education and Scientific Research (MOHE), one of the main associates of MOSR. Its strategic goal is the advancement of a national policy for research and inquisitive strategies for public universities and institutions. They both strive for a new organizational and funding model clearly aimed at research and education, two sectors deemed essential for the advancement of growth and development. The above reform is systematically controlled by the Higher Council of Science and Technology (HCST) consisting of a team of Ministers and non-government experts.

The role of the funding mechanism is now taken up by the Science and Technology Development Fund (STDF) which was founded in 2008 based on the model of the German Finance Association (DFG). STDF distributes funds, incorporates programs and is in charge of joined research grants and international co-operations. Since 2000 an independent part has been established that has taken over the distribution of funds from the government, the European Union and the private sector and at the same time strives for the promotion of industrial competitiveness and the strengthening of the bonds between universities and the industry. Finally, the Research, Development and Innovation program was designed to promote the culture of innovation in the country and beyond funding to attempt the creation of strong bonds and networks among the institutions focused on the process of innovation.

There are currently clear indications of quality improvement in research as well as the assimilation of the business culture. One of the few ways and control indexes of innovation is the conversion of research results to products. In this sector there is a clear increase in patents and papers compared to 2007 (WIPO, 2011).

Despite all these efforts though, there is no indication of radical change. There are still factors functioning as setbacks in the developing course of the country. A typical example is the fear of transition from one state of power to another. In addition there is a class of people in key positions of the administration threatened by democracy. Reforms are always difficult as conflicting generations do not accept and recognize one another. Finally problems of illiteracy and contagious diseases are still quite present, slowing down the change of the system.

It is of the outmost importance for the government to pinpoint gaps in research and try to cover them. In the process people in charge should be extremely careful to correctly direct funding and research areas to get viable, productive results instead of wasting mental and financial assets.

Table 2.4: State funded and Private Universities in Egypt

State-funded Universities			
University	Year established	University	Year established
Ain Shams University	1950	Kafrelsheikh University	2006
Al-Azhar University	975	Mansoura University	1972
Alexandria University	1938	Military Technical College	1957
Assiut University	1957	Minia University	1976
Aswan University	2012	Minufiya University	1976
Banha University	2005	Port Said University	2010
Beni-Suef University	2005	Sadat Academy for Management Sciences	1981
Cairo University	1908	Sohag University	2006
Damanhour University	2010	South Valley University	1994
Damietta University	2012	Suez Canal University	1976
Egypt-Japan University of Science and Technology	2010	Suez University	2012
Fayoum University	2005	Tanta University	1972
Helwan University	1975	University of Sadat City	2013
Institute of Aviation Engineering and Technology	1997	Zagazig University	1974

Private Universities			
University	Year established	University	Year established
Alamein University	2011	Higher Technological Institute	1989
American University in Cairo	1919	International Academy for Engineering & Media Sciences	2002
Arab Academy for Science and Technology and Maritime Transport	1972 as an Arab League Organization	Misr International University	1996
Arab Open University	2002	Misr University for Science and Technology	1996
Ahram Canadian University	2005	Modern Academy In Maadi	1993
MTI University	2004	Modern Sciences and Arts University	1996
British University in Egypt	2005	Nahda University	2006
Canadian International College	2004	Nile University	2006
Delta University for Science and Technology	2007	October 6 University (O6U)	1996
Egyptian e-Learning University	2008	Pharos University in Alexandria	2006
Egyptian Russian University	2006	Science Valley Academy	2006
Cairo Private Technology Institute	1988 (closed as of 1996)	Sinai University	2006
El Asher University	2009	Thebes Academy	1990
El Shorouk Academy	1995	Culture & Science City	1992
Future Academy	1993	Université Senghor d'Alexandrie	1990
Future University in Egypt	2006	Université Française d'Égypte	2002
German University in Cairo	2003	Cairo Higher Institute for Engineering, Computer Science & Management	1995
Heliopolis University	2012	Modern University for Technology and Information	2004

Source: (Wikipedia, 2014), (Deutsches Wissenschaftszentrum Kairo, 2014)

### 2.3 Human Resources

It is a fundamental principle that economic growth and progress in general needs to be based on the reform of the educational system. That is owed to the fact that anyone who might examine the educational system of Egypt will arrive to the assumption that it is completely 'corroded' and significantly inferior to educational systems around the world. That is the direct impact of the significant decrease of educational funding that from 2002 until 2009 almost reached 3%. An inadequate, public educational system is the primary reason for the increase of private schools and consequently more inequality among the Egyptian people.

The problems are focused on the lack of infrastructure and design of an educational system capable of hosting and coping with the ever increasing population of the country. The country's population is growing. There is information about population and growth rate in Table 2.5. Additional weaknesses exist in the educational personnel characterized by the inability to inspire and to promote the mentality and culture of innovation and progress (Anonymous, 2014).

As far as the students are concerned there is an intense phenomenon of parroting combined with a lack of critical thinking and skills. Based on the fact that critical thinking dictates economic growth, the current situation is very unhelpful. In combination with the lack of equipment, passive learning can be a main inhibitor in the development and progress of the students. What is unreasonable though is the fact that educators are still influenced by antiquated teaching methods and resist modern practices that incorporate active involvement for all in the learning process. The lack of self-confidence and initiatives by the interested parties is attempted to be countered by interactive learning methods that are unfortunately still in an 'immature' stage (OECD, 2010).

As far as higher education is concerned, what seems very alarming is that despite the rise of graduates during the past few years, only a small percentage of about 20% deals with practical subjects that contribute to the advancement of technology and innovation. One more unpleasant phenomenon of higher education is the bad or inadequate choice of subjects. A characteristic example is the existence of not only a surplus of engineers but the fact that they are occupied as technicians (Gamal, et al., 2002). According to a UNESCO report, there is a general tendency in Arab countries to produce bureaucrat scientists and not experts with an innovative capacity for the private sector. (Table 2.6)The result is that the studies and training of the Egyptian people do not correspond to the needs of the industry, thus creating a major gap leading to delays in technological changes. On the other hand it is very positive that the government has acknowledged the problem and is striving to address it in the correct direction (UNESCO, 2010). In particular it is promoting a new model of technical education based on essential cooperation of the industrial clusters of schools and colleges located in the same area (Gamal, et al., 2002). Furthermore, it is trying to encourage researchers that have left abroad, through funding programs, to return and re-enter the academic community.

Table 2.5: Population and Growth Rate in Egypt

Year	Population	Growth Rate	Year	Population	Growth Rate
1960	27,997,745	N/A %	1988	54,011,214	2.34 %
1961	28,785,879	2.81 %	1989	55,207,254	2.21 %
1962	29,590,639	2.80 %	1990	56,336,614	2.05 %
1963	30,409,962	2.77 %	1991	57,387,589	1.87 %
1964	31,241,836	2.74 %	1992	58,370,712	1.71 %
1965	32,083,955	2.70 %	1993	59,307,778	1.61 %
1966	32,937,066	2.66 %	1994	60,231,864	1.56 %
1967	33,798,820	2.62 %	1995	61,168,397	1.55 %
1968	34,660,399	2.55 %	1996	62,123,592	1.56 %
1969	35,510,567	2.45 %	1997	63,094,069	1.56 %
1970	36,342,268	2.34 %	1998	64,084,443	1.57 %
1971	37,152,209	2.23 %	1999	65,097,777	1.58 %
1972	37,945,429	2.14 %	2000	66,136,590	1.60 %
1973	38,733,784	2.08 %	2001	67,204,189	1.61 %
1974	39,533,995	2.07 %	2002	68,302,914	1.63 %
1975	40,359,038	2.09 %	2003	69,432,477	1.65 %
1976	41,212,513	2.11 %	2004	70,591,288	1.67 %
1977	42,093,668	2.14 %	2005	71,777,678	1.68 %
1978	43,005,773	2.17 %	2006	72,990,754	1.69 %
1979	43,951,351	2.20 %	2007	74,229,577	1.70 %
1980	44,931,971	2.23 %	2008	75,491,922	1.70 %
1981	45,945,655	2.26 %	2009	76,775,023	1.70 %
1982	46,991,385	2.28 %	2010	78,075,705	1.69 %
1983	48,071,851	2.30 %	2011	79,392,466	1.69 %
1984	49,190,419	2.33 %	2012	80,721,874	1.67 %
1985	50,346,551	2.35 %	2013	82,304,023	1.96 %
1986	51,545,011	2.38 %	2014	84,549,112	2.73 %
1987	52,776,850	2.39 %			

Source: (World Bank, 2011)

Table 2.6: Graduates by field 1996 and 2006

Study Orientation	Theoretical Fields		
	1995/96 Persons	2005/2006 Persons	Change 1995/96-2005/06 Persons
Arts and Humanities	117,577	238,019	120,442
Domestic Management	4,588	3,638	-950
Tourism and Hotels	3,514	12,162	8,647
Education	123,338	201,169	77,831
Dar El- Uloum	8,336	16,729	8,393
Quran Knowledge	152	1,070	918
Artistic Education	1,707	1,576	-131
Musical Education	763	794	31

<b>Social Services</b>	11,360	24,422	13,062
<b>Archaeology</b>	1,939	3,919	1,980
<b>Mass Communications</b>	927	13,378	12,451
<b>Sufficient Productivity Institute</b>	10,037	4,992	-5,045
<b>Commerce</b>	192,077	462,603	270,526
<b>Law</b>	110,891	208,800	97,909
<b>Economics &amp; Political Science</b>	1,504	3,385	1,881
<b>Sharia &amp; Law</b>	18,754	46,177	27,423
<b>Languages(AI-Alsun)</b>	3,102	10,099	6,997
<b>Islamic Message &amp; Theology</b>	22,874	48,038	25,164
<b>Islamic &amp; Arabic Studies</b>	34,388	106,194	71,809
<b>Islamic Faculty for Girls</b>	2,613	8,990	6,377
<b>Arabic Languages</b>	15,118	37,204	22,086
<b>Languages &amp; Translation</b>	2,164	4,757	2.93
<b>Special Type Education</b>	0	30,339	30,339
<b>Kindergarten</b>	0	3,192	3,192
<b>Azhar Girls</b>	0	1,488	1,488
<b>Mubarac Police Academy</b>	0	5,708	5,708
<b>Total Theoretical</b>	696,839	1,516,353	819,514

#### Practical Fields

<b>Study Orientation</b>	<b>1995/96 Persons</b>	<b>2005/2006 Persons</b>	<b>Change 1995/96-2005/06 Persons</b>
<b>Medicine</b>	25,530	62,934	37,404
<b>Athletic Education &amp; Physiotherapy</b>	13,462	24,270	10,808
<b>Fine &amp; Applied Arts</b>	9,167	10,376	1,209
<b>Engineering</b>	45,120	98,382	53,262
<b>Agriculture</b>	20,222	24,902	4,680
<b>Pharmacy</b>	15,070	45,143	30,073
<b>Dentistry</b>	2,950	10,220	7,270
<b>Agricultural &amp; Environmental Sciences</b>	154	176	22
<b>Petroleum &amp; Mining Sciences</b>	841	1,943	1,102
<b>Veterinary Medicine</b>	28,681	46,240	17,559
<b>Construction Planning</b>	6,985	16,047	9,062
<b>High Nursing Institute</b>	244	934	690
<b>Technology</b>	5,340	9,521	4,181
<b>Technology</b>	1,519	13,018	11,500
<b>Total Practical</b>	175,222	364,107	188,885

Source: (Handoussa, 2010)

#### 2.4 The contribution of business

In the business sector there is an appetite for entrepreneurship that is not adequately fuelled. The lack of funding creates an environment in which retail businesses and services are the key players combined with an intense absence of the research industry. Egypt's exports in high tech products reach only 1% (World Bank, 2011). This is due to the low transfer rate of knowledge from the universities and research centres to the industry (Bond, et al., 2012).

Regarding foreign direct investments (FDI) despite having increased their rate, they have failed to transfer technology to domestic industries or investments in research and technology. The expected question that arises then is why they have not succeeded. Are foreign direct investments to blame that failed to come into contact with domestic ones, or did domestic investments not offer the opportunity with the business environment of the country lacking the ability to absorb new ideas, to create innovation transfer systems and communication channels; It is worth noting here an example that raises several concerns. The pharmaceutical industry in Egypt produces drugs already commercially available. It doesn't make new ones. This is for two main reasons. The first is the bureaucracy and the second the failure to protect copyrights and patents. The Egyptians have not even given a clear answer on how to commercialize the research (Bond, et al., 2012). The major focus is on the results of the investigation and not in the way it would be able to get into the market translated as a product. According to Azzazy the problem stems not from the lack of knowledge but from the lack of information.

The lack of motivation and indifference are the two reasons that keep academia and research from collaborations with industry. Moreover bad attitude and the refusal of businesses to fund research and development interrupt each connection attempt and collaboration with research centres and universities (Hattab, 2008) (STDF, 2012).

The attitude of the Government towards the commercialization of research does not favour any circumstances. Besides the minimal funding another important setback poses the stiff and not convenient legislation. A typical example of non-support of the government is the University of the Nile, to which, despite the fact that it commercializes research; the government is offering very low funding for this effort. And the most unpleasant is that this university which has helped to link the country to

the outside and has signed contracts with multinational companies is under threat of being dismantled (Bond, et al., 2012).

An important step has been taken on the part of universities in an effort to link their operation and their research with the industry and that is funding achieved by the EU's TEMPUS program.

An equally important achievement is considered the funding achieved by the Assiut University from the sugar industry to conduct research on the subject. In the scene we must add one more positive development on self-financing. The businessman Ahmed Bahgat is one of the few who have invested in R & D. He produced a new lightweight fire resistant building material out of limestone and scrap aluminium (Bond, et al., 2012). This puts into play the private sector and from now on it is a challenge for the future development of the country in the field of innovative products and research.

## 2.5 The success story of IT

The sector which was particularly successful in the country of Egypt is undoubtedly the ICT sector (Innovation and communication Technology). In the period 2005-2011 ICT companies doubled in number. The country attracted a large number of companies now including Microsoft, Ericson, Vodafone, Intel and IBM. In 2010 the country was among the top five outsourcing destinations. For the period 2010-2014 an increase is projected from \$ 1.4 billion to \$ 2.6 billion (Egypt Information Tecnology Report Q4, 2010). One reason that Microsoft decided to invest in Egypt is the government's commitment to use as a driving force for development the IT sector. This commitment was reflected in 1999 in a national plan for development with the signing by the Ministry of Communications and Information Technology. The foundation of the Smart Village and the IT Park is proof of the continuing effort made by the country for the further development of the sector in which it seeks to provide definitive solutions for the problems in agriculture, health, society and the economy.



In addition, the Technology Innovation and Entrepreneurship Center (TIEC), with the full support of the government, makes steps to create the right business environment and promote a culture of entrepreneurship and innovation. TIEC is currently encouraging three incubator programmes. Smart ID Systems provides biometric security and identification services, Damlag operates the largest Arabic movie database and Apricot has developed a tool to allow 3D characters to talk in Arabic with full lip synchronisation and facial mapping. An equally important incubator program is that by Plug and Play, a community of technology startup companies, entrepreneurs and investors in Silicon Valley Egypt. Its purpose is to direct funding and support 80 startup companies (TechWadi, 2011). The primary goals of this effort are the establishment of innovation through the Smart Village Center and the reintroduction of the country as a leading regional hub for ICT based innovation and entrepreneurship by 2014 (TIEC, 2011).

## 2.6 Universities and Innovation Centres

Upper Egypt is not as developed as Lower Egypt. This is not just about the indicators but also universities and research centres and the funding they receive. Disparities between universities are intense. Some of them are struggling to make ends meet and to cope with the basic obligations towards their students. There is a great need to finance them so as to cover their serious lack of equipment. According to Fayez El – Hossary, who is the dean of Sohag's faculty of science, Egypt has very good scientists who have demonstrated their abilities in the research labs, but with low wages and serious deficiencies in infrastructure and equipment, most choose to go abroad. This is one reason why the country has lost a significant number of competent scientists (Bond, et al., 2012). An important progress is the launch of STDF (2008). Through this the government essentially accepts that it is necessary to take action for better research. Before STDF and the RDI program was only provided to well-known institutions. Unfortunately, the mentality has not changed yet. Although there are hopes, disparities still exist. STDF insists on supporting more universities and research centres of Lower Egypt.

The good news is that even in such a special environment with many prejudices, with low wages and no competition, there are Centres of Excellence that promote growth. It is worth mentioning that such a centre is the Smart Village on the western outskirts of Cairo, home to a cluster of 130-odd multinational and local companies including Ericsson, Hewlett Packard, Microsoft, IBM, Mobinil, Microsoft, Intel and Telecom Egypt. It is worth noting that two new Smart Village business parks are being designed at Dammieta and Alexandria, which are expected that by 2015 will increase employment from 40,000 people currently employed to 100,000 (Deutsches Wissenschaftszentrum Kairo, 2014).

Remarkable is the Cancer Biology Research Laboratory of the University of Cairo, where the scientific staff and researchers have published in many international and Egyptian magazines. Current project is about breast cancer cells and their behaviour in different environments. The project stems from a \$160,000 scholarship that Dr Mona won from the Avon Foundation's American Association. The problem of the laboratory is a serious shortage of equipment (Bond, et al., 2012).

The Analytical Chemistry Unit, Assiut University, is a laboratory of the State which undertakes projects from the industry. It is funded by the state, the university and external customers. The unit has laboratories accredited by the American Association and what is wonderful is that research here has results in practice as well (Bond, et al., 2012).

The City of Scientific Research and Technology Applications was established to meet the needs of the industry. It is active in covering genetic engineering and biotechnology, advanced technologies and new materials, arid land and agriculture and IT. The government took the initiative to create a department that encourages the industry to engage in the process of research and to promote investment. Many businesses have already signed (Azab, 2014). The Aswan Heart Center is a hospital specializing in heart diseases and its laboratory conducts research on diseases of the heart and genes. The financing of both comes from individuals (Yacoub, 2013).

Finally, there is an important revolution of nanotechnology in the country of Egypt. The company Nano Tech is a private investment of Ahmed Bahgat, one of the most

successful entrepreneurs. The company is a part of an industry group which conducts research applied in the fields of nanotechnology. As it was seen as a significant move in the sector, whose research requires special equipment, financing was undertaken by UNESCO and STDF (Bond, et al., 2012).

## 2.7 Egyptian Culture

After the revolution and the fall of the Mubarak regime, which as mentioned above was a revolution acceptance by all of science and technology, the country is going through a transition, but to which the balances are still fragile. This point is a transition that should be used appropriately to benefit these areas and thus to justify and mark a new era. Maged Al Sherbiny, President of the ASRT said that: «*There is no turning back now. Nobody can say anymore that science and technology is not important*» (Bond, et al., 2012). Ramy Aziz, a lecturer in the faculty of pharmacy at Cairo University said: «*The biggest thing of the revolution was the glimpse that we can change things, and that nothing is going to get fixed if you don't go out onto the streets*» (Aziz, 2014).

Early efforts have resulted in a significant reduction in bureaucracy, increasing the contact time between academic institutions and the industry, the increase of salaries and research projects. Finally through these points comes the need to reform curricula. To ensure a successful outcome requires a sustained commitment and support from the government in the direction of the overall cultural transformation. This is useful because until now there has been no understanding of the importance of science (Yahia, 2014). Despite the improvement in the quality of life of people and the different angle from which research is faced, long and laborious work is still needed to get the country out of this transition to a new era of research and science. At this point it is worth mentioning that those involved in the relief of citizens out of poverty - which is essential for a country with a low standard of living - have not yet connected their critical role with the development of research (Bond, et al., 2012).

Important is the attitude of journalism on research and technology because it is the connective tissue between the research and the public. Despite the strong interest of journalism in research, the quality of reports has been bad because journalism is

imprecise and unclear. This is due to three main reasons. One of them is the lack of training of journalists. The second is the fact that journalists are subservient to the government and the third is the suspicion of the academic community towards media. Although the interest in science increased after the revolution and the media supported and raised enough attention, the university community refuses to accept a long and serious communication with them so that no inaccuracies will be passed on to society (El-Awady, 2009).

A critical part of Egyptian culture is shaped by religion. Their religion is very strict in some areas and sometimes contradictory phenomena arise even within research centres. For example during the development of a major research people should discontinue from their duties for their established prayer (Bond, et al., 2012). Important is also racial discrimination stemming from their religion. Women are under-represented in leadership positions, because they have less access to education. This is due to the perception that the woman has serious commitments at home that make it unable for her to pursue a successful career. In addressing these prejudices an important role is played by non-government organizations (Handoussa, 2010). Despite the limitations of religions on issues related to new ideas, in recent years trying to coexist science and religion. This seems to be a success given that the lack of receptivity of new that characterize the Islam (Masood, 2006).

The inviolable hierarchies even within universities suffocate and strangle many efforts for innovation. These changes are gradual and relatively slow on related topics. For example a new law according to which the President - Dean of the faculty will not be appointed anymore by the government but will be elected by the university. This is a threat to many since in Egyptian culture no competition is desirable. Competition is avoided and had never promoted or common in such conditions. This law promotes key changes. Moreover, in a perspective of law development it includes the autonomy of universities up until now directed by the Ministry. Persons who were appointed to the universities were chosen by governments and central role played their political beliefs and affiliations (OECD, 2010).

## 2.8 Sustainability

According to the World Development Indicators of the World Bank agriculture contributes about 14% to the country's GDP (WIPO, 2011). Wheat is the main product produced in the country. At the same time there are other crops such as sugar, cereals, vegetables and fruits. Despite all these, grain for example, which was exported, is not worth any more producing such large quantities because at the international market it is available at much lower prices. It is worth emphasizing that Egypt supplies wheat to the USA. The commercial law of the USA helped Egypt after being allowed to enter duty-free (A.R.T.I, 2008). In addition the availability of water is limited as time goes by which intensifies efforts towards better use of land and aquatic environments. The water issue is crucial for agriculture since farming is responsible for 80% of its consumption. The significant lack of water makes imperative the need for drastic measures by the government and a National Water Plan for better water usage and the production of new sources (Simas, et al., 2009).

The climate change is projected to bring a reduction in crop productivity and further reduce resources (Egypt National Cleaner Production Center, 2008). If you combine this with the growing population of the country, there is a risk of increase in malnourished people. The contribution of science and research to address problems of climate change is important. The nanotechnology researchers are already working in this direction. Unfortunately, the world has not realized the need for new energy sources. Some efforts of public awareness on climate change have been made through the educational system but are still in their infancy (Bond, et al., 2012).

It is also important in this field that agricultural biomass remains largely untapped. Moreover, as already mentioned Upper Egypt lags significantly compared to Lower Egypt, therefore critical is the Toshka project (Water-technology.net, 2014) aimed at developing and using the desert as a positive element of the country. The deserts despite the vision to become a beneficial piece of land, the largest expanses are exploited by the elite who convert them into tourist resorts (A.R.T.I, 2008).

## 2.9 Collaboration with other countries

In recent years, the emphasis is on teaching courses on new technologies and teamwork theory (Erasmus+, 2014). This results in better cooperation between groups of mechanics, not to work in isolation and not waste resources.

Partnerships with the West and other countries might be the key to the development of the country. Already Egypt sends human capital in Saudi Arabia and is a connective tissue between North Africa and Middle East. The positive is that the country has managed to triple the subsidies it gets from European countries but also from other countries by signing bilateral programs. A typical example of countries are France, Germany, Italy (A.R.T.I, 2008),, the United States, Canada, China and Australia. The peculiar at this point is that Islamic countries although they have a lot in common and many common interests and problems, they do not cooperate with each other to a large extent. There are no channels and paths to diffuse knowledge and experience between these countries. In conclusion, Islamic societies were and remain closed (Bond, et al., 2012).

Egypt is working hard and has the potential to open more than other Islamic countries. Europe for its part needs scientists. It also understands the great differences in human capital of Egypt in this regard, compared to India's and China's. Professor and Chair of the Academy of Scientific Research and Technology Maged Al - Sherbiny sends an open invitation to international level but mainly addressed to Europe by saying: «*Now is a very good time to form research partnerships in Egypt*» (Bond, et al., 2012).

## 2.10 Conclusions

The revolution in Egypt has brought to focus technology and innovation. However, the need to make the country competitive in science is very critical. The road to this achievement is long and arduous. Egypt is still in a transition that should be used and exploited appropriately and rapidly in order to achieve a significant position in a globalized and highly competitive environment (A.R.T.I, 2008, Bond, et al., 2012, STDF, 2012).

The beginning for the transition happened. But basic assumptions such as the learning, knowledge and absorption capacity originally reported have not been embedded and understood even by society. This may be due to the situation that existed for years and the closed society that characterizes the country. Concepts such as channels and pathways between businesses, people, countries and universities seem to be unfamiliar words. The effort made is admirable and worthy but should all be assimilated by the actors. So far all that happens is passive and is still in its infancy. Of course there are significant movements of people, universities, and government agencies, but they give the impression that there is no coordination. Instead there is still anarchy and disorder in efforts to create an environment suitable for exercising entrepreneurship and innovative products (STDF, 2012).

As far as the existence of an innovation system in the country is concerned, it seems that the components exist. Missing, however, are the good level of interaction and the common purpose that would operate the system to generate results. That is innovation and technology.

The big gap comes from the serious lack of funding and that is why there is an urgent need to focus on finding resources for the actors to function properly. In this the key role is played by the government in order to support these actions and take up a strategic development plan adapted to the new reality. Apart from financing, the government should take steps against the bureaucracy that hinders the development of the country, to form stronger ties with the system and to strengthen the institutions that promote the development of Egypt. This task is quite difficult since the area has a past in which the state was strong enough and citizens willingly and faithfully followed power and the competition concept was unknown.

Closing, according to Jim O'Neill, Egypt despite political instability, corruption, poor education and non-use of technology has been identified as a growing market. It belongs to the N - 11 fastest growing countries that can have a global impact comparable to that of BRIC. Particularly for Egypt it is expected to come to the forefront not only for the \$ 200 billion that characterize the size of the economy but for the 80 million population and a significant presence in the developments in the Middle East. The possibilities for improvement and possession of a country's dominant position in the international environment are there. A prerequisite though is improving microeconomic variables (inflation, debt, investment, external indebtedness, openness of the economy and macroeconomic variables, mobile phones, computers and internet, life expectancy, education, law enforcement, the corruption fight and government stability) otherwise possibilities remain possibilities (O'Neill, 2011).

Instability in Egypt influenced the price of oil. Brent crude oil had traded at around \$109.67 per barrel and up roughly 3.6 % since Mohammed Morsi's ousting on July 3. Meanwhile, WTI (West Texas Intermediate) oil has risen by around 6.0 % and traded at \$107.32 (Barnato, 2013). Egypt isn't among the Middle East's major oil countries, but it controls the Suez Canal since 1956, a vital choke point in the worldwide distribution of petroleum resources (Unger, 2013).. According to Jim O'Neill: «*The political upheavals that occurred in Egypt had a serious impact in the Middle East since they influenced the price of oil. But if these historical events improve the development environment of the country they will be worth it*» (O'Neill, 2011).



### **3. Analysis of current situation based on key concepts of literature**

In this chapter an effort will be attempted to assess the situation in Egypt and the challenge of moving on and having a balanced transition from the current system to a different, new and promising system which will be capable of upgrading the national innovation system that's giving Egypt the profile and momentum of a powerful country in the innovation sector.

The first question that arises is what will continue to exist from the old situation and what new and innovative will be imported to the environment that will also be the foundation of a new system. We will therefore examine the concept of transition and moving on from one situation to another. A basic characteristic of this process is the powerful interaction between systems, actors, rules and institutions as well as their influence on the selection environment (Geels, 2004). The selection environment is not just the environment that consists of the markets and the users but also one that encompasses their policies, institutions and regulations as well as their structure, culture and maintenance resources.

Another enquiry that we will also try to answer is what can policy exercising institutions do in order to boost innovative activities in the area of Egypt, aiming to promote development of the country and the securement of a competitive position in the international world. It is therefore basic to understand how innovation can be achieved. There is already an innovation system in the country that will be examined.

As far as innovation systems are concerned they have been defined as the networks between institutions of the public and private sector, the activities and interactions which import and produce new technologies (Freeman, 1987). The system consists of ingredients and tacit or uncodified relationships between the two sectors, serving communication between them (channels, institutions etc.) consisting a whole. Ingredients of the system can be universities, government organizations as well as other institutions public or private. They all participate in the system and interact. The system has one function and one aim. It is capable of innovation, knowledge creation and of technology and research production (Edquist, 2005).

The carriers and actors will have to find the proper channels and the ways of communication in order to transfer knowledge, learning and experience aiming to the development and the promotion of the new environment. At the same time with the flow of knowledge there has to be the infrastructure through which knowledge will be transferred, that is why societies have to take care of ensuring both at the same time. In authoritarian systems that are based solely on the concept of state in order for technology and innovation to be promoted, the active participation of the government sector in the evolutionary process is demanded.

The capability to innovate is based on learning that is focused on an absorptive capacity. Learning is extremely crucial as a factor and is the main contributor to the production of knowledge. Knowledge is cultivated in universities and comes into existence in industries through the production of innovative products. Furthermore learning is a cumulative process while knowledge requires an absorptive capacity (Cohen & Levinthal, 1990). If we therefore suppose that knowledge is a club, if there are no exclusions and society has strong rights of access to it, it will also have the opportunity to innovate (Cohen & Joly, 2001). Additionally the role of the European Union is of paramount importance as it can financially support Egypt in this endeavour.

In an attempt to answer the above questions we will discuss and analyse basic concepts and theories. As the second chapter unfolds we will try to analyse the current situation using swot analysis as a tool. Hopefully in this way an assumption will be reached on whether there are any hopes for this country to rise to an important region and whether it can overcome the problems it faces and shortly move on to a new era.

### 3.1 The process of transition

Classical theory claims that the issue of transition is closely connected with that of growth and emphasized on the static technical features of economic systems. Trade, labour specialization and improved transportation, were rightly considered conducive to growth and higher living standards (Rodríguez & Rodrik, 2001). Therefore societies should seek the minimum conditions and of how they can be obtained (Colombatto, 2001). According neoclassical theory the growth becomes the inescapable consequence of transition. Although neoclassical theory remains inadequate is accepted that in

transition countries, foreign aid is to soften the adjustment-cost problems that the institutional shocks generate (Colombatto, 2001).

The concept of transition concerns the passing from one situation to another. During the process of transition to the ecosystem, the actors primarily change and then based on the influence and power they have and can exercise on the ecosystem changes the environment as well as. The basic characteristic of this process is the strong interaction between systems, the rules, the players and the institutions (Geels, 2004). The process of transition therefore demands a proper management so that activities can be reassigned. Important roles in the creation of the new environment have institutions as they can contribute to the dynamic evolution and the coordination of activities (Geels, 2002).

Societies do not have to be closed but interconnectivity and communication amongst them is necessary. The same should take place at the lower level that is the internal issues of the country. For the progress of mankind at the local level a leading subject is territorial innovation in all its dimensions. The subject concerns international bibliography vividly and seems to be of paramount importance (Moulaert & Sekia, 2003).

Coming back to our initial claim concerning a change of the actors in the system aiming to achieve transition, we will have to examine the interaction among them. Therefore, besides the simple participation of players within the system, intense interaction, good communication and mutual trust are demanded.

### *3.1.2 Innovation systems*

Based on the definition termed by Freeman in 1987 for the National Systems of innovation, which are characterized as networks through which activities and interactions export and create new technologies, we understand that there is an anxiety for a superior activity concerning technology and innovation. Innovation systems can be national, local, divided by sector or technological. Despite that, they all aim at the creation, distribution and use of knowledge. They consist of their vital ingredients and the relationships between them (Carlsson & Stankiewicz, 1991). When functions in the

IS, organizations, institutions and interactions or links between these elements in the system of innovation may be inappropriate or missing, the innovation system fails. All the above are vital elements of the system (Edquist, 1997). The basic functions of innovation systems are to create new knowledge, guide the direction of the research process, the supply resources for example capital, competence and other resources, to facilitate the creation of positive external economies (in the form of an exchange of information, knowledge and visions), and to facilitate the formation of markets. Furthermore, Edquist in the same project pointed out all the main economic or political, social and organizational as well as the institutional and other factors that contribute to an innovation system and influence the distribution and use of innovation. He therefore coined a wider definition.

In the Scandinavian approach, the interactions developed among the actors have two dimensions. One concerns the way production is structured and the other the founding institutions that will contribute to an improved operation of the systems (Lundvall, 1992). Production is closely related to culture. To be more specific social culture is converted into technological culture through technological orientation offered by the educational system. Consequently education will lead the country beyond technological progress and into technological change. In innovation systems is, therefore, of extreme importance the ability to strengthen both systemic learning as well as interactive innovation (Cooke, et al., 1997). The structure of the country, the income and its behaviour in the development of technologies determine its attitude in the development of innovations and technology that concern not only the product but also the process of production. Furthermore elements that have a main role in the proper function of the system are the quality of education and expertise, the institutions and foundations that exist in the country as well as the framework in which economical and commercial policies are exercised. The study of these elements in 13 countries of different income and development has confirmed all the above (Nelson, 1993).

In 2002 Freeman inserted into the discussion the factor of the R&D organizations that influence innovation systems. «... *R&D organizations are embedded in a much wider socio-economic system in which political and cultural influences as well as economic policies help to determine the skill direction and relative success of all innovative activities*» (Freeman, 2002).

Based on the above it is understood that the system is created, preserved and improved based on the behaviour and the presence of two different dimensions. One dimension concerns the players, i.e. the businesses, the universities, the research centres, the corporate R&D facilities, the financial institutions, the public policy agencies and the unions. The other dimension is the institutions that are differentiated depending on the country or the province and are formed based on the culture, norm, laws, rules and the rights of every player. Institutions based on the definition provided by Edquist are: «...sets of common habits, norms, routines, established practices, rules or laws that regulate their relations and interactions between individuals, groups and organizations» (Edquist, 2005).

What is required though is not just the creation and function of an innovation system. What is more important is the viability of the systems so that we can have the required developmental result. The four basic criteria for the design of a successful innovation system are:

- The importance of peripheral circles as the material for corporate economy and regional value creation
- Balanced employment situation
- Balanced development of infrastructure areas with indirect relation to innovation
- Quality of regional knowledge transfer from customers' (enterprises) point of view

Furthermore there are five driving forces which are based on different approaches that characterize theories about innovation and organizational development. These are:

- Binding effect of explicit normative vision
- Density of RIS discourses
- Enlistment of RIS promoters
- Intensity of information exchange between RIS
- Intensity of organizational cooperation between RIS

Assuming that all four criteria are met, the sum of approaches can offer us the desired result for a fruitful and successful innovation system that will be the source of growth for a country (Gerstlberger, 2004).

If we accept that national innovation systems create important conditions for the advancement of technology and innovation then we can understand the catalytic role of them in the growth of the country and improvement of the quality life of the people. This acceptance urges governments to design and implement policies towards this direction. Bibliography has recorded several views on this subject. What is troubling though is whether we can finally have a design framework. In this way, based on successful examples from other countries the process of design could become much easier for the institutions that create policies. If we assume that innovation is a phenomenon partly and geographically incorporated and that furthermore different regions present dissimilarities, then we cannot have a model for policies. The only thing that developing countries could take advantage of or even imitate from developed ones, are the tools used in the creation of policies aimed at the promotion of innovation and technology (Isaksen & Nilsson, 2013).

### *3.1.3 The Egyptian innovation system*

Egypt occupies the northern part of the African continent and is lucky enough to take advantage of the fertility of the ground offered by the Nile. There most of the financial activities of the country take place. During the period of 1985 to 2005 the government, taking into consideration its geographical position, decided to exercise long-term policies of innovation. For the success of the current achievement crucial reforms in the economy took place, an economy that some time ago was authoritarian. The result is Egypt currently enjoying a mediocre but stable growth (Hahn & Meier zu Köcker, 2008). Of course in comparison to Maghreb countries like Morocco, Algeria, Tunis, Libya and Mauritania it seems like Egypt has opportunities of improvement because despite the growth of the real GDP, GDP per capita is extremely low compared to these countries (Table 3.1).

Table 3.1: GDP and GDP per capita for Maghreb Countries 2013

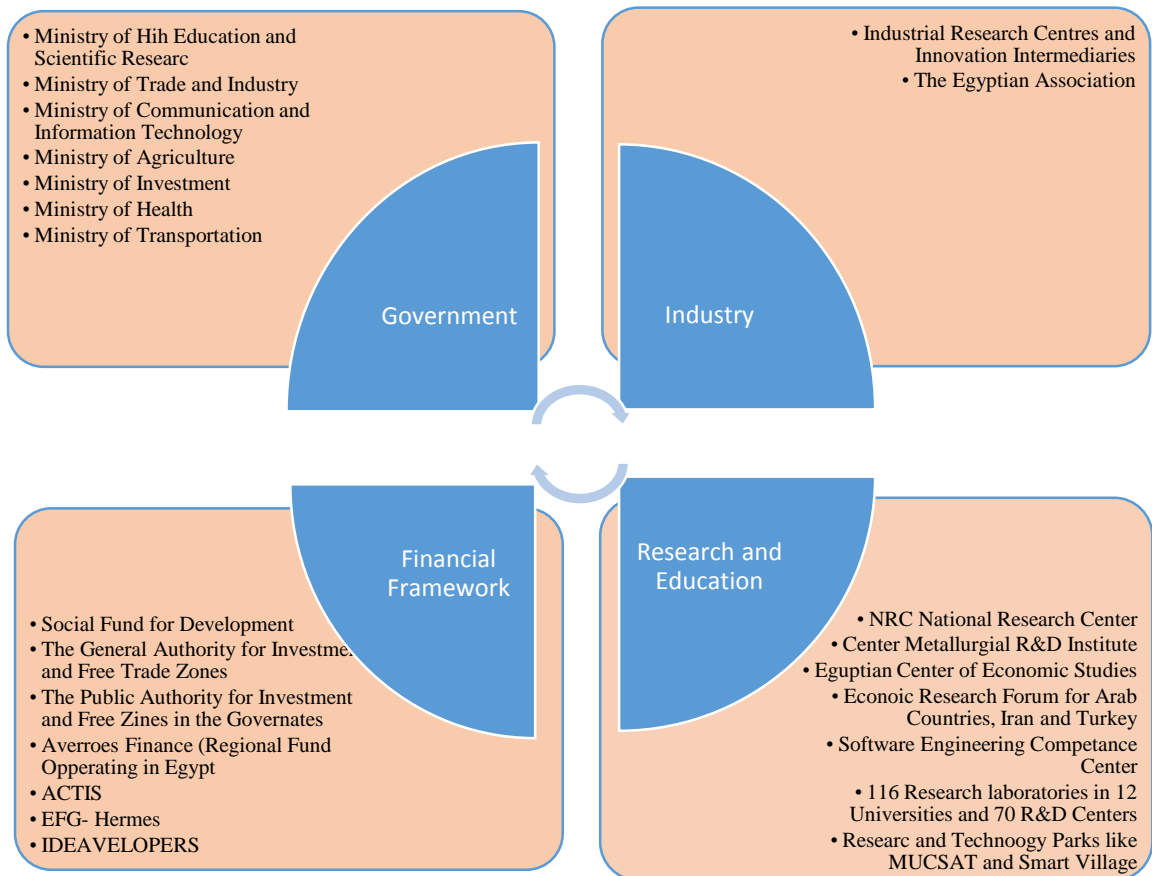
<b>MAGHREB COUNTRIES</b>	<b>GDP (US\$BILLION) 2013</b>	<b>GDP PER CAPITA (US\$) 2013</b>
<b>MAURITANIA</b>	4.2	1,127.09
<b>LIBYA</b>	67.6	11,046.37
<b>ALGERIA</b>	206.1	5,437.86
<b>TUNISIA</b>	47.4	4,345.17
<b>MOROCCO</b>	105.1	3,199.13
<b>EGYPT</b>	271.4	3,225.52

Source: International Monetary Fund: World Economic Outlook Database (April 2014)

The attempts by the government were a result of increased concern of the Egyptian people for the discovery of ways that would lead the country to economic growth. The policies followed were mainly connected to European principles and characterized by cooperation between different institutions. Since they understood that success can come through IT in 1993 their Information and Decision Support Centre introduced the Technology Development Program. Furthermore the “Fund for studies, technological and scientific research” was created which is currently the main tool for the transfer of technological expertise to the industry.

In this way an innovation system in the country is beginning to take form consisting of four categories of players aiming at cooperation, the transfer of knowledge and the creation of flow between them so that they can take advantage of all the elements currently available and so that they can urge the country into transition. The four categories of players are the Financial Framework, the Government, the Industry, Research and Education. As it is evident in the following scheme the country is trying to identify each innovation system with the definition provided by Freeman in 1987. Freeman defines the innovation system as a network of institutions of the public and private sector whose activities and interaction import, modify and transfer new technology (Freeman, 1987).

Figure 3.2: Main players in the Egyptian Innovation System



Source: Institute for Innovation and Technology

The industries and the research community, as they couldn't respond until now to the needs of society, they imported technology and innovation products from abroad to take advantage in their own market. The current strategy of industrial growth taking into consideration the current situation created Egypt Technology Transfer and Innovation centres (ETTICs). The purpose of these centres is to cover the technological needs of Egyptian industry so that more competitive products can be produced and furthermore to design the course for the transfer of technology.

Their basic principles of function are three:

- The search and cover of the needs of the private sector through the use of networks and industrial units
- Partnership and the creation of close bonds with foreign partners
- The supply of the technological services with a charge that makes them viable



The ETTICs can be considered as sectorally, sub-sectorally, or horizontally operating centres with sectoral orientation, each serving certain industries, and seven projects that have broad applications in the industrial sector for the transfer of cross - sectional technologies that have broad applications in the industrial sector. The primarily targeted sectors are:

- ready-made garments
- leatherwear, textiles
- plastics, engineering
- traditional industries
- food
- Furniture
- Marble and granite
- Jewellery
- Fashion and design

ETTIC's offer a broad spectrum of services in the industrial sector through patents, technological support, business advice and R&D. What is worth noting is that besides their cooperation with foreign sources they are also obliged to work closely with local research foundations. Basically they function as connections between manufacturers in local technological service providers following the same business model adopted with the technology transfer. Their main aim is to strengthen knowledge, experience, abilities, technological expertise and the transfer of technology among those who have it and those who need it (Hahn & Meier zu Köcker, 2008).

Today's strategy is turning into action. More than 12 centres are functioning and most of them are orientated according to sectors and funded by foreign investors. Their goals are:

- The replacement of product/services
- Reduced energy consumption
- Conformance to regulations

At the core of their function lies the definition of innovation and among the many services that they offer you can find training with the focus of technology and

individual consulting on technologies. Some of them are also focused on testing, innovative processes and cooperation for development projects (Egypt National Cleaner Production Center, 2008).

According to a study conducted by the VDI/VDE-IT and concerns the Egyptian Innovation System eight basic points were located that function as an inhibitor in the improvement of the country's environment so that it can be capable of absorbing and producing innovation (Hahn & Meier zu Köcker, 2008). A lot of points were presented in the analysis of the current situation and will be cross referenced by the current study.

Initially, Egypt requires a long-term Egyptian National Science and Innovation (S&T) plan in terms with National innovation/ oriented goals, which in reality doesn't exist. Such a project would be very important for the effectiveness of the National innovation strategy. There is a document composed by the government's commission, which set up for the management of macroeconomic issues and concerns the S&T plan that the country could have. Nevertheless this document hasn't been finalized yet. Such a project is essential though for a society currently in transition. Science and technology do not constitute issues of the national agenda and they can be supported by certain plans only if there is an interest by the business world. Subjects that have been individually supported are "Man and Space" as well as "Flying to the moon". For the particular projects students were given motives to strengthen technological interest, a fact that urged them to continue their studies on the sector of engineering. On the other hand the lack of a National S&T plan poses as a serious challenge to the effort of the country to evolve technologically. In the European countries the particular project was created taking into consideration the demands and the needs of the industry. Consequently the main cause for the lack of an S&T plan can be the implication of several institutions such as ministries, research centres, universities and the industry as well as the lack of communication among them (STDF, 2012). Thankfully, the country is moving towards a direction of improving the particular situation. This can be shown by the will of the government to increase funding to the sector of the research and education as well as by the Research, Development and Innovation program addressed to the country aiming to strengthen the bonds between the players in the country and the participation of Egypt in the European research area. Furthermore ETTICs are likely to absorb experts from the universities and that will symbolize the beginning of an important cooperation.

A second and very important issue is that MTI is responsible for the development and improvement of ETTIC, which can become an important tool for the exercise of their policy. Despite that the ministry doesn't take advantage of all the executives as well as the potential of ETTICs (Hahn & Meier zu Köcker, 2008).

A third point that is worth noting is that there are a lot of good public institutions currently established in Egypt which can help the industry. And therefore bases should be given to the improvement and development of these and not the establishment of new ones. The research centres, the industry, the universities and the technological parks can be different as far as importance and dynamics are concerned but they definitely have a plan and strategy for innovation (A.R.T.I, 2008). What's missing from the scene is the introduction of new policies and needs by the clients. If a group introduces a new policy only then will institutions have to become troubled into creating a new ordinance. According to my opinion, in the current situation there has to be an orientation towards the clients and intensive networks among the players so that flexibility can exist. Nevertheless this will also benefit the rest of the ministries.

Another inhibitor that decreases the rate of development of the national system of innovation is poor management of ETTIC which stamps further development of the companies' abilities (WEF, 2006). A significant lack of communication and marketing is also noted and the worst part is that the mentality on behalf of the companies doesn't exist. Only if all secondary functions are performed correctly within the business, will we have innovation. ETTIC requires interaction, a good manager and knowledge for proper communication. Only then will they be able to offer advice to education.

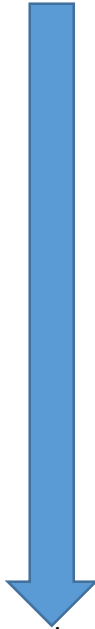
In addition a very important issue is the need to overcome social obstacles and to create a system of innovation that will help constant innovation. We have to take into account current family businesses aiming to carry on the family tradition (ESCWA, 2001). For this businessman, innovation stands as technological upgrade. This type of business contains two main risks. The first one is that businesses do not dare to take big leaps into introducing innovative ideas if they haven't been tested yet and the second reason is that their enlargement might lead to aristocracy. The role of ETTICs will have to be the promotion of innovation focused on long-term development to overcome psychological borders within society.

Furthermore this serious lack of bonds between R&D institutions and the industry, which is mostly because of public funding and not because of the funding by the industry, has as a result the lack of flexibility in the structure of the system. University graduates prefer an academic career rather than the career of the researcher or industrialist. Their performance is based only on papers and not on patents because they are not financially attractive (WIPO, 2011). Because of the limitation in the educational sector we have a significant brain drain. In table 3.3 we can see a comparison of size between Egypt and other countries concerning human capital that leaves abroad. The comparison takes place in the scale of 1 to 7, where one means most migration and seven the least migration. At this point it is evident that there is an urgent need of connecting education with the industry and for better results particular universities with particular industries could be connected depending on the area of the country and the sector (Hahn & Meier zu Köcker, 2008).

Unfortunately regulatory and financial measures are not fully used for the founding of the national system of innovation in Egypt and that poses as a negative factor for the creation of the society that will introduce innovative policies (Hahn & Meier zu Köcker, 2008). Sometimes taxes and grants inhibit the development of such policies and it is deemed necessary to take regulatory measures and offer motives that will empower innovation (STDF, 2012). Table 3.4 shows taxes and subsidies for the period 2002 - 2009

Finally, if we take into consideration that the cases of coordination between universities and industry are minimal (STDF, 2012) we reach the assumption that both parties should be more open to future cooperation and the creation of bonds between them (CORDIS, 2006). Structured coordination, besides the partnerships that can create, will also mean a decrease in the waste of resources. Working towards this direction, the country might achieve to change the weak culture of transmission and of information that exists in all MEDA countries (WorldBank, 2005).

Table 3.3: A measure of the extent to which Egypt loses its “knowledge workers” abroad

<b>Human capital flight index</b>		
<b>Country</b>	<b>Human capital flight (scale of 1-7)</b>	<b>Most migration</b>
<b>Egypt</b>	2.1	
<b>Algeria</b>	2.3	
<b>Syria</b>	2.5	
<b>Mauritania</b>	2.5	
<b>Jordan</b>	2.8	
<b>Morocco</b>	3.1	
<b>Tunisia</b>	3.8	
<b>Oman</b>	4.4	
<b>Bahrain</b>	4.8	
<b>Saudi Arabia</b>	4.9	
<b>Kuwait</b>	5.1	
<b>Qatar</b>	5.5	
<b>UAE</b>	5.8	

Source: World Bank knowledge Assessment Methodology (KAM) 2008, via Mohammed bin Rashid Al Maktoum Foundation and UNDP Arab Knowledge

Table 3.4 Taxes and subsidies for the period 2002 – 2009 (billions of Euros)

	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
<b>Taxes</b>	11.68	8.86	8.53	10.45	13.49	14.01	14.89	20.65
<b>Grants</b>	0.98	0.52	0.64	0.3	0.33	0.47	0.39	0.57

Source: Ministry of Finance

### 3.1.4 Recommendations

What is evident from the above analysis of elements that inhibit the development of the country is that there is certainly potential for improvement and development. Because Egypt is on the way of innovation we should be troubled by the fact that as an obstacle we come across is a serious lack of strategy and vision by the side of the players. Efforts continue to be isolated that hinder the whole picture. Furthermore there is no coordination and a proper organizational, legal and functional structure of institutions concerned with the design of a new innovation system for the country. For example as far as functional, legal and organizational structure of the ETTIC is concerned, it appears that they are limited by the rules and principles of MTI of which they are a part. Consequently they fail to function according to the rules of demand of the market and they cannot serve their customers due to a lack of flexibility of their functions.

In the European Union ETTICs function as ltd (CORDIS, 2006). In Egypt that is not the case. The flexibility that such an organizational and legal form would offer them would certainly lead to efficiency. If we could add to this their own list of responsibilities both parties would be fully benefited. In Europe the tool of control of ETTIC by the MTI is the design and control of activities (CORDIS, 2006). According to my opinion this case is particular because of the fact that MTI loses control by the change of governments and the different strategies that each government favours.

According to Peter Hahn and Gerd Meier zu Kocker a serious solution to the problem of the absence of a list of responsibilities is a holding company between MTI and ETTICs, which will simplify administration work, direct and enforce the coordination of the centres. There have been some isolated efforts in the past in order to create innovation projects but unfortunately failed. The reason was differentiated funding creating different channels in connection to the lack of coordination, national vision, and long term planning. For the definition of the National project a separation of roles is paramount. ETTICs will have to take over the provision of innovation according to the needs of the industry and to act on their own research while MTI should ensure the proper environment for action and initiative (Hahn & Meier zu Köcker, 2008).

### 3.2 Knowledge and learning create learning regions

The last few years a lot of areas in Europe have taken part in the strategy of learning regions. It has become understandable that areas with a higher rate of interaction proceed to partnerships and communicate intensively with their interior and exterior environment. These regions have presented advantages in comparison to others that do not behave in this way. The basic goal of this process is the transformation of knowledge into entrepreneurship and peripheral development through quality (Normann, 2005).

At this point a general image should be given concerning what bibliography reports on learning regions. Initially there is no perception that collective learning and knowledge are important factors in promoting growth. Nevertheless there is a tendency for a progress of society because of the existence of local networks and partnerships among businesses (Piore & Sabel, 1984). This new liberalism has introduced the sense of learning regions and considers this notion not self-evident (Florida, 1995).

Furthermore with the intervention by Porter in 1990 with his work “Competitive Advantage of Nations”, bibliography went even further developing Piore and Sabel’s theory and observing that local networks can contribute to the competitiveness of businesses that take part in them. Through clusters and the use of innovation that is created because of them, competitive advantages for all businesses occur (Porter, 1990). In 1998 Porter in his work “Competitive Advantage of Nations” with the new introduction modified his initial theory and introduced the notion of space within it, using the term “regional clusters”. The geographical space in which businesses exist has an important role in their development. Of course the term regional cluster was criticized later by Arbo and Aarsaether in their work “Ny norsk regionalpolitisk strategi, i Staten og den regionale teknologipolitikk”. Porter's model was considered too linear based on fordist mass production of large businesses and was considered inappropriate for the strengthening of innovation in SMEs.

Ever since knowledge was considered an important resource for economy, learning became the most important process. Learning therefore becomes a key notion for the development of economy. The influence of innovation in the development of this

process creates interactive learning (Lundvall & Johnson, 1994). The ability to learn something new and to combine it with something old has as a result the development of new products, structures and processes or the improvement of existing ones. Thus economy transforms as the system changes. The core of this innovative process remains knowledge and learning.

Of course there was also the opinion that interactive learning is a branch of innovation (Asheim & Isaksen, 1996). The other branches of innovation are close cooperation among institutions and the use of experience acquired by the implicated institutions. A partnership is the most important strategy for the promotion and development of innovation. Furthermore a dynamic flexible learning organization promotes learning to its members and has the ability to change quickly and to adapt rapidly to the conditions of its environment. This is due to partnerships that exist within the business but also outside of it. Organizational and institutional innovations are central aspects for the development of learning regions (Asheim, 2000).

Of extreme importance is the sense and notion of institutional thickness. It is defined as a combination of elements including interaction between institutions as well as a collective representation of all institutions that have a common goal. The sharing of cultural norms and values (Amin & Thrift, 1994). They believe that it is because of this important notion that the development of partnerships can arise that in turn characterize the learning region. The institutional thickness deals with developmental strategies for growth and competitiveness in the global environment. Later on the notion of institutional thickness was named learning region (Normann, 2005).

According to Lundvall, communicational action and discursive rationality influence the time and the quantity of establishing new institutions. Furthermore they influence both the direction as well as the process of their innovative action (Lundvall, 1993). Furthermore technical learning strengthens social learning and communicational rationality.

According to Goddard there are four types of knowledge. The know-how, know why, know-how and know who. Each of these forms of learning is used in different channels for the transfer and exchange of information. In the first two forms the main channel of communication is typical learning in school and universities. The third form is based on practical experience through tacit knowledge and has improved significantly with the



communication of networks for businesses and trade partners. The final case is taught by social interaction, by the daily partnership with clients, subcontractors and other actors (Goddard, 1997).

Learning regions are limited geographical areas in which the learning process takes place. Furthermore these regions constitute main points for the creation of knowledge and learning, as well as for the distribution of ideas (Florida, 1995). This means the promotion of development and the ability to innovate (Cooke & Wills, 1999).

### 3.3 Absorptive capacity for greater performance

Absorptive capacity is the capacity that enables a business to recognize values or information from an exterior environment and the ability of absorbing them in order to achieve innovative activity. Previous knowledge that has accumulated has a very important role. A cumulative, absorptive capacity during a period helps even more in an effective accumulation of the next period. That also influences the technical performance of the business which is not dependent only on the past (Ahuja, 2000).

Knowledge has the ability to be transferred from one project to another and is furthermore capable of creating abilities that will lead to the production of new knowledge as well as the resolution of problems. In addition what needs to be pointed out is that the absorptive capacity is completely dependent on personal capacity and the way it is dispersed. Consequently there have to be channels of communication for the proper transfer concerning both the external and internal environment. In this way businesses decrease experimentation and easily produce alternative ideas (Vinding, 2006).

Tilton John in 1971 in his book entitled “International Diffusion of Technology: The Case of Semiconductors”, observed that businesses that have a developed R&D sector are at a better position than others. The same was observed by Thomas Allen in 1977 in his book entitled “Managing the Flow of Technology Transfer and the Dissemination of Technological Information within the R&D Organization”. That is the case because R&D doesn't only create new knowledge but also helps with the absorptive capacity of the business. R&D's influence is higher in more demanding environments and promotes absorptive capacity even where knowledge is difficult. That is in difficult environments

the importance of absorptive capacity becomes even greater as it creates technological opportunities. Therefore we can say that the absorptive capacity is a subproject of investment in R&D, education and training with the transfer of innovation taking place quicker in businesses with advanced knowledge in relative sectors (Cohen & Levinthal, 1990).

A newer study by Shaker and Gerard comes to create the model which discriminates between potential and realized capacity. The particular study considers that the use of knowledge additions and experience through activation triggers create potential capacity which is based on acquisition and assimilation. On the other hand when social integration mechanisms are inserted, realized capacity takes place which is capable of exploiting the circumstances of the environment and to transform. With regimes of appropriability it will be able to deliver sustainable, competitive advantages through strategic flexibility creating in this way innovation performance (Shaker A & Gerard, 2002).

The four characteristics of absorptive capacity are technological capabilities, the level of education of the workforce, economic growth and the institutional quality of the country (Krogstrup & Matar, 2005). Based on these four characteristics Arabic countries don't seem to have substantial absorptive capacity.

The study by Li and Liu who research the influence of the technology gap on the growth effects of FDI in developing countries concluded that the lower the level of technological development of the host country, the smaller (or more negative) is the impact of FDI on growth (Li & Liu, 2005). FDI does indeed contribute to economic growth over and above other forms of capital formation, but only when the effect is made conditional on the level of human capital development of the host country in question (Borensztein, et al., 1998). According the study by van Pottelsberghe de la Potterie και Lichtenberg, who conduct a panel regression analysis of growth in a broad panel of developing and developed countries and the study by Sadik and Bolbol who investigate the effect of FDI through technology spill overs on overall total factor productivity for Egypt, Jordan, Morocco, Oman, Saudi Arabia and Tunisia over a 20-year period we can introduce that: FDI has not had any manifest positive spill overs on technology and productivity over and above those of other types of capital formation. On the contrary, there are some indications that the effect of FDI on total factor

productivity has been lower than domestic investments in some of the countries over the period studied, indicating a possibly dominating negative crowding out effect (Pottelsberghe de la Potterie & Lichtenberg, 2001) (Sadik & Bolbol, 2001). Moreover, according Durham's study who based on World Bank data is precluded a direct classification of Arab countries related to their institutional absorptive capacity. Unfortunately, measures of regulatory quality are fraught with imprecision, measurement error and bias. For this reason, is evaluated one little aspect of institutions, namely regulatory quality, for Arab countries (Durham, 2004).

Perhaps these four characteristics are the reasons that the productive capacity of FDI hasn't brought forth the relevant economic growth. The only exceptions in the past few years are Jordan Morocco and Tunis (Krogstrup & Matar, 2005). We are therefore left with the question whether it is likely for an average Arabic country, given the low absorptive capacity, to gain from direct foreign investments. In addition an important issue is whether the attempt of attracting more direct foreign investments is a waste since these countries and capable of having positive external influence by the FDI. Krogstrup and Matar in an article entitled "Foreign Direct Investment, Absorptive Capacity and Growth in the Arab world" noted the following:

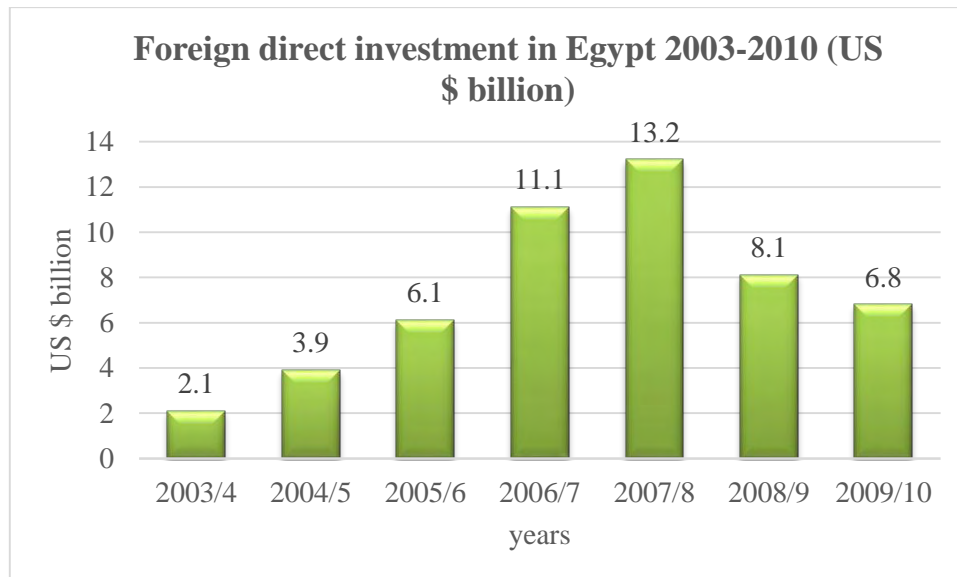
- FDI flows to the Arab region are low relative to the region's economic size
- FDI inflows to our countries have declined relative to other developing countries since the early 1990s
- FDI constitutes a relatively small part of the overall investment in Arab countries
- Wide disparities in FDI inflows exist among Arab countries

Their research was based on UNCTAD data.

After the above analysis we can certainly say that when a business desires to acquire and use knowledge not related to the continuing activity it will have to develop an absorptive capacity. At a business level absorptive capacity, taking into advantage knowledge, gains competitive advantages, separates the roles of the human factor and creates values. At the national level it offers national innovation and higher productivity (Shaker A & Gerard, 2002). If Egypt desires to attract FDI and to manage internal investments better it will have to work hard towards the direction of reducing the

technological gap, emphasizing on the sector of the education and be troubled concerning its institutional density. Only in this way can there be positive results by investments. Figure 3.5 shows FDI in Egypt.

Figure 3.5: Foreigner Direct Investment in Egypt 2003 – 2010 (US\$ billion)



Source: Central Bank of Egypt/ Egyptian Ministry of Investment

### 3.4 Can Egypt learn?

International experience has shown us that expenses for R&D and the promotion of innovation in less developed countries are much lower. Such examples exist among countries that belong to the European Union. The result is middle sized businesses not having access to technology (Landabaso, et al., 1999).

In Egypt a similar environment has been created with small family businesses with the limited human resources and expertise competing in a closed market. Because of the

situation, businesses do not express the request for innovation and there is no infrastructure of R&D is incorporated into peripheral economy. Consequently they are in no position to determine the needs of innovation and the possibilities currently existing in economy. There is therefore a lack of completion between offer and demand for innovation. We also know that the system of innovation doesn't have the necessary interconnections and therefore doesn't create the circumstances for cooperation between institutions (STDF, 2012).

In addition current research centres, and universities and innovation institutions should not be increased because in this way this system will be corrupted more. There are already several in the country and the only thing necessary is their improvement directed towards innovative actions that will benefit the industry (Hahn & Meier zu Köcker, 2008). Furthermore because services towards businesses and the networking of factors are less compared to those of developed countries and they are not specialized on the sector of innovation, it may hinder their opportunity for business innovation (STDF, 2012). Initiatives in the country especially private ones are trapped in a vicious circle of low demand that's making the transition and the development of the system really hard. Despite that technology and innovation proponents create important opportunities which are lost in the local industry (Bond, et al., 2012). It is worth noting that the private initiative that is trapped and chances that created are constantly and lost in Egypt are described by the scenery that Landabaso et al. describe in their study entitled "Learning regions in Europe: Theory, Policy and Practice through the R I S Experience", for the less favoured countries of Europe where are the same situation exists.

It is worth noting that the quality of the institutional framework of Egypt is often the main obstacle for the creation of an innovation system as well as a learning region. Important factors are the lack of credibility, political instability and the lack of professional competence in the sector of innovation. That automatically leads to a limited capacity for the creation of corporate relationships between businesses and other institutional factors such as universities, research centres or the state (STDF, 2012). Furthermore political instability undermines any serious attempt to apply innovation policies which by nature is middle-term to long-term. Finally the local professional adequacy reflects the current situation in the industry in their ineffectiveness of efforts taking place (Bond, et al., 2012).

The ability for innovation and learning is dependent on the density and the quality of networks. In particular the relationships and their interdependence among public and private initiatives are a result of institutional density and that provides the final product which is innovation (Asheim, 1998). Successful innovation demands the correct combination of influx that is knowledge, technical expertise, planning, funding, administrative experience, marketing issues, trained workforce and equipment (Landabaso, et al., 1999). In contrast to large businesses, small ones did not have the climax or the resources to conduct research for the development, planning and inter-business training. Therefore they are in no position to take advantage of internal economies large businesses thrive on. This problem is dealt through the cooperation in the framework of networks that offer to SMEs the ability to take advantage of collective external economies and allows them to compete in equal terms with bigger businesses (Landabaso, et al., 1999).

Egypt could take as an example the European Union and the way it deals and handles less favourable regions. The new kind of peripheral policy emerging in Europe is the emphasis given on the collective learning and institutional innovation instead of the basic provision of infrastructure. Attention has shifted from ‘natural capital’ to ‘social capital’ that these collective actions are based on trust, confidence and their will for cooperation in order to achieve their goal (Landabaso, et al., 1999). In this process the state and the governments should have a catalytic role mostly as animators aiming at coordination and networking of all the factors that aim to the advancement of innovation.

In particular the improvement of the international system of innovation can pave the way so that the people in charge of promoting innovation can respond to the needs better and deal with the problem of absorptive capacity that could drastically change the country. That can be achieved through basic strategic planning with the participation of all political institutions. Social capital, learning and networking for the promotion of collective external economies are of vital importance in this process of promoting collective, external economies (Landabaso, et al., 1999). Thus the innovation system of the country seems to have a catalytic role in the creation of the fruitful environment for further experimentation and learning directed at the improvement of innovation and with the basic goal of offering stable and valuable economic growth in the country that deserves it and it needs it.

### 3.5 The European role as a driving force for innovation

The conclusion in which were redound by the research of current situation will be the beginning of a comprehensive study on what factors can be exploited by Egypt to be able to compete and emerge as a country in the globalized environment in which it exists. On the one hand, the data showed that the country faces critical problems in key sectors such as education, research, technology, culture and funding. The good news is that people have realized these gaps, concerns about how to cover them and shows strongly the need of modernization, of the transition to a new era and of the radical changes in the country.

On the other hand, policies of the European Union under the European Neighborhood Policy, which was developed from 2004 onwards, come to engage with these needs of the Egyptian people and to give relief to a serious concern about the major issue of funding. In 2007 within the framework of the European Neighborhood Policy Action Plan was signed for Science and Technology Research and Development between the EU and Egypt with the main objectives:

- Develop closed scientific links between Egypt and the European Research Area through increased Egyptian participation in the Framework Programme for Research and Technological Development.
- Develop of scientific and technological capacity, with the focus on the use of research results by the industrial and SMEs sector.
- Promote the integration of Egypt into high-level exchanges.

(EEAS, 2014)

The Egyptian government having realized the need to modernize the country's competitiveness and agreed that research, innovation and technology are the driving forces for economic growth and consolidation of the country in the global scene. Therefore Egyptians have put the research and the innovation in the centre of its development strategy. In this direction was the Supreme Council for Science and

Technology which aims to develop a national strategic plan for development posed as priority the science and technology and to ensure the implementation of these plans.

### 3.5.1 RDI

The Ministry of Scientific Research and the European Commission in 2007 was launched with a grant of €11 million to support research, development and innovation initiatives in Egypt. The success of this funding has resulted in the signing of an agreement for an additional € 20 million in May 2011 in order to establish a culture of innovation in the country and to see the positive results in the Egyptian economy and industry (RDI, 2010).

To support innovation and promote entrepreneurship, the Innovation Fund distributes grants, in industry and in research community with focus on projects in line with Egypt's innovation objectives that include:

- Energy
- Water
- Nano technology
- Space
- ICT
- Processing
- Agriculture
- Environment
- Food
- Education
- Biotechnology.

(RDI, 2010)



The Fund supports projects that aim to strengthen industrial enterprises and particularly small and medium private enterprises for the exploitation of research results and innovations.

For the years 2008 - 2011 there were two calls. 719 proposals were received of which 51 were funded. In this way important links were established between academia and national / European industries. Furthermore, the creation of RDI networks resulted in increased cooperation between Egypt and EU. Finally, it is worth noting that the success rate for the participation of Egypt in the 7th EU Framework Program for Research (FP7) has increased from 7% in 2007 to 20% in 2010 (El Zoheiry, 2014).

In this phase, for the next programming period 2012 -2016, there have been 3 calls, one of which was recently closed and expects positive results.

The Fund is composed of two grant schemes with different objectives, eligibility criteria and types of actions:

- 200.000 € -600.000 €

The aim of the first project is to support the sustainable development of the country through increasing investment, strengthening technological innovation and improving competitiveness. Furthermore, this system aims to strengthening cooperation with European and regional counterparts to enable the transfer of technology know-how and best practices to Egyptian institutions.

- 50.000 € - 100.000 €

The aim of the second grant program is to foster collaboration between industry, research institutions and society to sensitize participants on issues related to innovation and R & D and to convince them of the positive impact that can have technological innovation in society and in the economy. Moreover this second program aims to strengthen cooperation with European and regional counterparts (RDI, 2012)

### 3.5.2 FP7

Therefore, the European Union, in order to strengthen links of R & D with Egypt, prepared the FP7 that gives gravity to the Euro - Mediterranean Innovation and Research. On the other side, Egypt which understands that the key to success is innovation, is receptive and now seeks long association with Europeans. It is worth to note that the cooperation in innovation sector will be extremely important in the big problem of the country which encounter on patents that are "local" as characterizing by the inventors Tarek El-Bagory and Mohamed El-Sayed and have no impact over the country and no international warranty

Four main programs of FP7 (2007-2013)

- **Cooperation:** International cooperation is at the heart of this program. For this reason, the cooperation among researchers internationally is promoted through the cooperation of the funds which will support ten major thematic areas and activities.
- **Ideas:** The program supports high-level research on innovative processes in all the basic sciences. The exceptional is that they can join non-European researchers who agree with the European spirit and want to implement their ideas in the European area.
- **People:** Provides fellowships, training and exchange programs for supporting mobility and career development of researchers. It is also known as Actions Marie Curie. Non-European researchers can apply to conduct research in the European institutions.
- **Skills:** Supports research infrastructures and innovative capacity of small and medium-sized enterprises (SMEs), regional clusters, the less advanced regions throughout Europe and neighbouring countries. It is also supports the coherent development of research policies, strengthening of science in society, and international cooperation.

## FP7 Funding Schemes

1. *Collaborative projects* are carried out by consortia of participants from different countries. It is a research-oriented project with clearly defined scientific objectives and specific expected results.
2. *Networks of Excellence* are designed to bring a critical mass of research institutions that have competence in this field in order to create a "virtual research centre" in this field.
3. *Coordination and support actions* do not fund research projects per se, but the coordination and networking of projects and researchers, workshops and programs to enhance dialogue, dissemination of knowledge and international cooperation.
4. *Individual projects* are funded by the Ideas Program and are carried out by a "principal investigator" acting individually or by leading a national or a multinational research team.
5. *Support for career development of researchers* is provided by the People program.

### 3.5.3 Horizon 2020

Now the EU is preparing to launch the successor of FP7, Horizon 2020. This project is the largest model of the international research program in the world, with an expected total budget of € 79 billion from 2014 to 2020. The Horizon 2020 program offers many opportunities to address common challenges of the Euro Med through international R & D cooperation.

International cooperation, especially with neighbouring countries in the Mediterranean region, is a key priority for the EU research and innovation funding. Under this strategy, the European Commission organized on February 9, 2014 in Cairo, a regional conference for the promotion and presentation of Horizon 2020 in the Euro area. The conference aimed to discuss the future of international cooperation in research and innovation in the Mediterranean region.

Specific objectives of the workshop was to enable policy makers, development agencies, research institutions and the private sector on issues relating to the sharing of

expertise and the creation of appropriate conditions for promoting research and innovation activities. Moreover it explored the gaps between all the actors to understand the great need that exists for creating synergies. These synergies and complementarities which pursued by the EU will allow the use of the possibilities of areas to address the challenges in the field of Research and Innovation. Finally, the workshop managed to draw the attention of stakeholders in the Euro med countries for opportunities that will have the Mediterranean countries which will be involved in the program Horizon 2020 (Euromedh, 2013).

Particular attention was given to identifying the drivers and barriers for the creation of alliances between those involved in research and innovation from the coasts of the Mediterranean. The conference focused on issues

- The ability of the southern Mediterranean in innovation and R & D
- Recording the results of previous programs (RDI, FP7)
- The presentation of Horizon 2020
- Analysis of the EU Strategy for International Cooperation
- As well as the challenges and opportunities that Egypt has to come from bilateral cooperation.

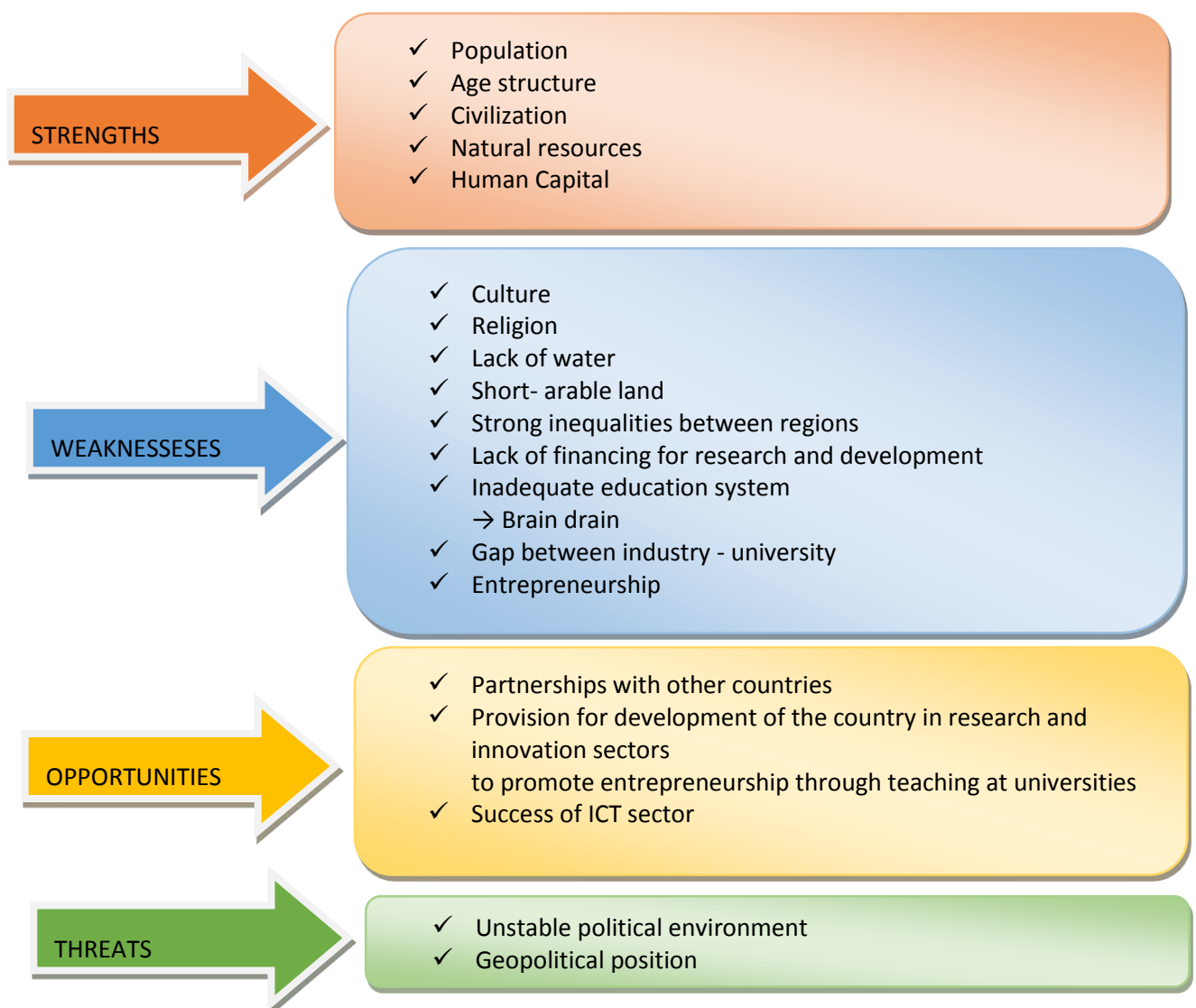
The conference gathered about 400 policy makers, researchers, representatives from academia and industry and research institutes, technology transfer centres, incubators, technological platforms of the Mediterranean region and all research communities dealing with innovation in the Euro area. Moreover the conference attended universities, research institutions, and representatives of SMEs, financial institutions, technology parks, clusters and NGOs (Euromedh, 2013).

### 3.6 SWOT Analysis

SWOT Analysis consists of the basic useful tool for the process of comparative assessment of activities (Porter, 2003). In more detail it concerns a very useful, methodological tool of recognizing strengths and weaknesses concerning research and

innovation in the country of Egypt as well as the definition of opportunities and threats in the country. With the current methodological tool we will try to reach conclusions about the current situation in the research and innovation. Furthermore the results will offer us a basis for the creation of strategies and policies that will have to be designed and implemented on the sector so that innovation can become a reality in the country.

Figure 3.6: SWOT Analysis



### *2.6.1 Strengths*

Egypt is the most densely populated country in the Middle East and the third most densely populated country in the African continent (Worldstat, 2014). Its population rises constantly since 1960 and this fact can be considered as a mighty advantage for the country itself. It is believed that the rapid growth is due to the medical progress and increase of agricultural productivity (Wikipedia, 2014). It is worth mentioning that the age structure of the country with the largest percentage occupied by the most productive ages is the fact that gives the country an advantage concerning its workforce.

Furthermore what is imperative to mention as a mighty characteristic of the country, renowned all over the world, is the civilization and the monuments left behind by ancient Egyptians and mostly those of the pyramids, the Sphinx, the tombs of the Kings and other structures of special architecture and innovation and of supernatural dimensions that are a jewel for the world. The history of the country has fascinated millions of people all over the world. In Egypt medicine, writing and astronomy have particularly thrived.

The natural resources of the country are yet another advantage that is worth mentioning. The natural resources consist mostly of oil and natural gas. The oil reserves offer huge and annual profits from exports. The oil wells discovered recently at the bottom of the Mediterranean have created new opportunities for the regrowth of oil exports which is one of the country's biggest businesses. The markets of Turkey and Israel are the main target for Egypt. There are also other minerals such as ore phosphorus, limestone, zinc, manganese, asbestos and plaster (Maps of World, 2013).

Something that is not particularly known is the cultivation of bees since antiquity for the production of wax and honey. Egyptian honey is used as a pharmaceutical basis, as a sweetener and for religious purposes as an offering to the gods. Furthermore, the plant papyrus which prospers at the banks of the River Nile is a product that gives the country uniqueness. Especially in antiquity Egyptians used to make huge profits from fabulous documents which they exported. The climate might initially seem as a negative characteristic but from the different point of view solar radiation it can, if used

correctly, become a source of growth. Finally the water of the river Nile can be considered among the best natural resources of the country as water can be used differently for the cultivation of the earth and the production of Hydro Electric Power. The River Nile is the reason behind the rise of the civilization of the valley of the Nile in the past and the main reason of the intense tourist activity in modern age. Furthermore the only land suitable for cultivation lies along the banks of the River Nile considering the fact that the biggest part of the country is covered by the Sahara desert.

The human capital of the country is also of extreme importance. Egypt has a huge tank of researchers and students not only in the county but also abroad. A lot of countries of the Middle East are already taking advantage of the human capital of Egypt. Correct education and training are other factors that influence entrepreneurship. In an experiment in the past, Egyptian students after being exposed to business attitude increased their interest and their scores in the business sector much more than students in the UK (Kirby & Ibrahim, 2011). Consequently if they were offered a different educational system they could achieve notable results cause as it seems human resources have the ability but not the proper environment. In fact the British University in Egypt in 2005 decided to train students how to think and not what to think in order to achieve the desired results. It is therefore evident that serious capacity for learning exists among Egyptian students, posing a mighty characteristic of human capital.

### *2.6.2 Weaknesses*

Despite the fact that culturally Egypt doesn't follow the classical Arabic model of clinching to Islamic tradition as Greeks, Romans, Arabs, Ottomans, British and French left their cultural stamp in the creation of the new Egyptian culture, their tradition and culture in innovation and research issues as well is almost non-existent. As we have already mentioned the biggest percentage of businesses are small family run businesses that survive and address a closed economy. Furthermore their owners not having the mentality of the businessman are afraid of competition in the import of new methods and processes in production.

An obstacle in the development of an environment friendly towards production and acceptance of innovative ideas are the limitations imposed by the official and most popular religion. Islam is very strict as far as worship is concerned and as a result it creates problems even with the daily life and the flow of the program. Furthermore while the globally racial discrimination is decreasing, in countries with a thriving Islam racial discrimination still exists. Consequently a large part of the population doesn't have access to education and the exercise of business activities because of this strictness of the religion. Even though racial discrimination is decreasing, a lot of effort and struggling is necessary that demand time and mental work especially on behalf of women.

The cultivated land is 2.87% of the total land of the country that accounts up to 1,001,405 km. This percentage is extremely low and it is also one of the weak points of the country. Egypt needs to cover its needs for agricultural products by cultivating land in order to decrease imports. The only way is to find new methods of cultivation that will increase the production taking into consideration the productive rate of the ground. The matter is of paramount importance for one more reason. As it was mentioned before in the past few years there has been a constant increase of the population. Therefore there is a simultaneous increase of the needs for agricultural products.

Another problem that the country needs to face is the lack of water (Table 3.7). Unfortunately the quantity of drinking water constantly decreases creating a serious problem for the population (World Bank, 2009). For this reason serious efforts are taking place through programs like their Environmental Information and Monitoring Program (EIMP) trying to keep at least at the same level in the quantity of drinking water, investing in viable growth (Egypt National Cleaner Production Center, 2008).

Upper Egypt has serious gaps in development and the difference between Upper and Lower Egypt constantly increases. STDF and RDI programs continue to support Lower Egypt's universities in the field of research. That is not the case with the universities of Upper Egypt and that is a serious problem as well as the general mentality of people that support those who have a personal relationship with the people in charge (Bond, et al., 2012).



The lack of funding connected to research, the equipment of laboratories and infrastructure is also an extremely weak point for the country.

Furthermore the educational system needs extensive and radical reforms and changes. Above all, the process of education should be taken away from mechanical learning and memorization and move onto perception and critical thinking. Graduates need more business skills. Entrepreneurship skills are among the worst anywhere. This has as a result of ideas that exist in laboratories not to be transformed into business opportunities. The current educational system there, still suffers from remnants of a forgotten era with old teaching methods that cannot support modern Egyptians (Bond, et al., 2012). The economic growth for the country will come only if it continues its reform. An unpleasant fact was that expenses for education from 6% in 2002 had decreased to 3.9% in 2009 (OECD, 2010). Probably the people in charge of creating policies have not understood that if they combine the large population with the progress in education they will be able to be optimistic about the future of the country. Because of the bad educational system we have an increase of private education and consequently an increase in discrimination and inequalities (Bond, et al., 2012). Furthermore the lack in funding and the lack of critical thinking urges a large percentage of young scientists to leave the country to acquire postgraduate degrees. A third of them will never return to Egypt and that is a big loss for the country (World Bank, 2009).

**Table 3.7: Precipitation in Arab countries, annual average per capita**

Country	Precipitation in cubic metres per capita	Country	Precipitation in cubic metres per capita
<b>Mauritania</b>	31,099.60	Tunisia	3,554.50
<b>Sudan</b>	27,678.10	Comoros	3,259.40
<b>Somalia</b>	21,322.30	Syria	2,406.30
<b>Libya</b>	16,311.60	Jordan	1,793.00
<b>Oman</b>	10,446.40	Lebanon	1,701.50
<b>Algeria</b>	6,341.60	United Arab Emirates	1,536.80
<b>Djibouti</b>	6,230.80	Qatar	987.4
<b>Saudi Arabia</b>	5,355.00	Kuwait	830.9
<b>Morocco</b>	4,918.60	Egypt	693
<b>Yemen</b>	4,064.40	Bahrain	79.8

Source: United Nations Development Programme 2009 Arab human development report 2009

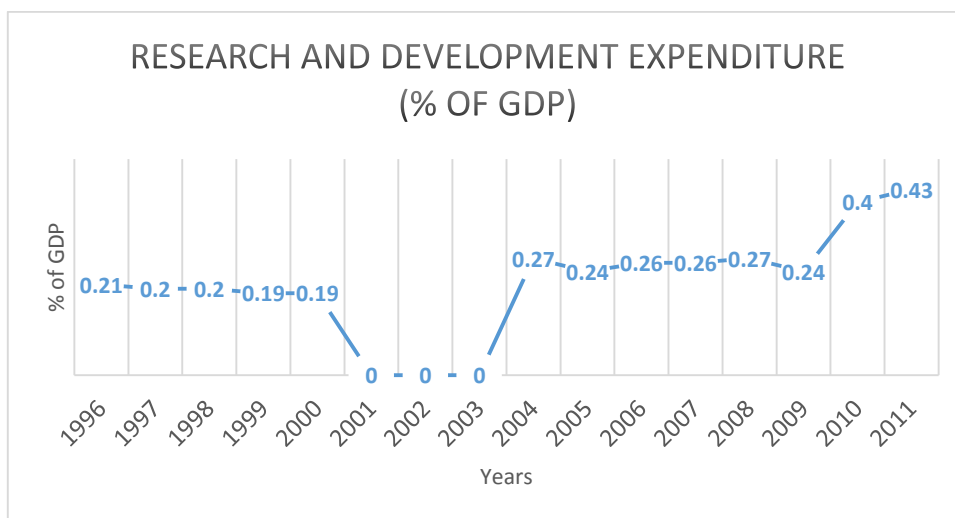
Another negative point is the minimal private investments in the sector of R&D. The main reason is the lack of confidence and communication amongst universities and industry (STDF, 2012). Furthermore the little appetite for science justifies the limited funding by the government and the private sector for research. Despite the fact that there has been an increase in funding for R&D in the past few years, the percentage remains low (Figure 3.8). The rigid academic culture holds back creativity and innovation. This includes the bad communication not only in universities but also between faculties of the same university (Bond, et al., 2012).

Entrepreneurship in Egypt coincides with the people's culture and is a negative factor for an environment that desires innovation. The industry and the Academy have not understood the benefits of cooperation and the result is a needless waste of resources with the production of products already existing in other countries. That bad mentality and the denial of a large percentage of businesses to invest in R&D doesn't help innovation. The few efforts are self-funded and the research isn't commercialized

(Bond, et al., 2012); that I assume is because of the legislation that doesn't protect copyrights.

One of the weak points of the country its competitiveness. This is due to the lack of cooperation between universities and the industry (Bond, et al., 2012) (STDF, 2012). If relationships and balance between them are strengthened this could definitely be a significant factor for the increase of competitiveness because through the research conducted in universities, the industry will deal with the real needs of the country.

Figure 3.8 Research and development Expenditure (% of GDP)



Source: (World Bank, 2014)

### 2.6.3 Opportunities

One of the main opportunities the country has in the sector of innovation and technology is cooperation with other countries. The past few years there has been extensive effort to achieve partnerships at the international level and mostly with European countries. Furthermore, a large percentage of foreign investments are observed in the country; these mostly originate from countries of the Middle East with Saudi Arabia, Turkey and Qatar to be dominating. The listing of the country is higher than that of countries in Northern Africa (World Investment Report, 2010). Europe through its foreign policy for better relationships with countries that do not belong in the EU offers Egypt the opportunity to open up significantly towards the west, to acquire the mentality in issues of innovation and technology and furthermore to be

funded by the European Union with a long-term goal of establishing it as strong player in the international world.

In addition if we take into account that there has been an intense appetite for change and modernization in the past few years, the scenery appears ideal for the big step of transition. Their need for revolution manifested in the revolution against the regime and the resignation of Pres. Mubarak on February 11<sup>th</sup> 2011. The understanding that science can lead them to a new environment is now a reality. With stable steps they react and seek ways to gain access to knowledge, to learning and to information. The first changes in the educational system have already taken place. The universities have already important lessons and projects that favour entrepreneurship and therefore will create new and proper businessmen (Bond, et al., 2012). This is a significant leap for such a closed country and society that have been overcome by the fear of competitiveness (Bond, et al., 2012).

The basic sector which we have already mentioned, and has already created a successful story, is the presence of Information and Communication Technology. Perhaps this sector will pave the way for other achievements setting not only an example but also the optimism for a bright future. The rapid increase of ICT companies can bring forth significant growth in the area.

Finally the innovation system of the country is included in the opportunities and as we mentioned before it exists in the country and with significant changes it could be an important opportunity for the advancement of the country in innovation issues.

#### *2.6.4 Threats*

Political instability in Egypt poses as one of the main threats for research issues and innovation issues that concern us. And while other countries have made significant progress in these two sectors, Egypt in the past few years has been struggling with changes in power and the way they take place. Unfortunately, subjects connected to research and innovation require long-term plans and policies that support any business move in the long-term. Furthermore the creation of innovation systems is dependent on education as well. Unfortunately that is also the sector influenced by political instability. Therefore it is problematic and full of gaps. The absence of the required

public infrastructure and training cannot support the human resources leaving the country with a defective education and the loss of human capital.

One of the tricky points for the country is its geographical position which is of extreme importance. Egypt possesses a strategic position and is considered a bridge among two continents. To keep the bridge open Egyptian leaders have been trying to reassure their power in Syria and Arabia. This fact has brought from time to time conflict with Turkey and Iraq. Today Israel which is located at the borders of Egypt is considered as the biggest threat for Egyptian security because Israel blocks its access to the east. It should also control the Suez Canal which is a link between two main routes that is the Mediterranean and the Indian Ocean. Therefore it has to be strong enough to have a dominant position and not to be the victim. Among its concerns is the security of the waters of the Nile which is also its main source of life. It has historic bonds with Sudan and has satisfying relationships with Uganda and Zaire (Platan & Teal, 2001). Its geopolitical importance has made the country very interesting for the great powers. Even Mubarak's weak Egypt has received important political support, financial aid and military training by the west and by the Arab world (Chapin Metz, 1990). Unfortunately according to my personal opinion such a strong geopolitical position is an obstacle in the development of the country in the sectors of research, innovation and technology. The advantages, the funding and benefits of the country are spent on the army and its leadership. Besides such a position demands the existence of a numerous and combat ready army and the waste of huge amounts of money for equipment. That is also the main priority in the course and concerns of every Egyptian government, thus placing at the lower level of importance subjects that are concerned in this project. Human and financial resources are wasted on external policy and military equipment and as a result important subjects that concern the development of the country are left behind. What is extremely important is the fact that the military tour lasts for three years and is mandatory for every male aged 18 and above.

### *2.6.5 Strategic goals for innovation*

The innovation activities in Egypt are divided into Technology, Entrepreneurship and Industry /Academia Collaboration. So, key strategies must include a focus on Technology, Entrepreneurship and Industry /Academia Collaboration (STDF, 2012). Technology transfer is the transfer of inventions, technology, know-how and methods between research institutions, industrial enterprises and government agencies. Technology transfer is done through licensing / selling Intellectual Property and available information (Kogut & Zander, 1992).

Entrepreneurship is about the activities were undertaken to convert inventions into new products, services, processes, and innovations that have economic or social benefits for the country.

Collaboration between Industry and Academia establish connections between industrial and research communities. In the case of Egypt, this cooperation is lacking greatly (STDF, 2012). It is therefore necessary to encourage the industry to trust the scientific research with in order to be able to meet future needs and to facilitate the process of technology transfer from academia to industry and government agencies. To achieve the best possible result, equally necessary is the academic community, which until now is a closed society, approach the industry and the productive forces. The relationship between the two parties is vital and bidirectional flows will certainly be progress element.

### *2.6.6 Recommendations*

At this point we have to include some suggestions and recommendations that are based on swot analysis. According to my opinion the subject of vital importance is the bridging of the gap between universities and the industry in order to have better and applicable results. Furthermore, besides the larger and constant funding of research that is demanded by the government, there has to be a proper management as well so that money isn't used in sectors and branches not efficient.

Egypt needs to go after partnerships but not only with countries of the Islamic but also of the rest of the world. These partnerships will have to be characterized by credibility and endurance in time.

The sector of education, which is also the most sensitive one, should introduce new technologies, allow the domination of critical thinking and a cross-scientific approach of technology. Emphasis needs to be given as well to professional and technical training.

The concept of the entrepreneurship should acquire a dominant position in academies. It should be taught, encouraged and promoted through the academic environment so that it can become a part of the people's life. Business should be encouraged by the government as well which needs to take measures like a decrease in taxes and the red tape and to direct business capitals to innovative investments.

Universities also require extensive reforms. For example it is important for a larger autonomy to be given for proper management. Also, something that is not easy until today, movement of personnel among universities should be helped. In addition it is not wise to connect the research only with publications but also with patents. That is the goal for every university in the country because patents are those that essentially produce a handsome example of science. Finally women also deserve a solution. The system needs to become more flexible for them so that it can incorporate women in education, keeping out any limitation.

To sum up emphasis should be given to sustainable development within a national strategy of information about the environment, access to information which can change the situation in Egypt and turn the country into a role model.

### 3.7 Conclusions

In this chapter some basic terms were discussed aiming to examine whether they are present in the case of the country we're studying. An effort has been made to show the current situation in the country concerning learning, absorptive capacity, cooperation with Europe, the innovation system and the educational system.

The transfer of knowledge from universities and the research centres to the industry is low and one can comprehend that it is an urgent need to take steps and actions aiming at an effective flow of knowledge from one side to another. It seems that there are no bridges connecting universities to the industry. Research interest for innovation in Egypt collides to a lot of problems and one of them is the lack of communication between the actors.

The Egyptian Innovation System proves that there are isolated attempts by the management, the ministries, and the universities and from non-governmental organizations, the industry and from other institutions. There has never been an organized effort or strategic plan that would bring all of them together to cooperate and produce substantial work with results that would have an impact on the country's economy.

In today's era the country faces serious problems concerning the technological environment, the political, economic, ecological and educational environment through which business activities take place. This unsuitable environment causes significant obstacles in the development of the country and delays that did not help the country begin as competitive as it could be based on various sources and human resources it possesses. The result is the country remaining stable and while there is will for transition, the country refuses to take the big step.

On the part of the leadership, the need for change has become understood and an effort for the creation of the bridge among players has begun. Despite the will though there are still significant obstacles. One of them is the importance governments give to military force. Given its geopolitical position the situation in this sector will remain the same absorbing a substantial part of public funding. Constant political changes are also



a very important event that most of the times causes problems to the internal stability of the country but also the external image it presents.

So far there haven't been any mature efforts to cooperate and increase the flow of human resources, knowledge and information among the actors. This flow is necessary if you want to achieve results in the sector of innovation. Unfortunately the proper emphasis hasn't been given to this flow. This might be due to the fact low absorptive capacity that characterizes Arabic countries.

Something that could be a significant factor for improvement of the current situation is the financial aid of Europe. The senior representative of the European Union Catherine Ashton and the Egyptian minister of foreign affairs had the biggest meeting in November 2012, confirming that the EU is the biggest financial partner of Egypt. The European Union committed to offer an additional economic help to Egypt of up to €800 million with the support of policies assuming democratic processes without exclusions will take effect (European Commission, 2014).

It is very important to take advantage of this economic help not only to be used in the right way but also to increase it. Nevertheless Europe seems to have plenty of reasons to keep its neighbouring country at a high-level.

According to the above assumptions we can set our next goal which is the recommendation of solutions and policies that could set the foundation for a change in the country. By improving the National Innovation System and setting research and science as a main priorities it is believed that the country will acquire an accepted capacity required to shape a new environment.

#### **4. Policy planning**

In the third chapter of this study and preceded by an analysis of the current situation in the country, an attempt will be made to look at the subject of strategic planning and policies. In particular the formulation of policies will be investigated and on what strategy the country will be able to move from the existing environment to a new, mutated and modern ecosystem, able to put Egypt on a growth trajectory.

Then we will discuss the issue on whether the country will be able to assimilate these policies and how. That is whether there are opportunities based on the characteristic that will make any changes accepted, proposals or policies deemed necessary, towards its development.

In addition to the end of the chapter we will introduce certain reflections that may trigger further studies on critical issues.

##### **4.1 Innovation as a driving force for the development of less favourable regions**

Innovation has the ability to face major development challenges. Through innovation solutions are produced to urgent matters such as access to drinking water, poverty alleviation and eradication of diseases. Furthermore, it is now accepted that in recent decades innovation has a key role in economic development of every country. The two concepts are now closely linked. The results of this relationship appear in the least developed countries as well (OECD, 2012). It would not be excessive therefore to claim that Egypt could face both global and local challenges with the dynamics that are offered to the country by innovation. This option implies the learning ability and a successful development strategy in this area (Müller, 2014).

The growth in developing countries faces serious obstacles. This is partly due to the lack of innovation, which simultaneously is exactly why these countries remain underdeveloped. These barriers arise from inappropriate business activity, the governance and poor education. In such cases it is innovation itself that is called to cope with difficult situations (Aubert, 2004). It is therefore concluded that the policies that

will be designed should be tailored to the special features and capabilities of developing country. In particular these policies usually attempt to promote cooperation between the institutions and businesses. This exercise requires intensive knowledge networks and knowledge flows. It also requires cooperation programs, science parks, incubators, production lines and bridges with other parts of the world (O'gorman & Kautonen, 2004).

It becomes clear then that among the strategies the state should emphasize on is a strategy to stimulate and improve the national innovation system. In this way, the country will be able to achieve its purpose, that is the transition from the existing traditional ecosystem to a new one characterized by promoting innovation in all sensitive areas that need reforms.

An extremely critical issue that has preoccupied Europe as well regarding less favourable regions is the basis given by the two sides on strategies for promoting innovation. There is evidence that the lack of policies for R & D capacity and technology diffusion mechanisms are not the only problem in these areas. The essential problem is the lack of demand and acceptance of such policies (CEC, 1994a).

A typical example concerns the interest of Europe to Egypt, was the second meeting of the EU-Africa High Level Policy Dialogue (HLPD) on Science, Technology and Innovation (STI), which took place in Brussels on 28 and 29 November 2013, the European and African officials agreed that the investment fields STI is vital and create growth. Moreover talking about their collaboration resulted in the fact that it is particularly effective since it enhances mutual trust in their effort to address several key challenges. These are climate change, global health and the improvement of living conditions. Finally for Africa identified as a priority the promotion of food and sustainable agriculture. Closing agreed for the next meeting held in April 2014 on the food security and nutrition (Hrst, 2013).

Since the problem of receptivity on the demand -side is more difficult to treat, three types of competence need to be promoted. The first is technological competence, which is the ability of a company to introduce technologies that will meet the needs of consumers. The second type is entrepreneurial competence that is the integration of technologies associated with corporate business strategies and finally the learning

ability which includes the organizational structure of the enterprise and the absorbance capacity of information (Morgan, 1997).

In general we should not overlook that the environment for innovation in developing countries is, by nature, problematic, characterized by poor business and poor governance, low educational level and modest infrastructure. This poses particular challenges to the promotion of innovation and technology diffusion and it is necessary to ensure an appropriate support package including technical, financial, commercial, legal, and other services in order to adapt to the new environment (Aubert, 2004).

#### 4.2 Designing policies for the promotion of innovation in developing countries

Innovation must be understood as something new in a local context. For developing countries, the framework that we are going to set is extremely important. In a global perspective three forms of innovation can be defined. The first relates to local improvements based on technology adoption by the global experience (technology adoption). The second type of innovation is built and implemented using existing technologies (technology adaptation). The third type of innovation is the design and production of technology based on global interest (creation of technology) from a global perspective (Aubert, 2004).

It is understood that there is a significant need for improved living conditions in developing countries, particularly in health, access to education, drinking water etc. The diffusion of technology is the most effective way to increase business performance, as well as to create wealth and jobs. In the case of developing countries should be extremely forgiving and realistic and accept simple technologies as an important step towards the transition. Furthermore, it is particularly important that these countries try to discover their existing dynamics. To capitalize on the diversity that can be derived from the cultural heritage, the geographical location, natural resources, climate etc. This means that some factors that are standard and do not change it is necessary to obtain identity and character. The development of technologies should suit the local conditions. It would not be bad if the autonomy of local communities was maintained (Schumacher, 1975).

What were discussed above have significant value. But the innovation policies have a special feature. They can be generalized and applied to all countries, even when it comes to countries with common characteristics such as developing that were just mentioned. The reasons why policies should be designed that will fit perfectly in the country's style are two. The first is because innovation is a partly territorially embedded phenomenon (Gertler, 2007) and the second is the heterogeneity of the regions (Isaksena & Otto RemØeb, 2001). Based on the above, Egypt cannot copy policies that have been pursued in other countries in the belief that they will succeed. But it can use the same policy tools to emulate the countries (Isaksen & Nilsson, 2013).

It is worth mentioning that the most successful regions in innovation have a rich organizational life. Furthermore there is good and open communication between key social actors and political organizations and institutions have popular support and work for their region at local, regional, national and international level and in relation to sectors and organizations (Putnam, 1993).

In contrast, in areas of dysfunction characterized by hierarchical structures and centralized power, it has been found that the initiatives are limited and reserved only for the elite. The result is that civil society is underdeveloped. Furthermore there is miscommunication and no cooperation among political actors, market institutions and society (Stöhr, 1990).

The main key factors, which must apply for the success of an innovation policy, are: Political Legitimacy, knowledge, capacity, capital, Trust and Self-confidence, Planning for the Region and Talk and cooperation (Amdam, 2003). These factors could be exploited by the Egyptians to develop policies for innovation. What emerged from the study in the previous chapters is that the country presents exceptional weaknesses in all these areas. In the above factors I would like to add geopolitical position. This issue, if we consider that innovation is closely intertwined with the area of concern whether the level of innovation is affected and how by the geopolitical position.

#### 4.3 Gaps that observed and policies that have been proposed for innovation in Egypt

The innovation activities in Egypt are divided into Technology, Entrepreneurship and Industry /Academia Collaboration (STDF, 2012). Technology transfer is the transfer of inventions, technology, know-how and methods between research institutions, industrial enterprises and government agencies. Technology transfer is done through licensing / selling Intellectual Property and available information (Kogut & Zander, 1992)

Entrepreneurship is about the activities were undertaken to convert inventions into new products, services, processes, and innovations that have economic or social benefits for the country. Collaboration between Industry and Academia establish connections between industrial and research communities. In the case of Egypt, this cooperation is lacking greatly (STDF, 2012). It is therefore necessary to encourage the industry to trust the scientific research with in order to be able to meet future needs and to facilitate the process of technology transfer from academia to industry and government agencies. To achieve the best possible result, equally necessary is the academic community, which until now is a closed society, approach the industry and the productive forces. The relationship between the two parties is vital and bidirectional flows will certainly be element for progress.

#### 4.3 Policies to bridge gaps

The national policy is marked by the ambitious plans and many diversified programs that started in the second part of the 20th century. The dominance of traditional ways of funding and research activity is very low (Deniozos, 2011). From a thorough investigation which introduced by the STDF were observed many gaps for each category of innovation activity. For gaps, research, suggests policies that are believed that they can cover them and improve their conditions.

To bridge the gap in the Technology Transfer activities are recommended the following policies:

- Disseminating up-to-date reports about innovation activities in Egypt on a regular basis, in order to create a database.
- The creation of communication channels between all innovators in Egypt through regular meetings and cooperation programs.
- Establishing a number of Technology Transfer Offices (TTOs) in universities
- Getting the top management and staff at universities and research centres involved in supporting the Technology Transfer activities. This includes the presidents, deans, heads of departments, and researches.
- Having clear guidelines and procedures to be followed in public institutions for the commercialization of government owned Intellectual Property.
- The government should support and encourage inventors and private investors who are willing to invest in implementing the inventions
- Establish formal education and training courses in technology transfer.

The following policies are recommended to support Entrepreneurship:

- Developing formal education and training on issues relating to the management of innovation and human capital, incubators licensing and negotiations, evaluation and assessment of technology, and international business development.
- Setting up a number of technology incubators according to the best practices worldwide and hiring qualified personnel to manage them.
- Start-up companies can use the equipment of universities.
- Commercializing the inventions of universities and research centres.
- Creating more opportunities for employment and promoting entrepreneurship, which will positively impact the Egyptian economy as a whole.
- Training Entrepreneurs from different educational backgrounds in order to work in Transfer Offices and Technology Incubators in commercializing research based inventions.
- The Egyptian government can always encourage start-ups to provide solutions for existing problems improve existing systems, participate in planning activities. The government must believe in their capabilities and support them.
- Establishing seed funds for inventors and business innovators who are willing to start new ventures to commercialize their inventions.

These policies are recommended to bridge the gap in the Industry Academia Collaboration activities:

- Creating programs to increase the research community's awareness about industry needs and the different business aspects that should be considered during the research process.
- Exploitation of previous success stories for cooperation between actors in them.
- Establishing communication channels between the industrial and academic communities.
- Promoting the R&D and open innovation cultures among industrial entities. The government can provide incentives such as research and development grants and tax reductions for R&D activities.
- Establish industry and academia as nodal points where will take part collaborations.

#### 4.5 Conclusions

If Egypt envisions getting into a course of growth and innovation, it is imperative to devise policies favouring conditions for the consolidation of innovation activity in the area.

These policies should address the workforce of the country, improving the education system to better use of information and knowledge creation and absorptive capacity. In addition, policies should support entrepreneurship, technology transfer and cooperation between Academia and Industry. Finally it is necessary to create pathways and communication channels between all players. This presupposes culture and mentality cultivated over time through education and partnerships with other parts of the world.

Any policy etched need to be dynamic and flexible. It should aim at the combination of science with practical knowledge. An important objective is also to accelerate the process of learning especially for a country that has an immediate need and is in a transitional stage. Furthermore any policy it is important to encourage research and development and to facilitate the flow of information.



What cannot be affected by any policy developed, and it is assumed is the geographical position of the country and the value of this location worldwide. Furthermore no policy can affect the past. But it may take note of it for the best design. Finally, the country's natural resources, when they become the subject of a policy are important to be managed with great respect, focusing on viability, preservation and not uncontrollable waste.

## 5. Conclusions

It is now common knowledge, the claim that the economic environment has changed dramatically in recent years. Globalization and the explosion of technologies have shaped a new reality. The importance of innovation in today's economy of all countries is undeniable. Innovation rises today as one of the most important parameters for growth, both at national economy and enterprise level, while it is set on a high priority position on policies of almost all countries

From the research conducted for the country of Egypt it was observed that while there are the components for a successful course in this direction, there are factors that put a stop on any attempt. First I must stress that behind the political revolution against the Mubarak regime; the need of people to switch to a new reality was hidden that will springboard innovative activity. Whatever the mood of the people, there are serious problems of funding research and education, that are critical factors to consolidate innovation. A significant gap exists in communication between the universities and the industry. It seems that the bridges are absent for the transfer of knowledge between the two parties. So far there seems to be a mature effort for cooperation and flow increase of human resources, knowledge and information between actors. However, this flow is essential if we are to achieve results in innovation. The above analysis for the Egyptian Innovation System proves that there are individual communication efforts but are in need of coordination and organization to achieve serious results.

In addition extremely strenuous efforts are needed to extricate the culture of the people from the traditional closed society, which puts barriers in anything new. Important roles have partnerships with Western countries, which can stand as a crutch in the country's effort to transition and change of environment. It is important that the components are there. One therefore should control the proper functioning of the system. In this process an extremely critical role is that of political leadership because it is the one that will be the umbrella under which this effort will take place. Therefore political stability is certainly one important factor that determines the country's development in innovation. In addition, policy makers are the ones who create a political environment appropriate to accept the change and ensure for the completion of this effort. Thus the institutions must function properly to create an environment of trust for the creation and acceptance of innovation activity. The sector which is considered critical and requires restructuring

is that of education. Moreover, the need to link academia and industry should be put in the spotlight so as not to waste manpower and financial resources. Policies that must be exercised should be long-term and take into account the particular characteristics of the country in which they are addressed. Thus the Egyptians who are responsible for designing policies, it is necessary to emulate other countries that have achieved success in innovation, adapting their policies to the data of the temperament of their country. One could therefore distinguish that prospects exist because there are elements but certainly serious work is required from all sides.

What is particularly interesting is the attitude of the country towards military leadership issues. Due to its prominent geo-strategic position large sums on military equipment are spent. This is possibly one of the reasons that other areas lack major funding. Military expenditure reach 1.72% of GDP for 2012, while spending on research and development is only 0.43% (World Bank, 2014). With the closure of this paper the question arises if ultimately the countries with significant geopolitical position have the same attitude towards innovation. If indeed there are similarities with the country of Egypt, then it means that in these countries, any attempt to innovative activity either way will not have positive results. But this is a matter of further research.

# Appendix

### 1. Map of Egypt



Source: <http://graphicriver.net/item/map-of-egypt/5074590>

2. List of Presidents and Prime Ministers in Egypt

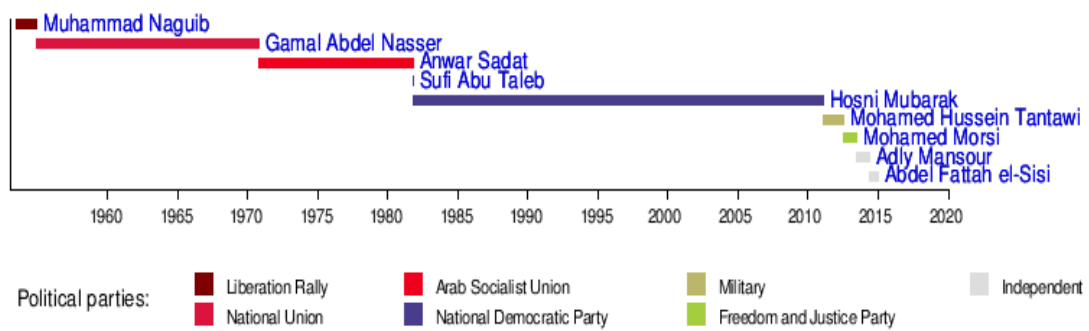
#	Name	Picture	Born-Died	Took office	Left office	Political Party	Term
 • <b>Republic of Egypt</b> (1953–1958) • 							
1	Muhammad Naguib محمد نجيب		1901–1984	18 June 1953	14 November 1954 (resigned)	Military /Liberation Rally	1
<b>Revolutionary Command Council</b> (Chairman: Colonel Gamal Abdel Nasser)			–	14 November 1954	23 June 1956	Military	–
2	Gamal Abdel Nasser جمال عبد الناصر		1918–1970	23 June 1956	22 February 1958	National Union	2
 • <b>United Arab Republic</b> (1958–1971) • 							
(2)	Gamal Abdel Nasser جمال عبد الناصر		1918–1970	22 February 1958	1 December 1962	National Union	3
(2)	Gamal Abdel Nasser جمال عبد الناصر			1 December 1962	15 March 1965	Arab Socialist Union	

				15 March 1965	28 September 1970 (died in office)		4
3	Anwar Sadat أنور السادات		1918– 1981	15 October 1970 Acting since 28 September 1970	2 September 1971	Arab Socialist Union	5
 • Arab Republic of Egypt (1971–Present) • 							
(3)	Anwar Sadat أنور السادات		1918– 1981	2 September 1971	2 October 1976	Arab Socialist Union	5
(3)				2 October 1976	2 October 1978		
				2 October 1978	6 October 1981 (assassinated)	National Democratic Party	6
—	Sufi Abu Taleb صوفى أبو طالب (acting)		1925– 2008	6 October 1981	14 October 1981	National Democratic Party	—
4	Hosni Mubarak		1928–	14 October 1981	5 October 1987	National Democratic Party	7

	حسنى مبارك			5 October 1987	4 October 1993		8
				4 October 1993	26 September 1999		9
				26 September 1999	27 September 2005		10
				27 September 2005	11 February 2011 (resigned)		11
<b>Supreme Council of the Armed Forces</b> (Chairman: Field Marshal Mohamed Hussein Tantawi)		–	11 February 2011	30 June 2012	Military	–	
5	Mohamed Morsi محمد مرسي		1951–	30 June 2012	3 July 2013 (deposed)	Freedom and Justice Party	12
<b>General Command of the Armed Forces</b> (Chairman: General Abdel Fattah el-Sisi)		–	3 July 2013	4 July 2013	Military	–	



—	<p>Adly Mansour</p> <p>عدلي منصور</p> <p>(acting)</p>		1945–	4 July 2013	8 June 2014	Independent	—
6	<p>Abdel Fattah el-Sisi</p> <p>عبد الفتاح السيسي</p>		1954–	8 June 2014	Incumbent	Independent	13



Source: <http://graphicriver.net/item/map-of-egypt/5074590>

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