Innovation and Economic Performance Evidence from Algerian industries

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Detailed abstract:

Innovation is often associated with competitiveness, economic performance and economic growth; it is accepted that Innovation is one of the efficient means to obtain a superior and a stable position in the marketplace. In the last few decades; the literature has shown that the growth in the stock of knowledge has been the most important factor behind the dramatic rise in living standards in countries that show a broad convergence in macroeconomic performance. Countries, also, all around the globe are paying a great attention to Innovation as well as to the whole national innovation system (NIS); While some other countries are still in need to gather their efforts in ways that drive the innovation activities development.

This paper aims at identifying the main characteristics of the NIS of Algeria, it, also, highlights the key innovation problems and obstacles of industrial firms, mainly in North African Countries. Our work is based on the one hand on a theoretical, and comparison study, of the National innovation system, of the Maghreb countries. On the other hand it stands on a field research carried out on a sample of Algerian industrial firms, the interpretation and analysis of the results of our survey through using both, descriptive analysis and logistic regression helped identifying the core characteristic of the Algerian innovative enterprises, in addition to the main obstacles of innovation in Algeria; in Maghreb countries, innovation systems construction takes place in a very specific environment characterized by privatization of public concerns, the rise of a strong Small & Medium enterprises sector but with very little experience in the fields of R&D and innovation, and a relatively weak industrial sector in terms of industrial performances, suffering high obsolescence both in terms of human resources, equipment and linkages between the different actors of the innovation system, which negatively affects the role played by research on development processes. Some recommendations, for a well-functioning national innovation system for Maghreb countries, have been drown from this study.

Key words: Innovation, National Innovation System, R&D, Logistic Regression, Algerian firms, product & process innovation.

Innovation and competitiveness: a theoretical background

Let's try for a moment to think of a world without airplanes, automobiles, telecommunications, televisions, refrigerators, telephones, internet, agriculture …where would we be without essential stuff for our lives such as alphabet, languages, printing etc? Maybe you would not be able to read this paper, and I, of course, would not be able even to write a word in it. Without Innovation our world would look very, very different, hence Innovation is as old as mankind itself, there seems to be something naturally human to thing about new and better ways of doing things and try them out in practice. In spite of its clear significance, innovation has not always got the scholarly attention it deserves, except in the last few decades; nevertheless, some authors have been interested in innovation processes, from the viewpoints of economic growth, changes and progress (Schumpeter 1939; Schmookler 1966; Freeman 1990; Kline & Rosenberg 1986; Dosi 1982; Amendola & Gaffard 1988, etc.), of social and organizational changes (Rothwell, 1994; Chandler 1990; Callon, 1994, etc.), or from the sociological and managerial viewpoint (Crozier & Friedberg 1977; Mintzberg 1982; Akrich, Callon & Latour 1988; Alter 2000, etc.).

Most authors, economists and theoreticians in the field of innovation have generally accepted that innovation is a key condition for economic success (Hamel, Gary & Gary Getz 2004; Audretsch et al 2000). It has also been argued that the most remarkable examples of growth have been based on 'upsetting innovation's platform. (Christensen et al. 2002). While much has been written on the role of innovation on economic growth, including the influential work of Schumpeter from the 1930's, only lately has there been a compelling folder made to argue that external environmental factors are at least as important as internal factors in motivating innovation. In particular some location based advantages such as the privileged access to information and institutions, the local economic, social, technological and political factors, and moreover the ability of acceptance in the local market by consumers (Porter, et al. 2001), mainly because there seems to be found a kind of strong effect of consumer desires and needs on the innovativeness of Industries; Schumpeter (1942) declared that Changes, including unexpected results and ongoing processes of creative destruction, create a need for systematic innovation of products, processes and management practices. He also defines Innovation as the process and outcome of creating something new, which is also of value. Michel Porter identifies it as "new way of doing things, which is commercialized. The process of innovation cannot be separated from a firm's strategic and competitive context…" one of the more cogent definitions of innovation is to be found in Theodore Levitt's work. According to Levitt, "To be innovative, an idea must be creative and it must be implemented" (Levitt, 2002). Nevertheless; particular emphasis was placed on Hamel's 'Design Rules for Innovation' and Drucker's comments on industry and market changes, demographic changes, and changes in perception (Hamel, 2000; Sutton, 2001; Drucker, 2002). This emphasis was balanced with consideration for the external environment, including factors such as preferential access to information and information flows (Porter & Stern, 2001). Rogers simply identifies innovation in general as "any idea perceived as new by a person or system" (Rogers, E.M. 1992). Bingham also accepts the definition of innovation as "the first or early use of an idea by one of a set of organizations with similar goals" (Bingham,R.D.1976). Altshuler and Zegans stress (1990) action by defining innovation as "novelty in action".

Meanwhile Change is the key point in Moore, Sparrow and Spelman's definition of innovation, "any reasonably significant change in the way an organization operates, is administered or defines its basic mission," (Moore, M. H. et al. 1997). In Lynn's definition of innovation "innovation is an original, disruptive and fundamental transformation of an organization's core tasks". (Lynn, L. E., Jr. 1997.). Van de Ven et al (1999) suggested that the best strategy which can be taken is to avoid being stuck in the middle, and remain to different solutions/ideas; From this point of view the stress is moved from the introduction of specific new and useful ideas to the general organizational procedures and processes for generating, considering, and acting on such insights leading to important organizational improvements or novelty of products, services, or processes. Through these diversities of perspectives, creativity is in general seen as the source for innovation, and innovation as the successful implementation of original and creative ideas within an organization. Table 1 which follows provides a comparison between four main concepts linked together in so many areas, which are innovation, creativity, invention and science.

Table 1 – Innovation, creativity, invention and science

INNOVATION vs INVENTION
Invention is the creation of a new concept. **Innovation** is reducing that concept to practice, and making it a commercial success.
INNOVATION vs CREATIVITY
Creativity is coming up with ideas. **Innovation** is bringing ideas to life.
INNOVATION vs SCIENCE
Science is the conversion of money into knowledge. **Innovation** is the conversion of knowledge into money.

Source: Composed according to Feldman, M., 2004

Arguably, we understand the role played by innovation in economic change, mainly because innovation introduces novelty (variety) into the economic field, for the reason that without innovation the economy will settle down in a “stationary state” with little or no growth (Metcalfe 1998), therefore, innovation is essential for long-run economic growth. Furthermore; innovation tends to gather in certain fast-growing sectors, leading to structural changes in so many areas such as production, demand technologies and, ultimately, organizational and institutional changes. The capacity to be the leader in any market or business issue is central for the ability to take advantage from innovation. Innovation also is a powerful explanatory dynamic behind dissimilarities in performance between organizations, regions and countries. Industries that succeed in innovation growth, at the expense of their less able competitors, Innovative countries and regions have higher productivity and income than the less-innovative ones.

Without a doubt, innovation is one of the essential factors of business performance as well as economic growth, the interactions between innovation and success have been and are still being a central topic of a number of studies; Schumpeterian and Neo-Schumpeterian analyses and endogenous growth theories are ones of the most interesting works in this field. Schumpeter for instance builds almost all of his studies and literature upon technological innovation, which is mainly based on Research and development (R&D); he highlighted the relationship between economic growth and innovation. Schumpeterian and neo-Schumpeterian analyses emphasized also the role played by the public policies to support innovation; mainly through sustain strategies within the country. as exemplified by Schumpeter's "psychological" theory of entrepreneurial behavior (Fagerberg; 2003). Likewise, most work on knowledge focuses on individuals, not organizations. Except Nelson and Winter's work (1982), on "organizational memory" and its links to practice lined the way for much subsequent work in this topic. However, In the late of the 1980s, a new conceptual framework appeared in the economic literature, which is calledThe National Innovation System, by researchers like Freeman, Lundvall and Nelson, this framework suggests that the research system's main goal is Innovation, and that the system is a component of a larger system composed of government, universities, research labs, and industries and their environment (Godin B. 2007); since then, and because of human resources development, the flow of foreign direct investment (FDI) and the rapid economic growth in some countries such as the US, the EU member countries, Japan, China, developments in the field of science, technology and innovation helped to make those countries and regions in the spotlight of the economic analysis for numerous researches. NIS is getting a growing importance in the literature as well as in policy making for countries all around the world, mainly for understanding and promoting innovation and economic development.(Stephen Feinson, 2002).

A brief overview on the National Innovation System (NIS) approach:

After its introduction in the late 1980s by researchers such as Freeman (1987, 1988), Lundvall (1988) and Nelson (1988), the concept of National Innovation system has been further elaborated and underpinned in the early 1990s. It can be regarded as a well-known approach within modern innovation research. Above all, the approach focuses on the analysis of national structures of innovative activities, their institutional determinants and economic effects. Freeman defined NIS as the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies. (Freeman, 1987); Lundvall (1992) declared that NIS is the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge ... and are either located within or rooted inside the borders of a nation state. Nelson, also, (1993) affirmed that it is "a set of institutions whose interactions determine the innovative performance ... of national firms; however, The NIS approach stresses that the key to the innovative process are the flows of information and technology between institutions, enterprises and people. Innovation and technology (I&T) improvements are the result of a multipart set of interactions among NIS actors, which contains people, enterprises, universities and research institutes (OECD, 1997). According to the OECD (1997) Innovative performance and general competitiveness can be achieved if the actors of the NIS understand what the best tools, and what the significant roles of the NIS are, and by the way the well understanding of NIS can help identifying leverage faces for enhancing economic performance. Several advanced economies have relied on Policies, which seek to improve networking among the actors and institutions within the system and to enhance the innovative ability of firms and people. And thus several developed economies are supporting education, research, and business in order to foster national and regional competitiveness.

From a neo-Schumpeterian viewpoint, differences across countries' economic performance are explained by the complexity of connections, coordination and interactions among public and private organizations that make their National Innovation Systems advanced. In this context, one can say that the lack of coordination between the major objectives of public and private sectors and those of the other national institutions involved in industrial and technological policies can make vulnerable the national economic performance. And to understand National Innovation Systems, Nelson (1993) says that it is essential to understand how technical advance occurs in the modern world, and the key processes and institutions involved.", while Rosenberg (1993) declared that "Today, R&D facilities, staffed by university trained scientists and engineers attached to business firms, universities or government agencies, are the principal vehicles through which technological advance proceeds in fields such as…...", one can say that the literature has centered the evaluation and assessment of NISs on four types of knowledge or information flows which are as follows;

1) Interactions among enterprises,

2) Interactions among enterprises, universities and public research institutes;

3) Diffusion of knowledge and technology to enterprises, and;

4) Personnel mobility, focusing on the movement of technical personnel within and between the public and private sectors.

Since the first appearance of NIS concept, it has internationally started to change the main directions of innovation policies; this concept highlights the role of the cooperative interaction between individual innovative firms and other innovative organizations. Hence, this concept would be promoted especially when businesses, financial system, and research and academic bodies are included within a general system. Research group headed by Nelson compared the NISs of 15 countries, discovered that the dissimilarities between them reproduced different institutional arrangements, including: systems of university research and training and industrial R&D; financial institutions; management skills; public infrastructure; and national monetary, fiscal and trade policies. By the late 1990s, OECD had initiated broad comparative countrywide study of national innovation systems (OECD 1997, 2002), which produced support to the ideas of Charles Edquist (2001) and Jack Metcalfe (1998), that national innovation system is a comparative concept – there could not be an ideal national innovation system, which fits different nations with their specific socioeconomic, political and cultural background (Urmas Varblane et all, 2007). Nevertheless, a recognized model of a NIS does not exist and it is so hard for a particular NIS to be useful to another country by the same degree of performance. By the way, through case studies, Nelson and Rosenberg have emphasized that "we have been impressed by the diversity of 'national systems' that seem to be compatible with relatively strong, and week, economic performance in particular contexts…partly is may be because the performance of the innovation system is a larger factor behind economic performance in some contexts than in others."(Nelson and Rosenberg, 1993, p.20); moreover they (Nelson and Rosenberg) have declared that"... since considerable differences exist when even comparing countries with similar economic conditions. The differences are caused by historical and cultural differences including the process of industrialisation, and have a role in shaping the legal systems and policies of a particular country."

As Schumpeter (1939, 59) said « innovation is possible without anything we should identify as invention and invention does not necessarily induce innovation, but produces of itself no economically relevant effect at all », and by the way, entrepreneurs are ones of key creator of innovation within the economy, whatever it is their degree of activities or performance, and even if they don’t have such huge capacities or tools to innovate they can do it without anything.

While the US, the EU and Japan are still leading the world in the term of research and development efforts, they are being increasingly challenged by emerging economies, especially China. (UNESCO Science Report, 2010) The Arab World has been trying to improve its NIS over the last few years, although 95 % of the world researchers are found in Asia, Europe, and North America, whereas Africa, Latin America, Oceania, and Caribbean represent only 5% of the world researchers (UIS S&T statistics; 2005) this fact shows a huge gap between the north and south in the matter of research as well as GERD as a percentage of GDP (Algeria is still behind by 0.07 % GERD) (UIS S&T Database, 2008)

As we all probably know, the innovation system approach was employed using experiences of high income countries, with developed infrastructures and institutions, well built knowledge base, and well-functioning /economic systems, The situation of developing countries is rather different than those of developed economies. They have much lower income levels, a smaller amount of the role played by institutions and infrastructures on R&D aspects, and less accumulated knowledge. In addition, the foreign direct investments in the developing countries are playing much more important role than in the rich industrialised countries applying the national innovation system concept, but it's not the case for the less developed countries. Therefore the relationships between globalisation and national/local systems need to be further researched.

There exists fairly little analysis of organizations acting as obstacles to innovations, which is the case in less developed countries, Therefore instead of copying the adaptation of the innovation system, a different approach is needed in those countries. In order to meet the challenge of adaptation the innovation system for development processes,

After the systemic change in the early 1990s the role of linear innovation model still remained the prevailing innovation model for the policy-makers in transition economies. It has taken the form of the mystification of the role R&D, which reflects the misunderstanding about the mechanistic relationship between increased R&D spending and higher per capita GDP. R&D and innovation are often used as synonyms among the policy- makers in catching-up economies. The higher the expenditures on R&D, the higher is the innovativeness of society expected to be. Unfortunately this fetishism of R&D has been cultivated also in many recommendations given to the transition countries from various consultants and even in the EU recommendations. according to Urmas Verbalane et al (2007). there exist several problems in the building up of NIS, as the reflection of path-dependency, such as the following ones;

1) Underestimation of the role of public sector in the national innovation system

2) Dominating role of the linear innovation model and neglecting demand

3) Confrontation between high- and low-tech industries

4) Overvaluation of the role of foreign direct investments

5) Lack of social capital and network failures

6) Weak innovation diffusion system and low motivation to learn

In 2002 the World Bank analysed the technological ability of firms to innovate and their internal willingness to change in Korea. Firms in the following figure are distributed into four groups based on the grade to which they are conscious of the need to change and the degree to which management is aware of what should be changed and how to go about changing it. At the lowest level are firms without any capacity for technological change and which do not feel any need for change; by the way, that is exactly the case of many firms in Algeria.

Figure 1: Classification of firms by their technological capability and motivation to change

Source: the World Bank, 2002.

The task of the innovation system in this case should be able to move firms up the ladder described in Figure 1. It requires activities in two dimensions. Firstly, to push firms to develop their capacity to absorb technologies from abroad and innovate by providing access to different sources of technologies. Secondly, to improve the internal motivation of firms to change, this requires providing data for firms about their relative position comparing with the best practises in the world.

What Drives Innovation?

In many ways the discussions made about innovation are not really new, boards are spending more time discussing innovation and what conditions and factors can drive the innovation process and especially that companies all around the world see innovation as a long game in which they can win or lose, thereby, they are continuously trying to tilt the odds in their favour, in order to win that game of innovation. In the recent few years the academic evidence appears to indicate that there exist four factors drive the innovation process of firms, which are:

- **The structure of the industry**
- **The economic structure of the firm**
- **The organizational structure of the firm**
- **The historical development of the firm**

The firm does not activate in a vacuum but in a very complicated environment full by several factors mainly those that construct and characterize the structure of its industry, which is a main determinant of whether or not it innovates. Empirical evidences point out that firms in industries where innovation is necessary do innovate, and it is the case of those which are facing a strong competitiveness. However, the evidence also shows that the innovation process is a high risk, but potentially high profit venture, the fundamental uncertainty that cannot be totally taken off from the innovation process, can be limited in industries and environment which help innovative firms; mainly those that include a very sophisticated intra and inter-organizations integration. There are also two main drivers of innovation in the economic structure of the firm, which are the firm’s size, and the seconds is based on the Teece/Itami view of the firm as a producer of information and other intangible outcomes. For the former, the studies that have been done have shown that there are large economies of scale associated with R&D and product development expenditures. While for the latter the stress is made on the firm as developing intangible and non-tradable properties. Firms with a combination of complementary assets can increase these assets over a number of potential products. Innovating firms according to this view invest more than non-innovating ones in both R&D and advertising, several studies have shown also that larger and more horizontally and vertically integrated firms are better innovators than single-product firms; while smaller firms are more flexible and successful at taking advantage of the external effects of R&D accomplished at other organizations, laboratories and universities; this free-ride permit them to recompense for their need of scale in R&D assets. In most innovative countries Innovations in small firms do not necessitate so many complementary assets, this reality is right enough to drive the smaller firms being innovative while they can sell or lease their innovations to bigger firms possessing the complementary assets to exploit as best as they can the product’s potential. the third factor that drives innovation of a company is the internal structure of the company. Evidences in a great majority of researches that have been done in the domain of innovation have shown that the organizational structure of the firm has a huge impact on the innovativeness of the firm, mainly because Innovations need such an internal environment into which information, knowledge and skills are generated and capitalized into profitable products. Much of empirical evidence indicate a very common view that successful innovative firms are less than committed to, they have such an integration of innovation strategies with corporate strategies that allow them to facilitate and insure their working processes and their cross-functional teams’ activities. Clark Wheelwright and Hayes provide a remarkable scheme that stresses on the relationship between the management role and its weight on new product development processes.

Measuring innovation

There exist several ways to measure innovation, but the most used measures are known as the traditional measures of innovation, which are R&D expenditures and patents. Following many studies in this domain since the 1950s, R&D expenditures can be regularly collected, usually on an annual basis, in several countries, while patent data have been collected since an earlier period of the 19th century, in the case of Algeria, patent data are available on the INAPI database.

Innovation and Patents

It is widely known that patents provide protection for the invention to the owner of the patent, thereby, the invention cannot be commercially made, used, distributed or sold without the patent owner's permission, this protection is required in today's market and especially with all the emitted products and services that are found in the market, generally this protection is granted for a limited period, which is 20 years in almost all the cases, and sometimes less; in this period, only the patent owner has the rights to give permission to or licence other parties to use the invention on mutual agreed terms, he may also sell the rights to someone else, as he may give them to that new owner; for free. Once a patent expires, the protection ends and then the invention becomes available to commercial exploitation by the others, and the owner no longer holds exclusive rights to the invention. In fact, All patent owners are obliged, in return for patent protection, to publicly disclose information on their invention in order to enrich the total body of technical knowledge in the world. Such an ever-increasing body of public knowledge promotes further creativity and innovation in others. Empirical evidence has shown that there was no relation between a country's score on this index and its economic growth. Increasing IP rights tend to be correlated with R&D spending, but it turns out the causality goes the other way: first a country starts spending more on R&D, and then later they increase IP rights strength. In this way, patents provide not only protection for the owner but valuable information and inspiration for future generations of researchers and inventors. In Algeria a patent may be granted from the INAPI *(Institut National Algérien de la Propriété Industrielle)*, which first of all requires the person who asks for the patent to fill up a patent application which contains the name or the title of the invention its self, the indications of its technical field, the background and the description of the invention as well as the drawings, plans, or the diagrams to better describe the invention.

In 2006 the INAPI received 477 patent demands from national companies, while the whole demand for patents was 514 demands, which is really limited comparing with other countries, and even though for that raise in patents demand, from a year to another in the last decade, patenting is still need to accelerate further; the case was the same for trademarks demand from the INAPI office because it was only 2682 demands in September 2006; with a raise of 244 demands comparing with 2005. the same organization received 2875 trade mark demand to extend into the Algerian market from foreign companies, while the number of these demands was counted by 3665 demands, 31 patents was the number of the accepted patenting demands in 2006 by the INAPI, from the whole 477 demands, sometimes the rejection of these demands was because of the missing files or the uselessness of the invention its self, while some of theme was because of the policy of the INAPI, and the wasted time concerning each of the preparation and the patents' demands studies, and so on…through some interviews with local Industries from which have already asked for their patents as well as the local commerce chamber, there was obviously a huge gap in time between the demands and the acceptance/rejection of the files, which is counted as a main problem and obstacle for Industries to get the industrial property rights of their invention. The next Table (Table 2) illustrates the patents' demands, registrations and renewals for national trade marks in the INAPI office in the first three trimesters of 2006 concerning national and foreign companies, this table shows that 554 demands was accepted from the number of 1664 demands of trade marks from national companies, while 546 trade mark was registered from 1018 foreign demands, while only 128 national trade mark have renewed their patents in that period in addition to 487 foreign ones have been renewed in the same period of 2006. In 2007, the WIPO received 84 Patent applications from the Algerian office of patents, while it was 58 applications only in 2006 and in 2008 the number was planned to be extended but data are not available neither at the WIPO's nor at the INAPI's official web sites. It was 59 in 2005 and 58 applications in 2004. (See the WIPO Statistics Database, December 2009)

Table 2: deposits, renewals, and registration of national trademarks (period from 01/01/2006 to 09/30/2006 :

Country of origin	Deposits	Registration	Renewals
National	1664	554	128
Foreign	1018	546	487
Total	2682	1100	615

Source: the INAPI web site.

According to the WIPO (WIPO, 2012) a considerable increase has been witnessed in patents granted to both resident and non-resident applicants in Saudi Arabia and Algeria.

Table 3 which is bellow demonstrates some statistics of patents taken from the INAPI data base, it illustrates the number of Patents delivered for national Industries by the INAPI, and the number of patents demanded in the period between 1988 and 2007, we have asked the INAPI offices for recent statistics of this kind, but each time we called they kept saying that it is still confidential and that they cannot offer us such information, because they do not concern the INAPI itself but also the local Industries which have asked about the patents of their products and services, as well as the ministry of the industry, anyway; was 214 in the date of 2007, while it was 590 patents in 2006 and 550 in 2005, with the exception of the drop of the number of patents in 2007, comparing with the previous year, patents number was raising by time in the last decade, while it was not steady in the 1990s; mainly because of the social, political and economic situations in that period. Algeria now is in the right way to strengthen the patents policies within the local market, with so many laws and texts through which companies will be able and sometimes obliged to register their inventions and trademarks.

Comparing with other African countries the Algerian Resident patent filings per $billion of Gross Domestic Product in the period between 1995 and 2007 seem to be very much low than these of the other countries in the table even the countries which have the same and even a lower income, such as Zambia, Kenya, Madagascar, and even Tunisia, the less than 0.35 billion from the GDP is considered to be law comparing with Egypt which gives more than 1.35 billion for the same year (2007), while Tunisia gave 0.87 $Billion in 2005 for resident patent filings, that may be because of the reason that in Algeria this kind of expenditures is financed by public sector only, which is the case in Saudi Arabia, and Morocco.

Table 3: Resident patent filings per $billion Gross Domestic Product* (1995-2007)

Country of Origin	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Algeria	0,18	0,30	0,20	0,24	0,20	0,17	0,27	0,22	0,14	0,26	0,25	0,24	0,34
Egypt	1,88	2,21		1,97	2,02	1,91	1,60	2,11	1,61	1,20	1,29		1,35
Kenya		0,40	0,58	0,69	0,63							0,74	
Madagascar	1,83	0,60			0,68	0,50		0,31	0,21	1,08		0,25	
Malawi	0,15	0,28	0,27	0,26	0,12	0,37							
Saudi Arabia	0,08	0,07	0,15	0,12	0,19	0,19	0,11	0,15	0,13	0,17	0,24	0,24	0,24
Tunisia	0,78	1,06	0,92	0,81	1,35	0,90	0,40	0,81	0,60	0,74	0,87		
Zambia	0,43	0,60			0,48		0,53						

Source: WIPO Statistics Database and World Bank (World Development Indicators), June 2009

*** data based on 2005 purchasing power parities.**

According to the WIPO statistics database (2012) the number of PCT filings in 2007 is higher than the 2002 level. Algeria, Turkey and Saudi Arabia had the most notable increase (average annual growth) in PCT filings. However, the combined share of all reported emerging countries in total PCT filings was only 2.5% in 2007.

Innovation and R&D:

The theoretical background of innovation, and R&D considers R&D as a main driver of innovation performance and is then a determinant of the innovation level of any country, R&D comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications. R&D is a term covering three activities: basic research, applied research, and experimental development. Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view. Applied research is also original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective. Experimental development is systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed. The main aggregate used for international comparisons is gross domestic expenditure on R&D (GERD). This consists of the total expenditure (current and capital) on R&D by all resident companies, research institutes, university and government laboratories, etc. It excludes R&D expenditures financed by domestic Industries but performed abroad. Several methods and concepts ma be in the use of measuring the R&D activities of an economy, such as the R&D impact on innovation, the NIS GERD, and the number of researchers…(Metaiche, 2010).

Measuring Innovation in North African Countries

It is widely accepted that there is a huge gap between the north and south, in all areas and domains including social, economic, organizational, and so on, this gap concerns also the R&D and innovation sector between the north and the south. Many Developing countries, like Maghreb countries (Algeria, Tunisia, Morocco) innovation systems construction takes place in a very specific environment characterized by privatization of public concerns, the rise of a strong SMEs sector but with very little experience in the fields of R&D and innovation, and a relatively weak industrial sector in terms of industrial performances, suffering high obsolescence both in terms of human resources and equipment (Djeflat A., 2008).The performance of research and innovation of Industries and universities from the North bank is very high and dynamic compared to the other bank. In most Maghreb countries, policies are being worked out to establish ITCs in key strategic sectors: textile, garments, mechanical, electrical, food industries etc. ((Djeflat A., 2008); it has been illustrated in the previous part of this work the portion of the Arab countries does not exceed 0.5% from the global scientific publications (all disciplines included)., and the GERD does not exceed the average of 1% in almost all the countries, if not pretty much less than that; GERD can show the real picture of these countries in research which is very limited and does not really contribute in the accumulation of knowledge and enhancement of the productive system. In Algeria, for instance, the GERD has been improving by time in the last decade, but even though that enhancement it (GERD) represented only 0.35% from the GDP in 2004; and research is almost 98% funded from public organizations but there are not any tools or programs to make it concrete and valuable, in Algeria also The creation of innovating Industries is exclusively the mission of large enterprises such as Sonatrach, Sonelgaz, Electricité d'Algérie, SAIDAL.. (Khalfaoui, 2006). While for Tunisia and Morocco, there is a little light concerning GERD and the existence of programs to motivate R&D and innovation, but research is still largely financed by public sectors. Moreover; these three countries possess only few patents in the European offices of patent while the patent applications of these three countries are totally absent in the American Office of patent (OST 2006). Algeria ranks 120 out of 127 (2007) in the BCI subindex "Sophistication of company operations and strategy", while in 2004 it was still 87th; this is surprising, as the countries ranking in "availability of engineers and scientist" (GCI) is excellent (25th, better than Austria, UK, and Netherlands).((Jörg Janischewski, Katja Branzk, 2008). the integration of innovation and R&D activities in the private sector in Maghreb countries seems to be limited mainly for the reason that these activities are not a part of the business proprieties of local Industries in these countries owing to the low rates of technological intensity of these countries, with slight differences between sectors as well as between countries. For instance, the major orientation of scientific and technological innovation policy of the Tunisian governments consists of encouraging enterprises and industrial support institutions to integrate innovation, technology transfer and R&D in their strategies; the following key Characteristics of the algerian NIS may explain a lot about the problems and obstacles facing innovation of the algerian companies;

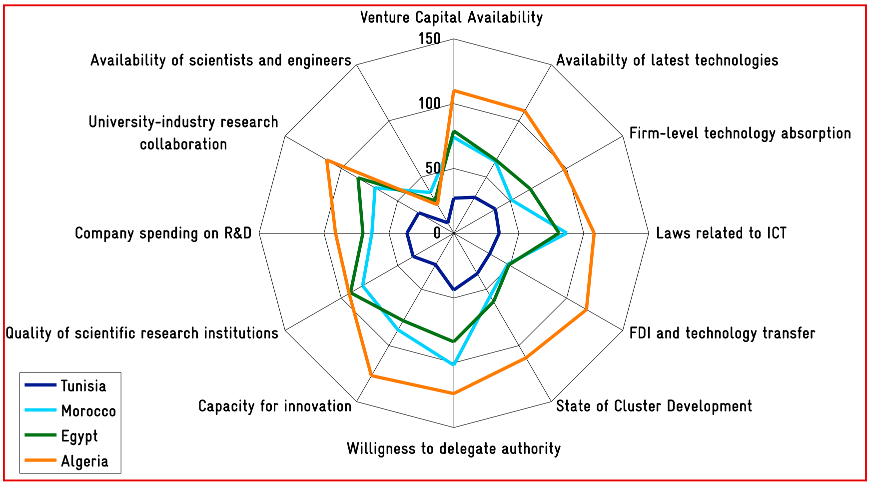
- **Centralised system with plans to decentralise operational support for enterprise development**

- **Emerging awareness of the importance of private equity and an embryonic venture capital industry**
- **The need for legislative reform to support private equity is currently being addressed.**
- **However there are essentially no links between industry and academia. A considerable effort will be required to develop appropriate structures.**
- **The higher education and public research system is weak and needs to be developed in parallel with industry reforms. There is no Research For Technological Development and no Innovation policy and the overall development of intermediaries is weak. (European Trend Chart on Innovation; 2005)**

During the last decade, trans-national Industries were considered as the main driver of R&D activities globalization, the R&D activities in these Industries represents almost the half of the global R&D activities and expenditures, and more than 2/3 of Industries R&D activities, R&D expenditures, as well as R&D activities have emerged in the last decade only to reach uncourageous rates in some emerging countries, mainly situated in Asia such as in China, and India, while it is still limited of Arab countries which constitute around 3.5% of world GDP and more than 4% of world population, but Arab countries consume around only 0.4% of the Gross Domestic Expenditure on R&D (GERD) and then The Arab world is not investing enough of its economic resources in technology, and was ranked last – even lower than African countries. By the way, a most recent statistics reveal that 89-97% of R&D expenditure in the Arab world is funded by the public sector. By contrast, more than 50% of R&D expenditure in developed economies is funded by the private sector. (Abdallah Alnajjar, 2002). More than few Industries generally in Arab countries and particularly in North African countries do not have an R&D account in their accounting system. Even if they have already undertaken R&D activities but their R&D expenditures are null. These activities are then funded by another budget. For all Maghreb countries, major efforts have been made to launch innovation, meanwhile; all numbers and facts show that innovation output remains relatively poor in these countries. (Djeflat A., 2008). Meanwhile, almost the totality of the Arab countries has become a destination for some Industries that aim to invest in R&D activities in so many sectors and not only strategic sectors as the case of the last few decades, and by the way, one of the main problems within Maghreb countries which limits R&D activities and then innovative activities for Industries is somehow the high rates of unemployment of well educated and skilled people, and sometimes the time gap between the degree/study accomplishment dates and the dates of being employed, because it works to limit the possibilities to enhance the skills and knowledge gathered and improved at universities and educative centres, and it also bound the knowledge value of those people; which in one way or another will affect the innovative capacity of the Industries; as well as product launching either within or outside the local markets of these countries; Thereby, the value of the R&D activity of the firm is directly related to the core competencies and knowledge of this firm as well as to its efficient innovative processes. Baldwin & Hamel, (2003) and Duget, (2000), have proven that the Industries which have higher rates of expenditures on R&D activities have the most competitive advantages in the radical innovation and claim more inventions rights. The poor institutional and incentive regimes of Maghreb countries may be one of the most important causes of the small absorptive capacity of these countries. (Djeflat A., 2008). However, The increasing integration into the world economy raises new challenges for the Algerian productive sector, particularly the industrial sector, which must face increased competition and whose consolidation largely depends on greater business competitiveness. If its transformation is to succeed, the Algerian productive sector must not only be capable of facing competition from imports but also be capable of exporting.

The MENA comparison with regard to selected key indicators describing innovation performance (GCI) sees Tunisia considerably ahead in most aspects, and Algeria far behind (lower ranking reflects better performance). (see figure below)

The MENA comparison with regard to selected key indicators of innovation :



Source: Jörg Janischewski, Katja Branzk, 2008.

According to Jörg Janischewski, Katja Branzk, (2008). Algeria ranks 127 out of 131 countries in “capacity for innovation” (at the company level) according to the GCI, due to relative market isolation and their “planned economy mentality”. Unlike many other countries, financial resources would be available. Nevertheless, Algeria has begun to develop elements of a national innovation policy; including the elaboration of an innovation policy, training of SMEs, financial support schemes, establishment of an Innovation Observatory, incubators and innovation-related organizations as well as reinforcement of the technical centres. (Jörg Janischewski, Katja Branzk, 2008.)

The Field Study:

Our study is based on the innovation survey which we used to measure the innovative activities for the Algerian Industries; a sample of 250 Industries were contacted either electronically via emails or via phone and even personally by the authors. Those Industries have been asked to respond to a questionnaire that includes, besides their principal characteristics (such as the firm's size, the business field, beginning date for the firm's activity…), several questions related to R&D and innovation activities, (R&D intensities, skilled employees' numbers, level of innovation, innovation obstacles, innovation performance, cooperation with universities, labs, other Industries and organizations, we have also taken into consideration the management of innovation, through asking some questions, either related or unrelated to each others but they all fall in the same aim which is to evaluate the innovation management within these companies

Variables Description and findings

Name of variables	Type	Value
INNO	dichotomous qualitative	1= the firms has already undertaken process or product innovation 0=otherwise
RD	dichotomous qualitative	1= the firms has R&S activities 0=otherwise
RDI	multinomial quantitative	0 no R&D expenditures 1 very small R&D expenditures 2 average R&D expenditures 3 high R&D expenditures 4 very high R&D expenditures
SIZE	Multinomial Quantitative	1 1-9 employees 2 10-49 employees 3 50-249 employees 4 250 employees, and more
MKGI	multinomial quantitative	0 no marketing expenditures 1 very small marketing expenditures 2 average marketing expenditures 3 high marketing expenditures 4 very high marketing expenditures
COO	multinomial quantitative	0 no cooperation with other organizations 1 very small cooperation levels 2 average cooperation levels

		3 high cooperation levels 4 very high cooperation levels
MAR	multinomial quantitative	0 no marketing integration into other departments 1 very small marketing integration 2 average marketing integration 3 high marketing integration 4 very high marketing integration
QI	multinomial quantitative	0 no qualified employees, at all 1 very small intensity of qualified employees to the total number of employees 2 average intensity of qualified employees 3 high intensity of qualified employees 4 very high intensity of qualified employees
OBLEV	multinomial quantitative	0 no innovation obstacles at all 1 very few innovation obstacles 2 average level of obstacles 3 high level of innovation obstacles 4 very high level of innovation obstacles

According to the survey, almost all the contacted companies do not have R&D departments, and then both R&D and innovation activities are included in other activities such as production. And many of them gather R&D spending to the cost of employees' training, product improvements and patents acquisition… in ways that enlarge the numbers of GERD.

In our first model we take the business characteristics as independent variables besides the specific characteristics of the firm as well as the whole sector of activity, for each firm. Our objective from this model is to estimate the impact of each variable on the probability of innovation in the Algerian Industries. The impact of the innovation obstacles is taken in consideration in each of these models, as well as the firm size, the firm's cooperation with other organizations and the skilled employees. We also take RD as a qualitative dichotomous variable which measures whether the firm has already undertaken R&D activities or no, this Model has as objective to see whether the R&D activities in the Algerian Industries have the same importance as in foreign countries or no, but obviously, most of Algerian Industries do not have R&D activities and in case they do some activities which have the same characteristics either for the reason that they do not call them R&D or they include these activities into other departments and functions inside the firm, such as the production activity, Quality, or even Marketing.

This Model takes in evidence the Marketing activity and its integration to other functions and activities within the same firm, we have seen that cooperation and marketing integration have a positive impact on the firm innovativeness as well as the innovation performance of firms, so we aimed to measure the integration levels of marketing functions to other functions within the firm, and the firm's cooperation with other organizations, and institutions including universities, research labs, firms and so on…

We use this model in order to estimate the impact of each variable on the probability of innovation in the Algerian Industries; taking in mind the impacts of Marketing intensity (MKGI) and Marketing integration (MAR).[4]

In the second model, we try to check out the impact of all the variables taken in "model 1"; with the exception of the existence of marketing activities, and the marketing intensity of the firms taken in this study, while in this time, we link between the marketing activities integration and the firm's cooperation mainly because there exist empirical evidences that both internal integration, and external cooperation have a positive impact on each others and that they are correlated to each other in so many ways. Because the significance coefficient is 0.11 for the 2-tailed, bivariate correlation between the two variables (COO, and MAR) while the correlation is significant at the 0.05 level. In this Model we take both COO and MAR as correlated variables in the second equation.

We try to check the effect of Marketing efforts on innovative activities of those firms with and without taking "Marketing" variables in mind, while the theoretical background of both innovation and marketing, show the massive impact of these two concepts on each other, we still need to see the results of our study concerning those variables.

M1:

$$\mathrm{INNO}=\beta_0+\beta_1\mathrm{SIZE}+\beta_2\mathrm{RDI}+\beta_3\mathrm{MKGI}+\beta_4\mathrm{COO}+\beta_5\mathrm{MAR}+\beta_6\mathrm{QI}+\beta_7\mathrm{OBLEV}$$

M2:

$$\mathrm{INNO}=\beta_0+\beta_1\mathrm{SIZE}+\beta_2\mathrm{RDI}+\beta_3(\mathrm{COO}*\mathrm{MAR})+\beta_4\mathrm{QI}+\beta_5\mathrm{OBLEV}$$

Through these two models we aim to validate or invalidate the next two hypotheses;

Table 4 : Classification Table (a,b)

	Observed		Predicted		
			whether the firm is innovative or not		Percentage Correct
			NO	YES	
Step 0	whether the firm is innovative or not	NO	43	0	100,0
		YES	13	0	,0
	Overall Percentage				76,8

a Constant is included in the model.
b The cut value is ,500

Table 5 : Variables in the Equation (Model 1)

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-1,196	,317	14,285	1	,000	,302

Source : Metaiche M.A., 2010.

Table 6 : Variables in the Equation (Model 1)

	Score	df	Sig.
SIZE	13,285	1	,000
RDI	34,031	1	,000
MKGI	11,146	1	,001
COO	40,068	1	,000
MAR	8,932	1	,003
QI	28,690	1	,000
OBLEV	9,305	1	,002
Overall Statistics	46,187	7	,000

Table 7: Variables in the Equation (Model 2)

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-1,196	,317	14,285	1	,000	,302

Table 8: Variables not in the Equation (Model 2)

			Score	df	Sig.
Step 0	Variables	SIZE	13,285	1	,000
		RDI	34,031	1	,000
		QI	28,690	1	,000
		OBLEV	9,305	1	,002
		COOMAR	29,590	1	,000
	Overall Statistics		41,511	5	,000

Source : Metaiche M.A., 2010.

We have found a positive relationship between the dependent variable and all the independent variables except for QI for the tow Models (1 and 2), and OBLEV for the model 2, while it was insignificant for the model 1, from the study that we have made, we found a positive impact between the firm's size and R&D activities as well as the firm's innovativeness and innovation performance, we must notice here that so many theories as well as empirical studies found that innovative firms which spend more resources on R&D and innovative activities, get bigger and bigger with the time impact, and especially that it benefits from the profits made by the innovation itself, meanwhile, The algerian companies are facing some difficulties in transforming their research efforts into Development efforts. for the Algerian companies taken by this study, most of them are public owned companies, where employees are logically seem to be numerous, and the most innovative firms in Algeria are big public firms with more than 250 employees, at the same time as the private sector plays a little role on the Algerian innovation activities, either counted by R&D intensity or by the innovations done within the national market.

Conclusion

Innovation is not a choice, it is becoming more and more necessary , day after day, mainly because we are living in an open market which is challenging us, "industries must Innovate or disappear" " (Djeflat, 2008)

In Algeria, both the private and public have invested in R&D centers mainly those situated within the local universities, as a result fort that, we find out that 90% of the local researchers are researchers at the university; and because of the structural weaknesses that face the links between universities and industry (less than 10% of companies in Algeria have links with the university), we can see how much efforts must be done in this field. Both private and public actors have to open their borders to each other, and work together in ways that foster innovation. (Ouchalal et al., 2007) while, one of the key issues facing the construction of a well functioning innovation system in Maghreb countries may be defined as the level of a mix of human, financial and institutional ingredients. (Djeflat A., 2008).

While the most important factor of innovation is driven by the R&D activity; Djeflat (2008) argued that creating new institutional university-industry links, and strengthening the existing ones, is a key solution to foster the innovation activities for the Algerian economy. Moreover, several results can be derived from this study, which are of interest to show the innovation level of Algerian Industries. First, the significant estimates in the logistic model recommend that Algerian Industries have to extend their efforts in innovation through raising their R&D activities, and by improving the number and quality of their skilled workers both via adopting short and long-terms training activities as well as by collaborating with other technological organizations. Second, "

Third, both the government and national economic actors must find a solution to enhance the foreign direct investment and exports of Algeria, this might help the economy to become more creative and will certainly improve the Industrial competitiveness of the country, through adopting new partnerships and collaboration agreements with foreign economic actors. And especially that foreign direct investment in Algeria is concentrated mainly either in the petroleum and gas sector, or in the low intensive technologies sectors; but firms' executives have generally a good sight for the future and who are trying their best making their firms more creative and more innovative in the future through adopting certain strategies which allow employees being creative within their organizations, they are aiming to raise the R&D and Marketing intensity of their firms in order to know how to satisfy their customers. The Algerian Industries' innovativeness rates are very low, but we have shown that these firms do innovate, so that we have unaccepted our second Hypothesis, which says that Algerian Industries do not innovate, and even if these firms do not make radical innovations but at least they do some efforts to be innovative, we have to notice here that both the economic structure and characteristics of the local market are ones of the most problems facing firms in their ways to be innovative, and even if the government is helping firms in so many ways, but there exist so many problems and obstacles that must be faced and resolved by both governmental and non-governmental organizations, the collaboration of the economic actors is so necessary to enhance the firms' innovativeness and innovation performance of the local firms in ways that help them being competitive within and outside the local market. Firms also have to be aware of the barriers to innovation which impede the firms' innovativeness and economic performance, the linkages and cooperation within the firm between Marketing and R&D departments are also so vital for the innovative activities of the firm in order to check out the roles played by marketing to enhance the innovativeness and competitiveness of firms; The requirement of rapid adjustment to dynamic changes reinforces the function of knowledge flow in inter-functional relations. The obligation of integrated knowledge is the most precise in the relations of R&D and marketing, researchers are increasingly aware of its key role in innovation. Innovation barriers in Algeria as well as other Arab countries have been reduced in the last decade but there still so much effort to be done in this aim, mainly through gathering the efforts of both Governmental and non-governmental organizations, and second, there is the role played by the firms themselves, and especially if they act as a one-unit, through creating linkages and networks between them. Nucleus programmes are a good example of these Networks that may help firms succeeding and strengthening their activities either inside or outside Algeria. We notice here that innovation will take place only if the result on the market acknowledges the creative idea, thereby, if the products and services developed with novelty are successfully sold, so that Innovation must rely on marketing activities to succeed, and they need to be linked and integrated either before, during or after the development process of the new product, our study shows that in most cases the integration of marketing and R&D is at much lower level than expected within the Algerian Industries. But it shows also that Algerian Industries are somehow innovative but their innovation rates do not help them being really competitive on the international market, and thereby they have to work collectively as well as individually in order to face the economic challenges and obstacles to improve the economic performance of the whole economy. The potential and capacity of firms for innovation does not only depend on technological and financial resources. Innovation requires expert know-how in a lot of areas such as management, production, the innovation process, intellectual property rights, marketing, and cooperation skills and so on.

Selected recommendations

- Awareness creation at firms level for the importance of R&D and innovation activities
- Awareness creation at highest political levels on long term benefits of a well functioning NIS
- Preparation of a detailed action plan to set up a NIS (including time table, and costs estimation)
- Improving the education system, and relying on quality rather than quantity.
- Awareness creation about market mechanisms, upcoming challenges, of a globalised economy and the benefits of technological innovation.
- Strengthen the links between the universities, and industries.
- Companies' Networks creation and enhancement.
- Matching the education system with the innovation and development goals
- Bridging research to development.
- Promoting new business creation and supporting existing ones.

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4. In this Model; We exclude the variable (MDG) that takes in mind the existence of the marketing department within the firm, because it is not necessary for firms to have marketing departments in order to do marketing activities; and as we noted earlier in this work, there have been found so many firms which are so active in the marketing tasks and activities, but they do not have any Marketing departments neither inside their firms, nor in their accounting systems.