

Original Research Paper

Contribution of the Algerian High Education in Supporting the Innovation Process

Wafaa BERBAR BERRACHED¹ and Wassila TABET AOUEL²,

¹Department of Economic Sciences, University of Abou Bakr Belkaid, Tlemcen, Algeria;

²Department of Economic Sciences, University of Abou Bakr Belkaid, Tlemcen, Algeria.

Corresponding Author: Wafaa Berbar Berrached, University of Abou Bakr Belkaid, Tlemcen, Algeria; Email: wafaa26dz@yahoo.fr

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Abstract

This research paper analyses the status of the Algerian High Education, by examining the number of patents and the level of spending on research and development R&D in proportion to the Gross Domestic Product (GDP). The data was collected from the World Intellectual Property Organization (WIPO), in order to measure the extent of the contribution of the Algerian High Education in supporting innovation. In this study, the number of patents and the level of expenditure on R&D activities for Algeria show a significant improvement over the last few years compared to past years. The expenditures for R&D was 0.54 percent of the GDP in 2017 compared to only 0.05 percent in 2007.

Keywords: R&D, Innovation, National Innovation Systems, Patent, Higher Education.

ملخص :

يتضمن هذا البحث دراسة حالة التعليم العالي الجزائري، من خلال عدد براءات الاختراع، ونسبة الإنفاق على البحث والتطوير، بما يتناسب مع الناتج المحلي الإجمالي (GDP). وتم جمع البيانات من المنظمة العالمية للملكية الفكرية (WIPO) من أجل معرفة مدى مساهمة التعليم العالي الجزائري في دعم الابتكار. لوحظ في هذه الدراسة، أن عدد براءات الاختراع ومستوى الإنفاق على أنشطة البحث والتطوير للجزائر في تحسن ملحوظ خلال السنوات الحالية مقارنة بالسنوات الماضية، حيث أصبحت 0.54 في المئة من الناتج القومي المحلي في عام 2017 مقارنة بـ 0.05 بال المئة فقط سنة 2007.

الكلمات المفتاحية: البحث والتطوير، الابتكار، النظام الوطني للابتكار، براءات الاختراع، التعليم العالي.

Introduction

Innovation has been well established worldwide, in the light of the new global transformations, represented by the transformation towards the knowledge economy, which depends on the speed of production, dissemination and investment of knowledge, and also on the increasing proportion of technology in exports, globalization of production and trade liberalization, increasing the role of education and training, increasing the importance and role of knowledge and innovation in economic performance and accumulation of wealth. (Ibrahim Abdel-Rafea Hammad, 2005).

Von Hippel is a Professor of innovation at MIT, point out that the most important external actors and “Lead –users” are the basis and sources of innovation (Martin duval, 2014). Creativity and innovation have become an urgent need for institutions and organizations that want excellence, leadership, ability to stand up, compete and deliver new ones, and hence growth and prosperity (Hamel, 2006).

Usually, when one thinks about innovation, he/she thinks first about technology, new products and services, technological processes, computer systems, software and technologies that sometimes have the ability to make comprehensive changes in the way business organizations perform. (Birkinshaw, 2008). Universities have long been considered important institutions in national innovation systems (NIS). (Lundvall, 1992.)

The aim of this study is to show the importance and role of Algerian University, in the innovation process. It tries to answer the following question: What is the extent of the contribution of Algerian University in support of the innovation process?

To answer this question, the article is divided into the following four parts.

1- Some Available Statistics

- More than 40,000 innovative institutions were to be created at the national level during 2017 and 2018 as confirmed by the Minister of Higher Education and Scientific Research Taher Hadjar. This program also aims to establish centers for innovation and technological transformation. Hadjar stressed the need to create an environment that encourages innovation, focusing on innovative project holders in incubators, emerging institutions, and technology platforms, as well as developing a system for the distribution and exchange of information and documents. (2017)
- A total of 200 innovative startups was planned to be created in six months from next June thanks to an Algerian support entity called International Carrefour for the Scientific and Technological Industry (CIIST). (2017)
- INAPI¹ receives 135 patent applications in 2017. (2017)
- INAPI: 150 patents registered in 2017. (2017)
- In terms of Innovation and economy: Algeria ranked 113th in the world out of 128 countries in 2016. (2017)
- In terms of Index of innovation: Algeria ranked at 108th position out of 127 countries in 2017. (2017)
- Global innovation index: Algeria ranked 110th in the world or of 126 countries in 2018. (2018)

2- Some Determinants of Innovation

Based on the available literature, the determinants of innovation were split into three main categories (see Figure 1) (Benhabib A. Berrached W. *et al.* 2016):

1. The Organizational Determinants that cover the responsibility to undertake an activity coupled with managerial culture and practice of innovation,
2. The Institutional Determinants that allow to highlight the role of institutions in the dynamics of innovation and particularly the public policy of innovation,
3. In addition, the Geographical Determinants that draw on the role of territorial systems of innovation as well as the forms of proximity to innovation.

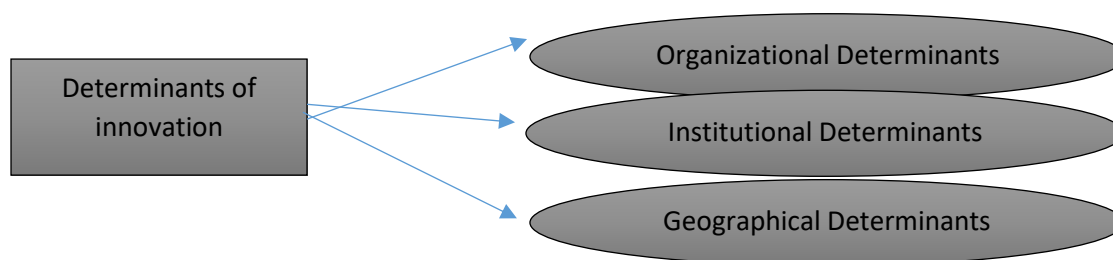


Figure 1: Factors that stimulate innovation Benhabib, *et al.* Op.cit, 2016.

Hereafter the factors that stimulate innovation are listed below:

Factor 1: R&D and Patent:

For a long time, R&D has been considered as an essential indicator of innovation. The presence of R&D activities helps create a convenient climate to systematic questionings by triggering off companies' flexibility, their capacity to integrate new concepts and their adaptability to any change in

¹ INAPI: Algerian National Institute of Industrial Property

market conditions. The results of some studies (Figure 2) show that R&D is bound to the level of protection of the intellectual property (Baldwin, Hanel and Sabourin, 2009, SESSI, 2001). By studying the relationship between protection of the intellectual property and innovation, these authors showed that the innovative companies establish more patent for their inventions.

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 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 Mohammed El Amine, 2013.)

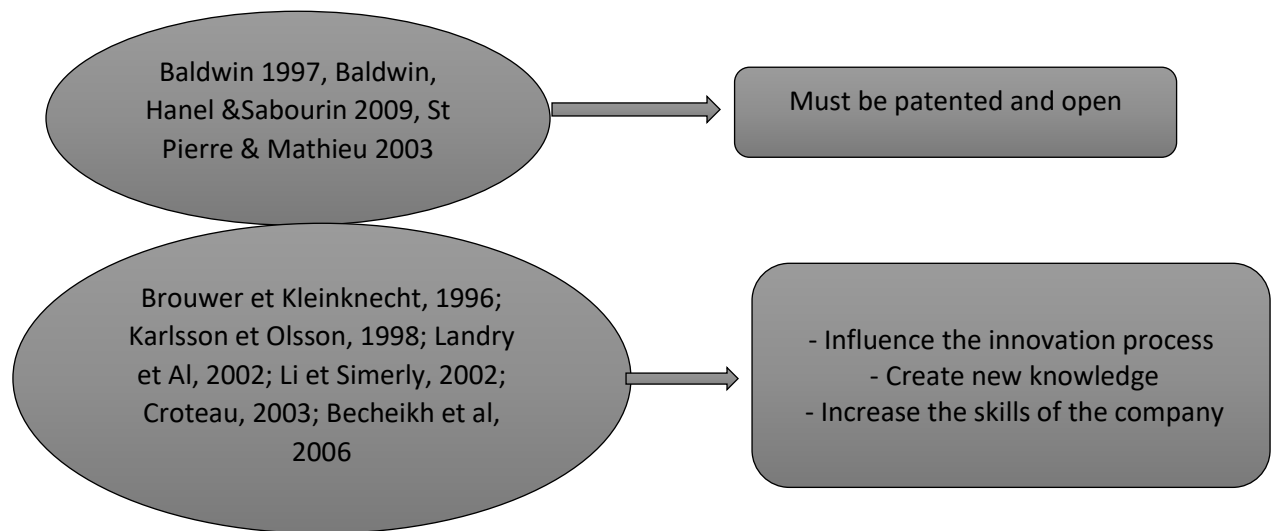


Figure 2: Importance of R&D

Companies that develop protection strategies for their intellectual property tend to be less innovative. Other studies have shown that R&D influence the innovative process and increase the skills of the firm.

Factor 2- The Characteristics of the Institution

- The size and the age of the company
- The business sector

Factor 3- The Organizational Skills

- The entrepreneur
- The human resources management

- The organizational shape
- The flexibility of the institution
- The work atmosphere
- The strategic orientation

Factor 4- The resources of the company

- The financial resources
- The human resources
- The technological resources

Factor 5- The external environment of the institution

- The environment
- The customers and the suppliers
- The technological opportunity
- The competitive pressure

Factor 6- Internal and external collaboration

- Internal collaboration
- Networking
- Partnership
- The technological alliances

Factor 7- Information source

Factor 8- Exports

3- The Institution of Higher Education and Scientific Research

The Algerian government should take some steps to reform the entire education system so that education is more closely linked to employment. Forging this link starts with early childhood development and basic education, moves to secondary and higher education that provide the fundamental skills required for creative and critical thinking (including through technical education and vocational training, TVET), and ends with the development of an effective system of lifelong learning. The Skills toward Employment and Productivity (STEP) approach offers a simple but comprehensive way of thinking about skills development as an aid to creating more jobs and more productivity. Overall, Algeria needs to adjust the governance, management, financing, and performance-related incentives of their education systems to produce better learning conditions (DJEFLAT, 2010).

the Algerian potential in terms of R&D, in particular in terms on the plans: Infrastructures, human resources, research funding are discussed below.

Higher Education and Research Infrastructures.

Algeria has taken important steps in developing its university infrastructure. Henceforth, the network of higher education institutions extends practically to each wilaya (district).

Table1: Breakdown of Research Entities by Type Supervision (2016) DGRSDT

Ministry	hematic Agency of research	Center of research	Unit of research	Laboratory
MERS	5	12	12	1440
Outside MERS		11	14	-
Total	5	23	26	1440

* Research Center except those of COMENA and ASAL (the latter's number is 6).

This network is made up of forty-eight (48) universities, ten (10) universities centers, twenty (20) national higher schools, seven (07) higher normal schools, twelve (12) preparatory schools and four (04) integrated preparatory classes and four (04) annexes. As for the research entities, they are distributed as follows (Table 3).

4- Innovation and National Innovation System (NIS)

The term ‘innovation’ is notoriously ambiguous and lacks either a single definition or measure (Adams, 2006). Below are a number of definitions of innovation

Innovation is the generation, acceptance and implementation of new ideas, processes products or services. (Thompson, 1965).

Another definition of innovation was proposed by (West, 1996): “Innovation can be defined as the effective application of processes and products new to the organization and designed to benefit it and its stakeholders”.

Innovation may be defined as act of propagating an idea and transforming it into a new product, service, or business model that can be useful to customers. There are two important segments of innovation, namely: product innovation and process innovation. It should be noted that innovation can also be pursued radically (i.e, sudden change of modus operandi) and incrementally (i.e, incremental with step-by-step improvement) (Soliman, 2011)

Innovation is the successful introduction of a new thing or method (Luecke, 2003)

To be innovative, an idea must be creative and it must be implemented (Levitt, 2002) .

The National Innovation System (NIS) perspective highlights the fact that countries organize innovation differently. Not unexpectedly, the role of universities in each NIS differs significantly. The NIS perspective has been criticized by scholars who have asserted that innovation processes in industries and regions differ even within the countries. (Amina Rahal, 2015).

The network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies. (Freeman, 1987).

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. (Lundvall, 1992).

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 (Nelson, 1993).

The national innovation system is now at the heart of the economic analyzes of innovation and economic policies aimed at adapting economies to competition knowledge-based world. With this in mind, for two decades, Algeria has been undertaking a series of measures aimed at improving the efficiency of its national system of innovation are mentioned below:

- The development and adoption of numerous laws implementing laws (the promulgation of laws 98-11 and 08-05);
- The strengthening of research infrastructure and equipment and the expansion of university infrastructure;
- The increase in funding dedicated to R&D;

Despite these measures, we believe that the Algerian system of scientific research and technological development does not yet play the role of an innovation system. It remains distant and disconnected from the economic issues and problem solving. It faces a set of constraints that hinder its operations and which are at the origin of several malfunctions. These constraints are mainly linked to insufficient

term of weakness in the endowments of the actors of the system and the lack of synergy and articulation between them.

5- Higher Education System in Algeria

To study the reality of the system of higher education and scientific research in Algeria and its impact on the innovation process through the number of patents and the level of expenditure on research and development, Data collection from the World Intellectual Property Organization (WIPO, 2020) To answer the problematic of this article.

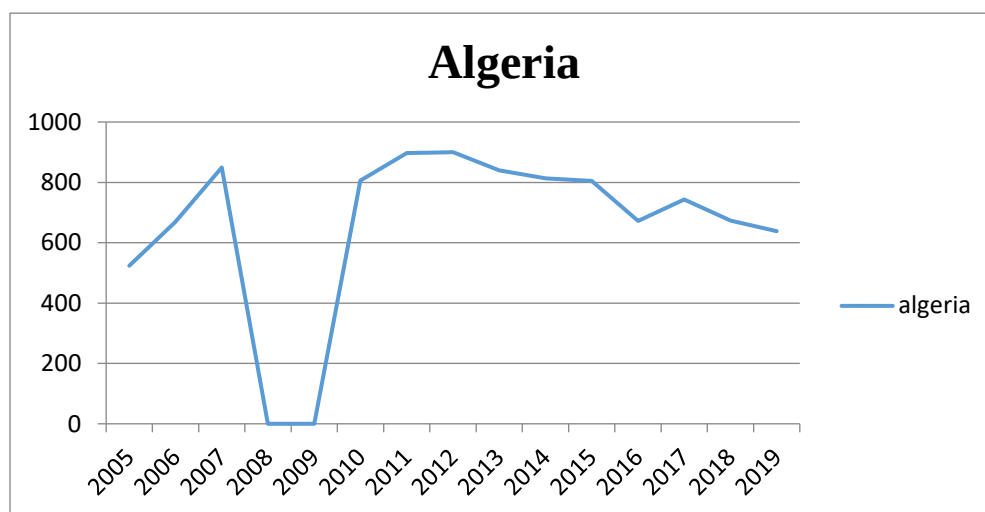


Figure 3: The Number of Patents in Algeria (World Intellectual Property Organization (WIPO), data 2020)

Above shows studying (2005-2015) height in the number of patents height but in years (2016-2019) is currently slight decline in total number of patents in Algeria.

For the Expenditure on Research & Development in Algeria

R&D expenditures are known as all money spent on research and development activity by the government in higher education sector and in research centers. In addition, to the expenditures of the industry, without distinction between the public sector and the private one, add to that the expenditures of the private sector non-profit character. However, the numbers adopted in the case of Algeria belong only to expenditures of the scientific research sector in universities and scientific research centers involving under the tutelage of the ministry of higher education and scientific research. (Samah, 2015)

Table2 : Expenditure on research and development(R&D) in Algeria World Intellectual Property Organization (WIPO)

	Expenditures for R&D % of GDP 2005/2015	Expenditures for R&D % of GDP 2010/2018
Algeria	0.07%	0.54%

For that indicator, data for Algeria from 2001 to 2017 is provided. The average value for Algeria during that period was 0.26 percent with a minimum of 0.07 percent in 2005 and a maximum of 0.54 percent in 2017. The latest value from 2017 is 0.54 percent. For comparison, the world average in 2017 based on 90 countries is 1.05 percent.

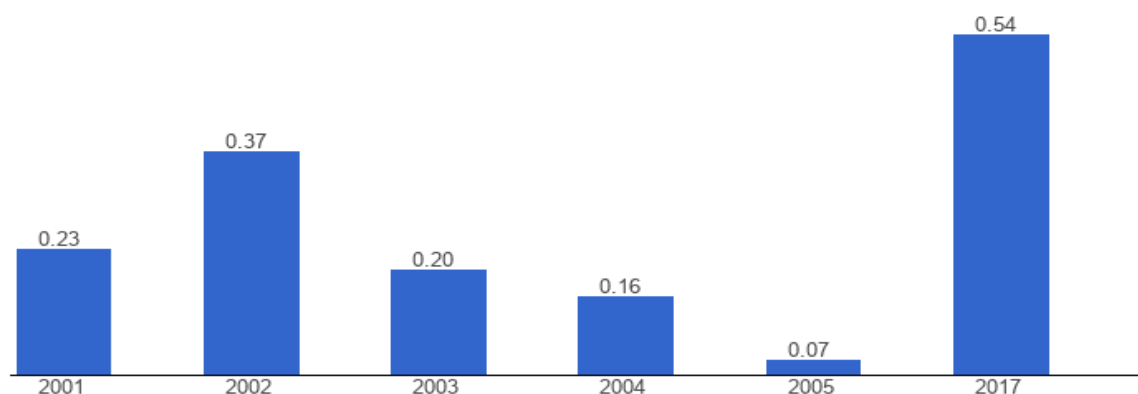


Figure2: Expenditure on research and development(R&D) in Algeria. World Intellectual Property Organization (WIPO),data 2020

The expenditure for R&D on the charts includes both private and public spending on research and development.

Definition: Gross domestic expenditures on research and development (R&D), expressed as a percent of GDP. This includes both capital and current expenditures in the four main sectors: Business enterprise, Government, Higher education and Private non-profit. R&D covers basic research, applied research, and experimental development.

IV. Conclusion

In Algeria, the 1999 reforms encouraged universities to forge links with the industry and to partner with actors in the local environment, in order to play a more active role in national development. The number of researchers increased from 5000 in 1996 to 15000 in 2002. With the 1999 reforms, S&T policy shifted from a centralised to a decentralised approach and institutional networks emerged through a greater community involvement of universities in liaison with local actors. This process involved relationships and joint actions within and between government, industry, university and research institutions, both at national and regional levels. Such networks and relationships helped promote innovation through knowledge creation and dissemination. (Djeflat, 2009).

The main aim of this study was to get an understanding of the Algerian High Education's contribution in supporting innovation. It was found that the Algerian high education is still suffering from the lack of a policy adopted by the government to improve the level of scientific and technological innovation, and it does not have an effective strategy for developing its scientific activities and knowledge research. However, currently, the Algerian state has become interested in spending on research and development and encouraging patents.

This research article may be concluded by an example of entrepreneurship house in Tlemcen university, as it has approximatively 600 of training students of the different departments. In 2021 after several trainings and support the entrepreneurship house registered 5 labels of innovative projects and won several places in the national and international competition level for the best innovative projects.

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