Algerian Review of Economic Development Volume 12, Number 01(2025) PP195-206 EISSN: 2588-2457 * PISSN: 2392-5302

Analysis of Innovation and R&D in the Algerian Business Environment

Okba Mekhnane [1,*]
[1] University of Ghardaia, Algeria.Laboratory of Applied Studies in Financial and Accounting Sciences (mekhnane.okba@univ-ghardaia.edu.dz)

Received: 04/05/2025 ; **Revised:** 04/05/2025 ; **Accepted:** 01/06/2025

Summary:
This research investigates the state of innovation and research and development activities in Algerian business organizations using a systemic approach (inputs - process - outputs) and their impact on the business environment. The findings indicate that innovation inputs were insufficient to produce the required outputs, which were weak and below expectations. This highlights systemic weaknesses and imbalances. Algeria's ranking of 111th out of 154 countries in the Global Knowledge Index reflects the country's poor infrastructure in this area.
Keywords: inputs, innovation, research and development, outputs, business environment.
JEL classification : O310; O320; M00 ; M150.

Okba Mekhnane mekhnane.okba@univ-ghardaia.edu.dz

I-Introduction:

Scientific and technical progress and the spread of the Internet have resulted in many effects on the nature and form of work of administrative systems within the organization, which allowed the structuring of research, development and innovation functions within the support functions of its core activities. Therefore, it has become necessary for the Department to develop integrated information systems including organization and processing, the use of computers and information and communication technology and the introduction of some mobility and flexibility in the conduct of its activities. It urgently needs to carry out deep and accurate research and studies that enable to know the requirements, foundations and milestones of achievements, and to continue research in order to reveal some of the challenges and obstacles that prevent the organization from achieving its performance in this field in order to ensure success and permanent superiority and thus access to leadership.

I.1. Problematic

In light of the development and expansion of the economy, as well as the phenomenon of economics and the resulting freedom to rise the elements of production, institutions have become good at making changes in their traditional methods and searching for modern ways to promote business organizations. This is why we ask the following main question: "**To what extent does the duality (innovation - research and development) affect the success of business organizations in Algeria?"**

I.2. Sub-questions

To simplify the problem, we ask the following sub-questions:

- What is the purpose of the innovation function in the organization?
- What is research and development? And what does it have to do with innovation?

How do the results of this duality manifest itself in the Algerian business environment?

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I.3. Hypotheses

- Innovation is a supporting function that puts forward new ideas, to help develop ways of exploiting the Organization's resources;
- Research and development within business organizations aims to achieve flexibility in the use of methods and tools, which helps the innovation function to adapt to the interactions of the surrounding environment;
- The importance of duality (research and development - innovation) appears through the outputs of business organizations and building expectations distinctly from competitors and the ability to discover a new product or service.

I.4. Importance of the study

The study is of great importance as one of the modern topics in the field of the knowledge revolution, as it is closely related to the concepts of business networks and information technology. In addition to being adopted in developing methods of exploiting its resources effectively by resorting to innovative processes and activities that satisfy the customer on the one hand, and gaining or expanding market share on the other hand.

I.5. Objectives of the study

- Highlighting technical functions and their importance in business organizations;
- Demonstrate the relationship between innovation and research and development in the effectiveness of setting the objectives of the organization and its development;
- Innovation is one of the most important factors that organizations can resort to ensure survival and continuity.

I.6. Study Methodology

In this study, we rely on building literary theories in the field of innovation and research and development, while researching the relationship between them. Determine the results and extent of its impact on the Algerian business environment through the use of statistical and analytical approach. The process of extrapolating the results and drawing the conclusion is carried out when studying the impact of bilateralism on the business sector in Algeria.

II- Generalities about innovation

The origin of the word innovation came from the Latin verb Innovare, which consists of two words, the first "in", which means into and the second word "novus", which means something new, but it is translated as "renewal" or "change". The term innovation goes back to the Austrian economist Joseph A. Schumpeter in 1912, who defined it as "accomplishing completely new things or completing things that already exist in a new way" (Mustafa, 2017, p. 14). In the following, we will present a chronology of the development of the concept of innovation according to the views of researchers in this field:

Table 1: Evolution of the concept of innovation (1965 to 2009)

Authors/researchers	Concept
Thompson 1965	Generate, accept and implement new ideas, processes, products and services
Zaltman et al. 1973	Any idea, practice or physical apparatus that is seen as new to the organization of the unit on which it is based.
Van de Ven 1986	A new idea, which may be an old combination of new ideas or project that challenges the status quo or is a unique formula or approach that is seen as a new object by the individuals involved.
Noria and Gulati 1996	Any policy, structure, method, process, product or market opportunity that exists that is seen by a party Innovative Unit Manager
Nieto. 2001	The first application of an invention that occurs when the first operations take place with new products, processes or services derived from it
Chen et al.2004	Introducing a new combination of basic factors of production in the production system, involving new products, new technologies, new markets, new materials and formulations
Egbetokun et al. 2009	It is a process whereby an enterprise can control, implement, design and produce new goods and services for them, regardless of whether these services are new to their competitors in the country or even the world.
Tödtling et al.2009	It is the result of an interactive process of generating, disseminating and applying knowledge

The Source: (Mustafa, 2017, page 15)

Despite the many definitions of innovation, there is no consensus on the exact definition of the term, and below we present some definitions about the concept.

II.1. Concept of Innovation

- **First definition:** Innovation represents the transformation of new and imaginative ideas into reality. Using this mental property effectively may result in the following outcomes:

• generating something new that is absolutely unprecedented (this product may be rare except in cases of high creativity);

• Unify or merge a divergent and non-divergent set of ideas in a new, unfamiliar way;

• Finding or demonstrating new uses that are not recognized for ideas or for a product;

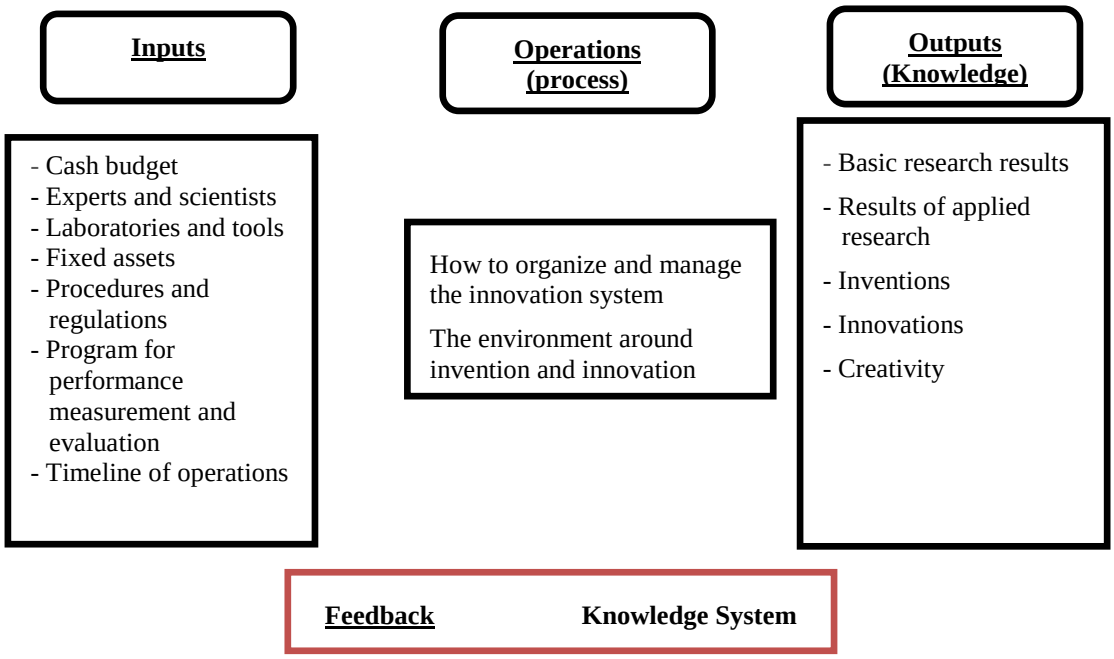
• Transfer existing ideas circulating to other beneficiaries or new people (Mufid S., 2020, p. 53).

- **Second definition:** The Dictionary of Psychology defines the concept of innovation as "the ability to produce new works in the field of art, mechanics or solve problems in new ways (Al-Shayeb, 2015, p. 54);
- **A third definition:** According to the OECD's definition of innovation, it is: "the delivery of a product (good or service), a new or significantly improved process, a new marketing method, or a new organizational method in enterprise practices, workplace organization, or external relations" (Djilali, 2020, p. 639). In general, we can consider innovation as: generating a new technology or idea with the aim of achieving excellence from others in a field.

II.2. Innovation management in the organization and its importance

The innovation process in the organization can be seen as a system that has inputs, a process of transformation and operation down to outputs. This system affects and is affected by the external environment of the organization, and the following figure illustrates this.

Figure 1: Innovation management according to the systemic approach



The Source: (Al-Sarn, 2020, p. 33)

The innovation system in organizations is influenced by quantitative and behavioral variables, previous experiences, education, friction, interaction, knowledge, perception, personality, environment, intellectual openness, possibilities and abilities and other factors affecting innovative management.

The importance of innovation lies in the fact that it is a means that allows the organization to reach its goal according to modern and easy methods that no one has ever done. In addition to:

• Devising a new way to increase factor productivity in developing countries by less than one per cent, which may contribute to increasing their GDP even more than an additional $100 billion in capital at historical profit rates?

• Seeks to achieve large profits and high growth rates, for example, on innovation returns, we find in the American M3 Corporation that about 32% of its total sales of ten billion dollars annually as a result of its innovation of new goods and services;

• Develops and monitors interpersonal thinking skills and group interaction through brainstorming teams;

• Increases the quality of decisions made to address problems at the level of the institution or at the level of its sectors and departments, in the various technical, financial, marketing and social work environment;

• Improves product quality (Al-Wahab, 2011/2012, pp. 34-37).

• Innovation is an important tool for governments, as it is linked to global indicators that raise the classification of countries, innovation indicators consist of basic research, applied research and development, trade commercialization, science, technology and innovation index (STI) and

performance indicators R&D as well as contributes to raising productivity, raising GDP per capita and economic growth;

• Startup survival rates rise by 90%.

According to European statistics and the European Innovation and Business Centre (BIC), it supported more than 67,700 action plans and created more than 31,700 new jobs, in addition to the creation of more than 17,400 innovative enterprises. Innovation centers supported more than 2,491 companies and registered 666 patents for companies and entrepreneurs, resulting in the granting of 307 patents to companies joining the innovation centers (Al Mubaraki, 2020).

III. Research and development function in the organization

The research and development function is one of the organization's activities related to creativity, knowledge addition and the transformation of its results into goods and services through which institutions gain competitive advantages in the market and raise their market share.

III.1. Concept

There are many definitions of the concept of research and development according to the different researchers and their affiliations (economic, technical, industrial, marketing...). We will address some of these definitions in the following:

• **First definition:** Research and Development (R&D) is defined as: all efforts involving the transformation of validated knowledge into technical solutions in the form of methods or methods of production and material products, consumer or investment" (Murad, 2013, p. 28).

• **Second definition:** It is "a set of processes that link discovery, invention and economic applications" (Akoun, 2021, p. 5).

• **Third definition:** The definition of the R&D function according to what is stated in the Frascati Manual, as:

"An activity that includes experimental research and development (R&D), creativity, and methodological work that has been done to increase the stock of knowledge – including knowledge of humanity, culture and society – and to create new applications of available knowledge." The term R&D includes three types of activities: basic research, applied research and experimental development.

- Basic research: theoretical work carried out primarily to acquire new knowledge of the foundations behind observable phenomena and facts, without any particular application or use in presentation;
- Applied research: It is an original investigation conducted in order to acquire new knowledge. However, they are primarily geared towards a specific practical goal or objective;
- Experimental development: is the systematic work, drawing on the knowledge gained from research and practical experience and the production of additional knowledge directed to the production of new products or processes or to improve existing products or processes (OECD, 2015, pp. 44-45).

It is clear from the definitions provided, that the function of research and development mainly includes the transformation of ideas and knowledge into scientific products through which the goals of the organization are sought to reach the goals of the organization by modern and scientific technical and technical methods and achieve the welfare of society.

III.2. Research and Development Outputs

The most important outputs of the research and development activity carried out by the organization are:

- Invention: Represents any idea, drawing, or model of a machine, product, process, or new or improved system, inventions can be patented. But this does not mean that it becomes a marketable good or service, which is one of the characteristics of innovation;

- Creativity: In order for the organization to be able to create new products, it must first manage and generate new ideas, and here the role of creativity appears as a mandatory means of innovation to present ideas by doing creative techniques within the organization

(Gatherings, interviews, brainstorming ...), or obtained from creative people outside of it;

- Innovation: It results from the successful exploitation of new ideas, which are the results of research and experiments, to be successfully applied. It represents the successful marketing of a new product, method of production or service (Salma, 2019, p. 144).

IV. The reality of duality (innovation - research and development) in Algeria

To research on this aspect, and to know the status of research and development - innovation in the Algerian environment, we decided to address the overall status of the two jobs through the results of some indicators in this field. The Global Knowledge Index gave a value of 40.3, where the global average reached 48.4. This ranked 111th globally out of 154 countries included in the Global Knowledge Index report issued by. Which sums up that the country's performance is modest in terms of knowledge infrastructure. We can detail the performance of the aforementioned binary in the following:

IV.1. For the field of innovation

We use the innovation system to express the significance of the process of addressing the various stages of innovation in a systematic way (inputs - processing - outputs). Where the process is according to the following:

IV1.1. Community innovation inputs

Volume of skilled labor (%) – Payments of intellectual property rights (% of total trade) – Status of development of productive clusters.

IV.1.2. Outputs of social innovation

Number of trademark applications for residents (% GDP) - Volume of cultural exports (% of total exports) - Outputs of the printing and publishing sector (% of manufacturing industries). The recorded results of these criteria were as shown in the following table:

Table 2: Community Innovation System (Inputs-Outputs) in Algeria for the year 2021

	Criterion/Indicator	Result	Global ranking 154 Countries
Inputs	Volume of skilled labor (%)	/	/
	Intellectual Property Rights payments (% of total trade)	09.8	82
	State of development of productive clusters	48.3	59
Outputs	Number of Resident Trademark Application (% PIB)	18	82
	Volume of cultural exports (% of total	00	140

	exports)		
	Output of the printing and publishing sector (% of manufacturing industries)	03.7	104

The Source: (UNDP and Mohammed bin Rashid Al Maktoum Knowledge Foundation, 2021)

The results and measurements recorded in the previous table were different, but they all gave a declining ranking to Algeria, whether for inputs, where the overall score was 29.1 in 92nd place globally (except for the case of the development of productive clusters was in advanced ranks (59 globally), or for outputs where it recorded 07.2 ranked 124 globally. This indicates a defect in the process of the innovation system in Algeria, at least in the field of: Intellectual property, trademarks, printing and publishing, as well as the cultural field (cultural exports, which include animation, the film industry, cultural exhibitions, publishing and distribution, television series, etc.), where the percentage is almost non-existent.

During the first decade of the millennium, China's cultural and creative industries have increased in size about 60 times, taking advantage of the significant advantages of the technological revolution in the sector. Recently, many Internet companies have begun to become heavily involved in the cultural industries, most notably Alibaba, Baidu, Tencent, and others. A group of intellectual and cultural platforms have also begun to appear to connect producers and consumers of this type of cultural industries, including the Chinese Literature Platform (https://ir.yuewen.com), which includes nine million writers, thirteen million nine hundred thousand literary works, and 228.8 million monthly active users, and the content in it is classified into more than 200 categories (Arafa, 2021).

V. For the field of research and development

The research and development function is very important in building organizations with effective performance, as the impact of this will be evident by knowing the readiness of this function to perform technically and economically. In the following, we will present the various measures of the effectiveness of the research and development function in business organizations in a systematic way.

V.1. Inputs of R&D institutions

Research and development expenditure in business companies (%) – Number of researchers per thousand members of the workforce – Research and development spending companies (%), R&D funding from abroad (%) – Expenditure on computer software (% GDP) – Researcher's share of R&D expenditure – Graduates from STEM programs (%).

V.2. Outputs of R&D institutions

Number of documents per researcher – Number of patent applications submitted nationally/regionally (% GDP) – Return on intellectual property rights (% total trade) – Number of applications for industrial designs (% GDP) – Companies producing new goods and services (%) – Quality of research institutions. The results were monitored as follows:

Table 3: Research and development System (Input-Output) in Algeria for 2021

	Criterion/Indicator	Result	Global ranking 154 Countries
Inputs	R&D expenditure in businesses (%)	01	75
	Number of researchers per thousand members of the workforce	18	46
	Companies spending on R&D (%)	/	/
	Funding R&D from abroad (%)	00	101
	Software expenditure (% PIB)	0.4	123
	Researcher's share of R&D expenditure	19	66
	Graduates from STEM programs (%).	54.6	23
Outputs	Number of documents per researcher	38.2	97
	Number of national/regional patent applications filed (%PIB)	40.4	85
	Return on intellectual property rights (% of total trade)	02.3	102
	Number of applications for industrial designs (%PIB)	15.6	43
	Companies producing new goods and services (%)	/	/
	Quality of research institutions	25.5	46

The Source: (UNDP and Mohammed bin Rashid Al Maktoum Knowledge Foundation, 2021)

The measurements provided in the research and development inputs were 03.2 ranked 140th globally, but we saw Algeria rank well for graduates from STEM (science, technology, engineering and mathematics) programs ranked 23rd globally. In addition to the 46th rank globally in the number of researchers per thousand members of the labor force. This indicates that there are good inputs in the field of research and development (meaning the presence of competencies and people with knowledge and science in this field. On the output side, we noticed an evaluation score of 18.3 ranked 134 globally, although there were positive results in the number of industrial design applications ranked 43rd globally, and ranked 46th globally in terms of the quality of research institutions. Other remaining indicators saw negative results such as: The return of intellectual property rights is 102 globally, the number of documents per researcher is ranked 97 globally and the number of patent applications submitted nationally/regionally is ranked 85 globally (due to the researcher's share of spending on research and development in Algeria ranked 66 globally). This indicates the weakness of the systematic processing of research and development due to administrative obstacles, the complexity of regulations and legislation regulating this field. In addition to poor funding or spending. As spending on computer software, it ranked 123rd globally, and spending on research and development in business companies ranked 75th globally.

IV. For business development

When measuring its results, the outputs of the biennium (innovation - research and development) are aimed at determining the extent to which this affects business organizations and various economic activities in the country. Referring to the Global Knowledge Index 2021 report, we have drawn the results as shown in the following table:

Table 4: Results of the biennium (innovation - research and development) in Algeria for the year 2021

Criterion/Indicator	Result	Global ranking 154 Countries
Density of new businesses per thousand inhabitants	01.7	113
Companies preparing new products in key markets (%)	/	/
Joint ventures / Strategic alliances (% PIB)	02.5	123
Cooperation between universities and companies in the field of research and development	37.1	90
Business Researchers (%)	0.2	82
Growth of innovative companies	46.6	90
Added value of medium and high-tech activities	02.9	130
High-tech trade (% of total trade)	51.8	49

The Source: (UNDP and Mohammed bin Rashid Al Maktoum Knowledge Foundation, 2021)

CONCLUSION

Innovation is the most important area for business organizations to interact with their environment, as it is the criterion for crossing them towards the future and its challenges. The R&D function also contributes to the creation of quality scientific outputs that contribute to achieving the competitiveness of organizations and raising their performance.

In summary, the duality between innovation and research and development represents a symbiotic relationship essential for driving technological progress, organizational growth, and competitive advantage. Effectively managing this duality requires strategic alignment, resource allocation, cultural support, and a keen understanding of market dynamics and emerging trends.

I. Hypothesis testing

- Addressing basic concepts about innovation gave concepts that focused in their entirety on generating new ideas with the aim of improving a particular product or service. Thus, the search for

maximizing the optimal exploitation of available resources with high and advanced technologies. This proves the validity of the hypothesis;

- The requirements of the research and development function within business organizations play an important role in the process of research by adopting high-precision technological techniques, especially in the fields of medical and biological research, and thus adapting experimental scientific tools and methods in this field. This is what innovation activities look for by adapting them to the organization's environment internally and externally. This leads us to prove the validity of the second hypothesis;
- Harmonization of the R&D functions with the innovation activities of the organization, allowing to achieve the best results, especially under the availability of appropriate conditions (suitable scientific research environment, support through abundant funding and spending). Thus, the use of innovation activities (new ideas, technical organization, development of methods, renewal of knowledge, ...) with previous scientific research outputs will provide an information environment for the organization to determine its market needs and build future expectations, and this supports the validity of the third hypothesis.

II. Results of the study

The innovation function of business organizations seeks to facilitate the achievement of set goals, by providing new technologies that facilitate the activity of organizations and reduce the risk of uncertainty in the competitive environment. The R&D function, through its scientific research and new business results, contributes to raising the organization's readiness to compete.

The impact of the duality (innovation - research and development) on the success of business organizations in Algeria is very clear, as the outputs were weak and unacceptable compared to the inputs, which indicates weakness in the processing process and the existence of imbalances and systemic differences between them. This is proven by Algeria's ranking of 111 out of 154 countries in the Global Knowledge Index due to the weak infrastructure for research and innovation in this field.

Innovation and (R&D) in the Algerian business environment have been gaining increasing attention in recent years. Algeria, with its diverse economy and strategic location, has recognized the importance of fostering innovation and investing in R&D to drive economic growth and competitiveness.

Here are some key points regarding innovation and R&D in the Algerian business environment:

- **Government Support**: The Algerian government has shown commitment to promoting innovation and R&D through various initiatives, including funding programs, tax incentives, and supportive policies. These efforts aim to stimulate investment in research, technology, and innovation across different sectors.
- **Collaboration with Universities and Research Institutions**: Collaboration between businesses, universities, and research institutions plays a crucial role in driving innovation. Algerian businesses are increasingly partnering with academic and research institutions to leverage their expertise, resources, and facilities for R&D activities.
- **Industry Focus**: Innovation and R&D efforts in Algeria are often focused on sectors such as energy, agriculture, healthcare, information technology, and manufacturing. These industries are seen as critical for the country's economic development and diversification.

- **Challenges**: Despite the growing emphasis on innovation and R&D, Algerian businesses face several challenges, including limited access to funding, a shortage of skilled talent, bureaucratic hurdles, and infrastructure constraints. Addressing these challenges is essential to unlocking the full potential of innovation in the Algerian business environment.
- **Emerging Start-up Ecosystem**: The Algerian start-up ecosystem is gradually emerging, with a growing number of entrepreneurs and small businesses focusing on innovative solutions. Government support programs and initiatives from private sector stakeholders are helping to nurture this ecosystem and support the growth of innovative ventures.
- **International Collaboration**: Algerian businesses are increasingly seeking partnerships and collaborations with international counterparts to access new markets, technologies, and expertise. Collaborating with foreign companies and participating in international research networks can help accelerate innovation and R&D efforts in Algeria.

Overall, while there are challenges to overcome, the Algerian business environment is increasingly embracing innovation and research and development as key drivers of economic growth and competitiveness. Continued investment and support from both the public and private sectors are essential to sustain this momentum and unlock the full potential of Algerian businesses in the global marketplace.

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