



The missing link of university and the triple helix model of innovation

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Abstract

The term triple helix is already known and widely used in innovation research in developed countries, but its use in developing countries remains weak, due to the difficulty of applying in the field. The evolution of this concept helped to increase the role of the university, after it was focused on research and teaching today has become one of the key factors for innovation and change in the field of science and technology. This article aims to study university-government-industry cooperation, this is known as the triple helix model for innovation, after tried to explore and study the characteristics and roles of all the spirals in the model We established that the state must develop economic policies that stimulate industrial activity.

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1. *Introduction*

There is unanimous agreement that innovation has become an imperative necessity to confront various changes. Intense and fierce competition has compelled organizations to adopt a reactive and short-term approach to address and adapt to environmental complexity. Economic thinkers have confirmed that innovation is the main driver of economic growth (Uzunidis, 2004, P.48) and a critical factor for competitiveness (Buesa et al., 2010, P.722).

So accordingly, innovation has become a key resource for the welfare of national economies, international competitive advantages, and as a source of selection for gaining competitive advantage in the market for all companies. Since the international economy is not only about participation and joining highly competitive markets, achieving restructuring, following low-cost strategies, or creating products and processes that overcome technological barriers, success requires greater efficiency in some form of innovation (internal innovation, external innovation) as well as adopting strategies and policies for the innovation system to develop and enhance the economy. In innovation literature, we see that the importance of the latter in industrial dynamics dates back to the era of Adam Smith in his book "The Wealth of Nations." However, with the advent of the industrial revolution, especially at the beginning of the twentieth century, the importance of innovation began to increase with the various works of Joseph Schumpeter, by introducing new concepts, most notably the concept of creative destruction (Zouikri, 2008, P.14).

But Schumpeter was only able to confirm his theory at the end of the Second World

War by authoring a book titled "Capitalism, Socialism, and Democracy," where he affirmed that innovation is the main driver in economic development and is driven by the entrepreneur who can break the routine with new ideas, through which they can disrupt the equilibrium in the system to gain a new strong advantage. The institutional structures of the state, such as the education and training system and the regulatory (legal) framework, are all factors that can play a major role in determining the innovation capacity of various institutions in the country. The state can intervene directly by providing grants, tax incentives, and public procurement, or indirectly by investing in the public research system (Rahmouni, 2011, P.58). The state can also enhance the innovation capacity of institutions and organizations by establishing a network of institutional structures in the public and private sectors so that their various activities and interactions allow them to import, adapt, and disseminate new technologies (Rahmouni, 2011, P.62). However, on the condition that this system is not limited to scientific and technological activities related only to innovation, but rather must bring together all organizations and institutions (universities) that influence learning and research activities and take into account the economic development policy of the country, especially in developing countries (Rahmouni, 2011, P.6).

Although several studies have confirmed that the national innovation system plays an important role in enhancing the innovation capacity of institutions, as evident through the intellectual property rights system that positively affects innovation (Elche-Hotelano, 2011, P.13), some argue that the national innovation system remains ambiguous, whether related to the specificity of the state itself or even the nature of its operation (the

national innovation system), as the effects of the national innovation system are generally non-reflective (feedback) between various structures, which is considered a negative aspect for any innovation process.

In this study, we will attempt to fill the scientific gap of the national innovation system by presenting other concepts related to this system that help in the process of knowledge and technology production, perhaps the most important of which is the concept of the Triple Helix model of innovation. Therefore, we will raise some questions through which we can address this scientific gap, as follows:

-Does the Triple Helix model of innovation play a role in enhancing the innovation capacity of organizations and institutions?

-What do we mean by the concept of the Triple Helix of innovation? Within the Triple Helix model of innovation, where does the role of the university lie?

2. Study Literature:

2.1 General Concepts of Innovation:

Despite the multiplicity of definitions of innovation, there is no global consensus on the precise definition of the term. Innovation was first defined by the German scholar Schumpeter, who defined it as the driving force of development and proposed five types of innovation (Vyas, 2009, as cited in Atalay et al., 2013, P.227):

-Creation of new products or qualitative improvements in existing products.

-Use of a new production process.

-Opening new markets.

-Development of new sources of raw materials or inputs.

-New forms of industrial organizations.

As for Drucker, he defined innovation as the organization's abandonment of the old, emphasizing what Schumpeter said that innovation is creative destruction (Najm, 2003, P.21). Additionally, in the third edition of the Oslo Manual, innovation was defined as the implementation of a product (good or service), process (production), significant improvements, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations (OECD, 2005, P.34-35).

Also, most early studies classified innovation into five types: new products, new production processes, new materials and resources, new markets, and new organizational forms. Alongside these types, other authors have classified innovation into two types: radical innovation and incremental innovation (Atalay et al., 2013, P.222). Due to the branching of the concept of innovation into several fields and its qualitative and quantitative duality, measuring it by setting indicators is very difficult. Therefore, most innovation activities have been identified and placed into two categories: the first category is related to inputs of innovation activity, such as expenditures directed to the R&D function

and the workforce in this function, in addition to the number of scientific publications. The second category is related to outputs of innovation activity, such as patents, number of innovative products, and finally the revenue obtained from this activity (Zouikri, 2008, P.34-38).

2.2 The Triple Helix Innovation Model:

The Triple Helix is an analytical and normative concept derived from the changing role of government in different societies regarding academic and industrial circles. The interaction between universities, industry, and government as relatively independent but interconnected institutional spheres is key to improving innovation conditions and sustainable development in a knowledge-based society (Dzisah and Etzkowitz, 2008, P.102). It provides companies and organizations the opportunity to develop their integrated capabilities to solve various technological problems. This term also relies on feedback derived from the interaction between the economic, social, political, and institutional spheres, which influences the development and dissemination of learning and innovation (Saad et al., 2008, P.433). The Triple Helix model is also defined as a triple network or hybrid of organizations or a model of relationships between university, industry, and state (Carayannis et al., 2012, P.2).

The Triple Helix model was initially derived from the analysis of the renewal

of the Boston economy in England in 1930 through cooperation between university, industry, and state, in order to form a partnership in academic research related to the training of company staff (Arnkil et al., 2010, P.13).

Torkkeli (2007) says that this model evolved in three stages (Arnkil et al., 2010, P.13):

- The first stage involved defining the three pillars in institutional terms.

- The second stage discussed the problem of communication between the three pillars.

- Finally, the focus was on the hybrid between university, government, and industry.

Regarding the types of the Triple Helix innovation model, Etzkowitz and Leydesdorff gave three types of this model as follows (Etzkowitz et al., 2000, P.3):

Statist Model: In this model, the state controls industry and university by monitoring both. For example, both the Soviet Union and Latin American countries provided necessary resources and developed projects, so the government's innovation policy was only through building bilateral links between university and industry. (Figure one)

Laissez-faire Model: Here, university, industry, and state are independent of each other and interact with each other only

modestly across strong boundaries. This type was applied in the United States. (Figure two)

Balanced Helix Model: This model emphasizes the necessity of feedback interaction, thus providing new insights for innovation through balanced interactions between university, industry, and government. (Figure three)

2.3 The Role of the University in the Triple Helix Innovation Model:

A/ State-University: Through various literature, we find that the state has a major role in improving the relationship with the university. The Triple Helix model allows the state to provide bridges for cooperation, whether with the university or even with another institution. Through this model, the government is able to invite university and industry to participate in innovation anytime and anywhere (Zhou, 2008, P.114). When talking about Algeria, the government is striving to improve the efficiency of the university by adjusting the wage policy for professors and enhancing their skills and knowledge through short or long-term internships. Although the state funds various academic research programs (such as PNR, PRFU), they remain insufficient compared to developed countries, especially when viewing the prevailing teaching climate in the university. Therefore, we say that the state must increase the number of laboratories and

research centers in Algeria, which is estimated at about 1425 laboratories and research centers in total (Dgrsdt, 2015).

In comparison with developed countries, we find, for example, that in China in 2009, university R&D expenditures ranked second, amounting to 34% of public state expenditures. Also, the budget for the R&D function in various official institutions is high, estimated at about 59% (Cai and Liu, 2015, P.7). This is important for enhancing the state's innovation capabilities. In contrast, in Algeria, the outputs of research centers are very weak. For example, looking at the CREAD center, we find that it does not hold any patents (DGRSDT, 2013, P.17). This is considered a problem for the state, so it must increase the financial amounts allocated to these specific laboratories and R&D functions in various state institutions to encourage them to innovate. Finally, we see that the state must impose laws or provide incentives and tax grants to institutions so that they can attract university students for internships, allowing them to enter the industrial climate.

B/ State-Industry: The role of industrial policy in economic development leads us to discuss the importance of the relationship between industry and the state. It is not difficult to see the relationships between the state and institutions in practical practices; for example, when discussing investment

incentives and tax policy, all are factors applied on the ground. However, not much is known about the economic functions of the relationships between the state and business people. Therefore, Doner and Schneider say that various business people must discuss many functions that are primary to the market and important in managing relationships between business people and the state, such as macroeconomic stability, horizontal and vertical coordination, reducing information costs, setting standards, and developing quality (Te-Velde, 2013, P.11).

Therefore, the relationship between the state and industry must be embodied in reality in a transparent and clear manner by providing keys, particularly improving the quality of the institutional framework and establishing public policies that encourage business. Thus, when looking at different literature, we notice that the Triple Helix innovation model is among the most important solutions that help bring together the state and industry to create a suitable climate through which all institutions and the state itself can increase their economic growth.

When talking about Algeria, looking at the Doing Business report and through Table No (1), we see that Algeria ranked 157 in 2020. We also note that except for the first four indicators that achieved a very slight leap when comparing 2020 and 2019, the other indicators remained the same. (Table One)

Additionally, when viewing the process of establishing companies, we see from Table No. (2) that Algeria is also in its worst condition. For example, looking at the first indicator related to the number of procedures required to establish a company, Algeria is lagging even compared to Middle East and North African countries and OECD countries, and this for both males and females in 2022. (Table two)

Also, regarding the indicator of getting credit, we see from Table No. (3) that Algeria is still far compared to OECD countries and even Middle East and North African countries in 2022. For example, we find that the strength of legal rights index is very low, as well as the indicator related to the depth of credit information, which reached 0 in 2022. (Table Three)

Finally, despite these weak statistics, Algeria seeks to improve these indicators by building a strong and sincere relationship with industrialists. The preparation of Prime Minister Abdelaziz Djerad for the upcoming tripartite meeting in June is proof of the state's intention to create a solid relationship between the state and industry. In this regard, the tripartite is also expected to discuss the outputs of the plan proposed by the Ministry of Industry and Mines related to revitalizing the industrial sector, where the actors in this field are the private sector that must accompany government efforts in the field. It is anticipated that the

tripartite will address issues related to studying how to eliminate bureaucratic methods that hinder wills and initiatives, in order to expedite the procedures for benefiting from the special fund to support small and emerging enterprises. In addition to studying ways to develop investment in its various fields, especially related to desert agriculture, especially after the Council of Ministers approved the establishment of an office for desert agriculture, aimed at reclaiming millions of desert hectares to develop industrial agriculture (N., 2022).

C/ University-State: Universities help the state in many things, including training human resources for the public works sector, and they provide experts who contribute to solving societal and state problems by providing useful research and studies. Moreover, universities can play an important role in improving the state's image globally by attracting people wishing to visit the university in particular and the state in general, whether for tourism purposes or for exchanging expertise. For example, Harvard University in the United States is a major funder for the state.

When looking at Algeria, the contributions of the university to the state remain weak, although several agreements have been concluded between the university and the state, perhaps the most important of which is the agreement of October 10, 2015, between the Ministry of

Education and Vocational Training and the Ministry of Public Works aimed at training and qualifying human resources for the public works sector (MESRS, 2015).

D/University-Industry: With the emergence of the knowledge-based economy, the role of the university has evolved. After focusing only on research and teaching in the past, it has today become one of the main factors of innovation and change in the field of science and technology and is considered a source of knowledge in the innovation process (Razak and Saad, 2007, P.212).

In the Triple Helix innovation model, the university has a new role represented in developing innovations and entrepreneurship in the socio-economic environment, which is called the second scientific revolution. The university also applies knowledge to solve problems in practice with industrial institutions (Villarreal and Calvo, 2015, P.4). Also, Dinapoli (2011) indicates that the university must generate new ideas and technologies by training a skilled and qualified workforce and establishing partnerships with private sector bodies and investors (Farinha and Ferreira, 2013, P.15). It also contributes to the formation of companies (Etzkowitz et al., 2000, P.11), and we note here that the abundance of universities in the region where companies are located increases the likelihood of interaction between the company and the university because it

increases the company's options (Maeitta, 2015, P.1342). Therefore, the university is expected not only to provide research results but also to create researchers, and this is not only for the benefit of the university but for the benefit of society as a whole (Lilles and Rõigas, 2017, P.4).

So the university has become an important and main role in the success of the innovation process, and this is implemented in most European countries. For example, we find that most Italian academic research focuses on agri-food topics, as the food sector in Italy is characterized by a large number of small companies (Maeitta, 2015, P.1345). Thus confirming the weak R&D intensity in institutions and thus representing an imperative necessity for cooperation between university and industry. As another application of this duality (university-industry), we find that Algeria initiated a cooperation agreement on October 5, 2015, between the Ministry of Higher Education and Scientific Research and the Forum of Heads of Enterprises, where it was agreed to establish a joint committee between them. In addition, a fund to support scientific research managed by both parties was established, with an initial value estimated at about 50 million DZD (MESRS, 2015).

Furthermore, the university initiated the creation of an entrepreneurship house for

each university at the national level in order to build a strong bridge linking both the university and industry. It also initiated the creation of incubators at each university institution. Another state initiative that contributed to strengthening the relationship between university and industry is the transfer of responsibility of the National School of Administration from the Ministry of Higher Education to another ministry, making its graduates more employable (Boutifour et al., 2015, P.97). This is what we see when looking at the Algerian Petroleum Institute (IAP), which is under the supervision of the Ministry of Petroleum. Several agreements were also recently signed; the first agreement is a framework agreement between the Ministry of Industry and Mines on the one hand and the Ministry of Higher Education and Scientific Research, aiming to promote research and technology development at the level of economic institutions active in the field of industry, alongside enhancing scientific research. The second agreement was signed between the Industrial University, the General Directorate for Scientific Research and Industrial Technologies, and the "Imetal" complex for metal, iron, and steel industries. Thus, these factors confirm the intention of the Algerian state to implement the university-industry duality in practice (aps.dz, 2020).

Table 1. Ease of Doing Business in Algeria

Indicators	DB 2020 Ranking	DB 2019 Score	DB 2020 Score	DB 2020 Score	DB 2021 Score	DB 2022 Score	Score change (% points)
Global	157	48,6	48,5	48,8	48,7	48,6	+0,1
Starting a Business	152	78	77,9	77,8	77,7	78	+0,1
Dealing with Construction Permits	121	65,3	64,6	65,4	65,7	65,8	+0,7
Getting Electricity	102	72,1	71,9	71,4	71,6	71,8	+0,2
Registering Property	165	44,3	44,3	44,3	44,3	44,3	..
Getting Credit	181	10	10	10	10	10	..
Protecting Minority Investors	179	20	20	20	20	20	..
Paying Taxes	158	53,9	53,9	53,9	53,9	53,9	..
Trading Across Borders	172	38,4	38,4	38,4	38,4	38,4	..
Enforcing Contracts	113	38,4	54,8	38,4	38,4	38,4	..
Resolving Insolvency	81	49,2	49,2	49,2	49,2	49,2	..

Source: <<https://francais.doingbusiness.org/fr/data/exploreeconomies/algeria>>, 05/05/2022

Table 02: Business Creation in Algeria

Indicator	Algeria	Middle East and North Africa	OECD high income
Procedures - Men (number)	12	6,5	4,9
Time - Men (days)	18	19,7	9,2
Procedures - Women (number)	12	7,1	4,9
Time - Women (days)	18	20,3	9,2

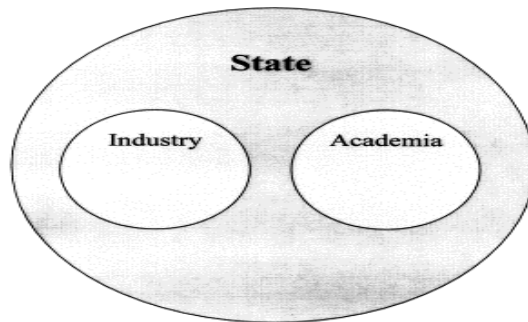
Source: <https://francais.doingbusiness.org/fr/data/exploreeconomies/algeria#DB_sb>, 06/05/2022

Table 03: Getting Credit in Algeria

Indicator	Algeria	Middle East and North Africa	OECD high income
Strength of legal rights index (0-12)	2	3,1	6,1
Depth of credit information index (0-8)	0	5,3	6,8

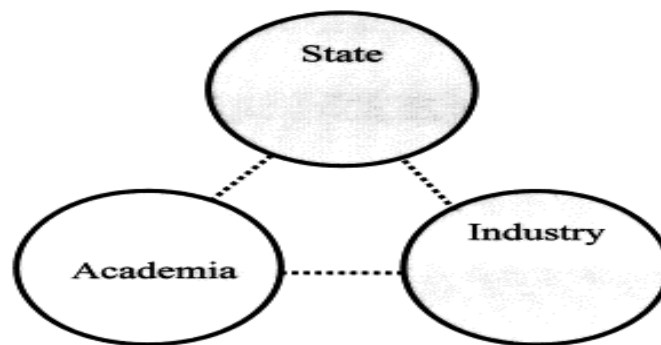
Source: <https://francais.doingbusiness.org/fr/data/exploreeconomies/algeria#DB_gc>, 06/05/2022

Figure 01: Statist Model



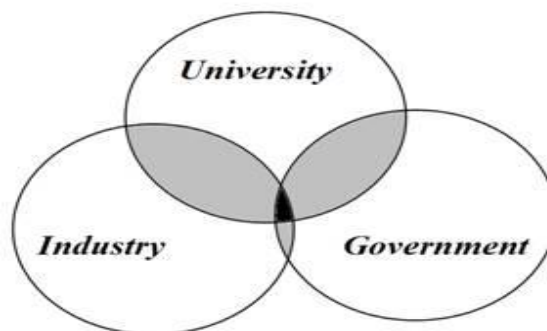
Source: Etzkowitz et al., 2000. The dynamics of innovation: from National Systems and 'Mode 2' to a Triple Helix of university–industry–government relations, p3.

Figure 02: Laissez-faire



Source: Etzkowitz et al., 2000. The dynamics of innovation: from National Systems and 'Mode 2' to a Triple Helix of university–industry–government relations, p3.

Figure 03: Balanced or Hybrid Model



Source: Etzkowitz et al., 2000. The dynamics of innovation: from National Systems and 'Mode 2' to a Triple Helix of university–industry–government relations, p4.

4. CONCLUSION

In conclusion, we say that the Triple Helix model not only clarifies the relationship between university-industry-government but also the internal transformations in each of these pillars (Leydesdorff and Etzkowitz, 2000, P.148). The overlap and interaction between each component of the Triple Helix system must be characterized by dynamism and flexibility, which are the basic advantages of any innovation system (Etzkowitz et al., 2000, P.10). Compared to other developing countries like Malaysia, we find that the Triple Helix system is applied better due to the economic development in these countries (Saad et al., 2008, P.441).

Therefore, political decision-makers in Algeria should consider the incentives and obstacles to implementing the Triple Helix model (Boutifour et al., 2015, P.107). The state must also invest more in the field of science and technology, in addition to developing the industrial field in parallel with the university field, and instilling a culture of innovation among institutions and peoples so that cooperation is effective. It should improve working conditions in the university to provide a suitable environment for increasing the quality of academic and experimental research, while emphasizing the need to accelerate the increase in expenditures directed to

the university, especially in R&D functions such as laboratories and research centers.

We also note that in recent literary studies, the term Quintuple Helix of innovation has been addressed, which adds two other pillars to the Triple Helix innovation model. The first focuses on the public (society), being linked to media, creative industries, culture, values, lifestyles, and art. The second is the natural environments of society, as its formulation relies on sustainable development.

Finally, we say that the new innovation environment is characterized by the effective role of universities, in addition to the main role of the government in policy-making and strategic alliances of companies in developing and marketing products and increasing innovation activities in industry (Arnkil et al., 2010, P.12).

Like any other study, our current study is not without some shortcomings and negatives, among which we mention the absence of the applied aspect due to the relative novelty of the topic. Therefore, we advise future researchers to introduce other variables such as society and the natural environment and their role in enhancing the various relationships present in the Triple Helix

innovation model, and why not attempt the applied aspect in Algeria.

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