

APPLYING THE QUADRUPLE HELIX MODEL TO HIGHLIGHT THE RELATIONSHIP BETWEEN ACADEMIC RESEARCH AND THE INNOVATION PROCESS

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Abstract

The 21st century, characterized by the VUCA concept (acronym coined out in 1987 to describe the volatile, uncertain, complex, and ambiguous world we live in), is a reflection of the technological disruption and its related social, economic and cultural impact, as well as a consequence of the rapidly changing business and organizational environment, which became our "new normal". These challenges cannot be addressed from an unilateral perspective, therefore the new paradigm implies a stronger cooperation between a society's most important pillars to provide the necessary infrastructure for innovation and economic development. In this context, the innovation process implies a new framework of interactions and interdependences between the four fundamental elements which constitute the Quadruple Helix (QH) model: universities – industries/companies – government – civil society. The purpose of this paper is to examine the relationship between the elements of the QH model and their potential synergy, as well as to highlight the prominent role universities undertake within this model. Universities are considered to be innovative laboratories of ideas, endowed with specialized human resource capable of improving the research and development (R&D) activities by capitalizing the knowledge obtained through research, teaching and learning, and to convert the scientific discoveries into innovations which, in turn, will support long term economic growth.

Keywords: Quadruple Helix model, Research, Innovation, Higher Education

JEL Classification: A22, O30, I230

1. Introduction

In the contemporary global economy characterized by high dynamism and complexity, the academic educational system (considered to play a major role in each national innovation and development network) has become increasingly relevant for the knowledge society. More specific, universities play an active role in producing and transferring the results (in terms of knowledge) at individual and community level

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through strong interaction among different scientific areas, and between the research endeavours and the economic impact on society at large. The importance of Higher Education institutions depends on their capacity to contribute to the knowledge society and on their ability to deliver proper answers to the influences of internal and external factors that configure the environment they activate in. Moreover, all these elements depend on how universities define their strategic mission.

Within this framework, we emphasize the role of Higher Education in the innovation process of the knowledge economy. The objectives of this study are to present the Quadruple Helix model of innovation, to point out the interconnections between the elements that compose it and their synergic effect, as well to highlight the prominent role universities play within this model. Universities are considered to be innovative laboratories of ideas endowed with skilled human resource capable of improving the research and development (R&D) activities by capitalizing the knowledge obtained through teaching and research, and to convert the research output into practice in order to contribute to the overall economic development. The current study brings value added to the literature on academic research and innovation by highlighting the importance of the Quadruple Helix model in emphasizing the relationship between Higher Education and the innovation process within the knowledge-based economy.

2. Research methodology

This article is based on the critical analysis of the relevant literature in the field of innovation, with a focus on the Quadruple Helix model. As a qualitative study, the paper involved the collection and selection of the relevant literature in the field (scientific journals, documents, online resources.), their analytical inquiry and interpretation. The aim was to understand and explain the theoretical framework, and to add some statistical data in order to defend the argument.

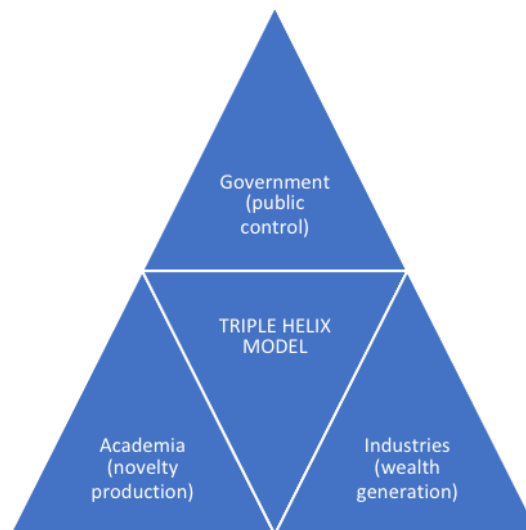
3. Theoretical background. From Triple to Quadruple Helix Model

The Quadruple Helix is a metaphor used in the literature to reflect an innovation model in which four components (universities, companies, government and the civil society) interact in order to produce effective innovations for all the stakeholders/partners involved. These four core components should be analyzed from above, form a larger perspective, as they "are not involved in unidirectional push-pull relationships, but rather in multi-layered, dynamic, bi-directional interactions" (Schültz, Heidingsfelder and Schraudner, 2019). These innovations may be beneficial to any field, from goods and services sector, to technology and trade (Arknit et al., 2010). For example, education for research is essential for delivering students the impetus to develop their creativity, to gain skills and confidence in order to acquire practical abilities needed in the innovation process. The philosophy behind the innovative universities is that Higher Education (teaching and research) has a significant contribution to innovation in the knowledge economy (Rebernik, 2009).

In order to understand the Quadruple Helix as an innovation model, it should be placed, first of all, in the literature on innovation research and policy. The concept emerged in the mid-1990's, a period when universities and companies were urged by the policy makers to cooperate more intensely for the benefit of the society (Smith and

Leydesdorff, 2014) through the production and transfer of knowledge and new technologies. In 1995, Etzkowitz and Leydesdorff identified three major components of the innovation process: the academia, the industry and the government (Figure no.1). This model was called the Triple Helix (TH) model, in which the academic environment (universities), the industries (firms), and the government represent the three helices which cooperate in order to discover new ideas, insights, knowledge, as well as new products or services. The TH concept highlights that the potential for innovation in the knowledge economy relies on the prominent role of universities and technologies developed in this science-based environment.

Figure 1. The Triple Helix Model



Source: Adapted by the authors after Smith and Leydesdorff (2014)

The TH model has evolved through different stages: in the first phase, the helices were defined institutionally, in the second phase more attention was given to the communication dimension within the system, and the third stage focused on the “hybrid organizations of academia, government and industries” (Tokkeli, 2007 cited in Arknil et.al., 2010). The Triple Helix model which intended to explain “the structural developments in knowledge-based economies” built on the university-industry-government relations (Leydesdorff, 2012), faced some limitations and critiques. Some scholars (Etzkowitz and Klofsten, 2005; Yawson, 2009 cited in Arknil et.al, 2010) considered that an essential element was missing, that is the public (the civil society). The inclusion of this new helix has become critical since scientific knowledge has been evaluated in terms of “social robustness and inclusion”. This new helix, the civil society, pointed out “new discoveries and innovations that improve social welfare”, such as eco-innovation.

The Quadruple Helix model, as a user-oriented innovation model, is not yet a “very well-established concept in the innovation research and policy”, but it is an explanatory model for analyzing the knowledge-based economy. The civil society has

been added as the fourth element of the model due to the fact that innovation is generated by the need of the users/citizens and it may be perceived as a “shift from technical to social innovation” (European Union, 2016).

According to Arnkil et.al (2010), the QH model can be defined as “an innovation cooperation model or an innovation environment in which users, firms, universities and public authorities cooperate in order to produce innovations” in any field useful for the stakeholders or partners, from technological to commercial or for products and services (Figure no. 2).

Figure 2. The Quadruple Helix Model



Source: Adapted by the authors after Arnkil et al. (2010)

In compliance with the report issued by the European Union in 2016, the fourth helix is defined as “a collective entity formed by individual users living on a territory and interacting with university, industry and government as customers, citizens and members of a community in order to contribute to build new innovation paths which are able to promote the socio-economic growth of the territory”. Moreover, civil society requests that innovations should be made according to its needs, provides feedback on products and services, and brings its own “contribution in terms of knowledge, inventiveness and creativity” (EU, 2016).

4. The role of Higher Education within the Quadruple Helix model, with focus on the academic research

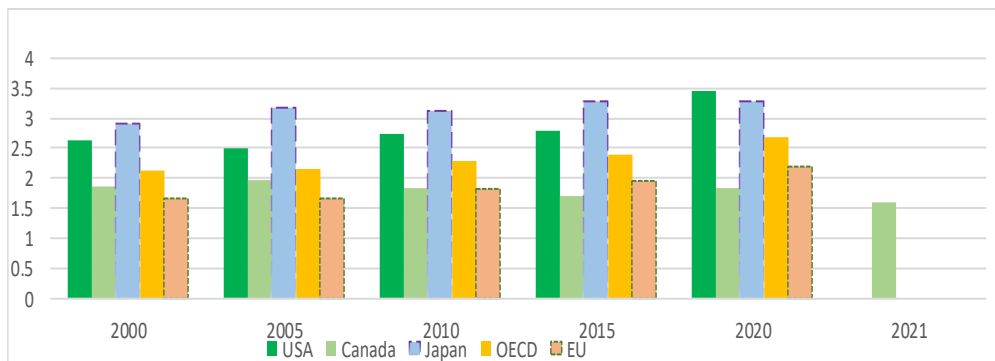
Over the past decade, the development of intellectual capital through R&D has been of great relevance. This is the reason why it is imperative for a country to rely on its own capabilities in research in order to be independent in tracking its own route in a

globalized and competitive world. From this perspective, the developed economies support the creation of dynamic research environments (universities, research institutions etc.) in which actors involved cooperate to generate new ideas and knowledge essential in the innovation process. In addition, developed countries are the most important contributors to R&D projects, financing this sector with substantial funds each year (Table no.1, Figure no.3 respectively).

Table 1. Gross domestic spending on R&D, % of GDP, 2000-2020/21

Year	USA	Canada	Japan	OECD	EU
2000	2.62	1.86	2.9	2.12	1.67
2005	2.5	1.97	3.18	2.14	1.66
2010	2.74	1.83	3.13	2.28	1.83
2015	2.78	1.7	3.28	2.38	1.95
2020	3.45	1.84	3.28	2.67	2.19
2021	-	1.6	-	-	-

Figure 3. Gross domestic spending on R&D Total, % of GDP, 2000-2021

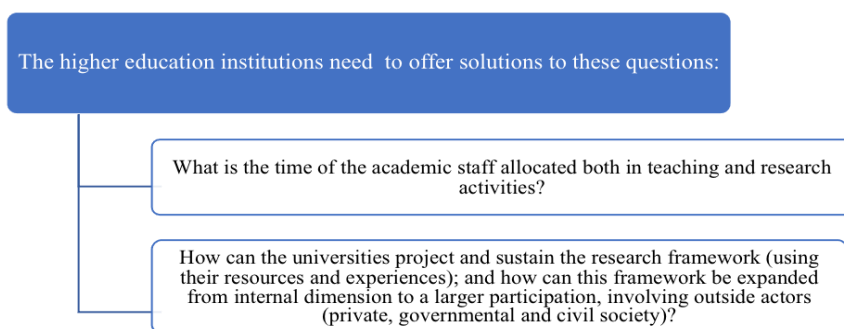


Source: Realized by the authors using the OECD Statistics

Academic research is considered to bring a great contribution to education as it involves scientific development and implies the innovation-driven factor to foster the innovation process. In general, the academic research is essential from several perspectives: firstly, for accomplishing the universities' strategic mission to offer a scientific environment for the accumulation of knowledge, improving the learning methods and developing research capacities (even though in the new complex socio-economic context there are many difficulties in adopting policies, practices and strategies that would not affect their traditional role related to teaching process); secondly, the academic research represents one of the fundamental conditions to sustain and develop an adequate environment for better inter-generational transmission of knowledge and experience. Thirdly, the academic research (with its contribution to the innovative process) generates connections with other High Education institutions, with specialists from different areas, creating an interdisciplinary flow of information. In addition, the academic research has demonstrated the capacity to attract and

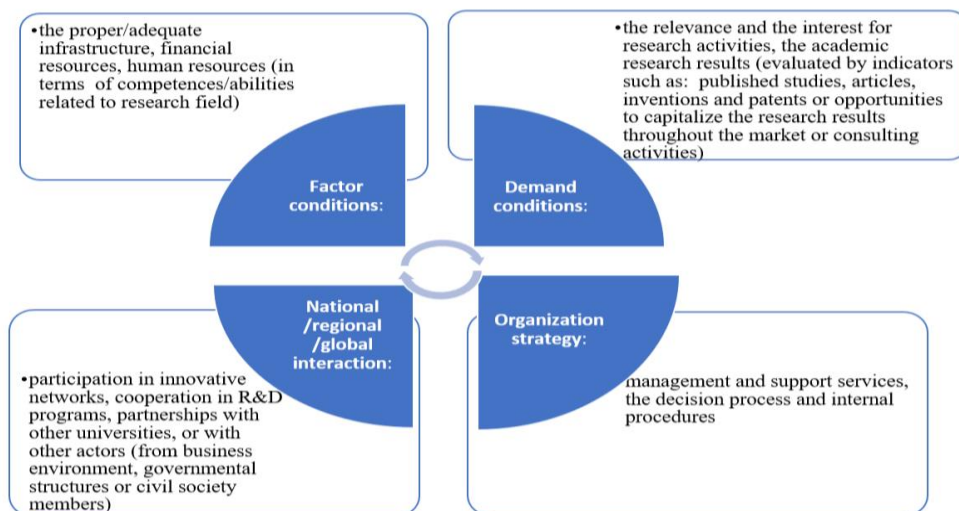
maintain the university staff of high professional quality as well as the best students. Moreover, the universities' classification systems, when they establish a certain hierarchy, rank them by taking into account a lot of criteria, among which the innovative contribution (throughout research activity) and research results, are considered to be extremely relevant (RAE, 2009).

In order to create an educational environment that stimulates the interest, the participation/implication and serious dedication toward the effective research activity of teachers and students, universities must solve key aspects that configure the academic framework and give them proper answers. As a consequence of this procedure, first of all, the Higher Education institutions need to offer solutions to the following questions:



Taking into account **Michael Porter's competitiveness analysis model** (Miron, 2003), the Higher Education institutions may concentrate their efforts on 4 forces/strengths, adapted to the research area, in order to accentuate the competitiveness and the innovative behavior :

Figure no. 4 Porter's competitiveness analysis model



Source: Realized by the authors after D. Miron (2003)

In this context, universities have an important role in increasing their participation to the production and the transfer of knowledge, providing solutions to social problems (the fourth helices of the Quadruple Helix model) such as those related to training the active population and supporting the insertion in the labor market. Moreover, they must develop partnerships with the other helices of the model, respectively the industry (the business environment) by creating business incubators, and the government.

5. Conclusion

The aim of this paper was to we emphasize the role of Higher Education within the innovation process in the knowledge economy. In conclusion, in the knowledge economy characterized by high dynamism and complexity, the academic educational system (considered to be an important part of each national innovation and development network) has become increasingly important for the knowledge society. Nowadays, universities play an active role in producing and transferring the results (in terms of knowledge) at individual or community level, through strong interaction between different scientific areas, as well as between the research activities and the economic environment. In addition, of great importance is the development of strong partnerships with the other helices of the Quadruple Helix model in order to have a an effective and sustainable impact on society.

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