Modelling the process of valorization of university research within emerging innovation ecosystems: a comparative study between Algeria and Canada

Rabah FRAGUA[1*], Sophie Veilleux[2]

[1]Mouloud Mammeri University of Tizi Ouzou, (Algeria), [2]Laval University, Quebec (Canada)

نمذجة عملية تثمين البحوث الجامعية ضمن بيئات الابتكار الناشئة: دراسة مقارنة بين الجزائر وكندا

رابح فراقة[1*]، صوفي فيو[2]

[1] جامعة مولود معمري، تيزي وزو (الجزائر)، [2]جامعة لافال، كيبيك (كندا)

Date of receipt: 08/04/2025; **Date of acceptance:** 30/06/2025; **Publication date:** 30/06/2025

Abstract: In an economy where competition has become the most difficult, it is imperative for the firm to gain a competitive advantage that is now based on knowledge and innovation (Porter, 2000). Such an approach requires collaboration between different actors involved in innovation ecosystems, including research and industry. This is done through mechanisms developed in industrialized countries with proven effectiveness and less effective in developing countries. This raises the issue of the influence of factors related to the context of collaborations on the effectiveness of these mechanisms. In order to understand the influence of contextual factors on the effectiveness of these mechanisms, this comparative study is conducted in an industrialized country (Canada) and another developing country (Algeria). The results of the study show that for each mechanism, there are factors that determine its effectiveness. These factors are respected in the Canadian case and absent in the Algerian case. Inspired by the Canadian case, developing countries such as Algeria must draw up a global innovation policy that defines the framework for collaboration between the various actors and takes into account the factors determining the effectiveness of the mechanisms.
Keywords: Ecosystem, Innovation, Technology, University-company.
Codes de classification Jel : Q5, O3, O33, L24

ملخص:

في اقتصادٍ باتت فيه المنافسة شديدة، بات من الضروري للشركات اكتساب ميزة تنافسية قائمة على المعرفة والابتكار (Porter, 2000). يتطلب هذا النهج تعاونًا بين مختلف الجهات الفاعلة في بيئات الابتكار، بما في ذلك البحث والصناعة. ويتم ذلك من خلال آليات طُوّرت في الدول الصناعية، أثبتت فعاليتها، بينما تقل فعاليتها في الدول النامية. وهذا يثير مسألة تأثير العوامل المتعلقة بسياق التعاون على فعالية هذه الآليات. لفهم تأثير العوامل السياقية على فعالية هذه الآليات، أُجريت هذه الدراسة المقارنة في دولة صناعية (كندا) ودولة نامية أخرى (الجزائر). تُظهر نتائج الدراسة أن لكل آلية عوامل تحدد فعاليتها، وهذه العوامل مُراعاة في الحالة الكندية، وغائبة في الحالة الجزائرية. واستلهامًا من التجربة الكندية، يتعين على الدول النامية، كالجزائر، وضع سياسة ابتكار عالمية تُحدد إطار التعاون بين مختلف الجهات الفاعلة، وتأخذ في الحسبان العوامل التي تُحدد فعالية الآليات.

الكلمات المفتاحية: النظام البيئي، الابتكار، التكنولوجيا، الجامعة والشركة

تصنيف جال: Q5, O3, O33, L24

I -Presentation :

The acceleration of the globalisation of trade, the speed of product renewal, know-how techniques, the permanent pressure of financial restrictions and the prospect of single markets have pushed companies to manage all their resources in the best possible way. In this context, in order to maintain

* **Correspondance mail**: dim@anvredet.org.dz

and possibly improve its position in the market, it is imperative for the company to gain a competitive advantage that is now based on knowledge and innovation (Porter, 2000). Two choices are then available to her. First, invest in research and development (R&D), which requires significant investments (financial, material and intangible) and involves managing a long, uncertain and costly process. As a result, the company is taking a very high risk given the uncertainty of the research projects. The second alternative is collaborative in nature. It consists of exploiting external sources through collaborative research projects, the acquisition of technology licenses and other intellectual property titles.

As a result, the role of institutions that produce new knowledge and technologies is becoming increasingly important. For example, the university is called upon to contribute more to economic and social life by transferring the results of its research to the industrial sector (Etzkowitz et Leydesdorff, 2000). This dynamic of interactions between the two actors (industry and university) disrupts the classic configurations often characterized by boundaries between the stakeholders involved in innovation activities. This has enabled the emergence of networks and ecosystems with high performance in terms of innovation and technology transfer. Indeed, innovation develops within environments that promote openness and knowledge sharing by requiring the establishment of interactions between all partners and sometimes between the competitors themselves.

The speed of technical changes and the complexity of innovation processes require high-performance collaborations between the actors who produce and exploit knowledge. The university, being the main generator of new knowledge, should channel the different sources of knowledge and federate the effort made by the actors of its ecosystem.

Since the publication of the Bayh-Dole Act, which allows American universities to appropriate and commercialize the results of research work financed by government funds, industrialized countries have put in place mechanisms to reduce the obstacles that hinder collaborations between innovation actors. Drawing on these experiences, developing countries have developed policies to support innovation. They have established mechanisms to strengthen the links between the actors of the innovation ecosystem. However, the results obtained remain far from aspirations. Thus, the question of the effectiveness of the mechanisms put in place in these countries arises.

Our study attempts to provide answers to the following question: how does the specific context of developing countries influence the effectiveness of university-industry collaboration mechanisms developed in industrialized countries? The objective of this study is to compare the mechanisms of university-industry collaboration in industrialized and emerging countries in order to analyze the effect of contextual factors on the effectiveness of these mechanisms.

Previous research that has examined the factors and mechanisms that promote or constrain the performance of university-industry collaborations does not provide information related to the context in which these collaborations take place and their effects on the effectiveness of the mechanisms studied. Our research will fill this gap by analyzing the effect of contextual factors on the effectiveness of the mechanisms put in place through a comparative study between an industrialized country (Canada) and a developing one (Algeria). Interviews were conducted with six players in the innovation ecosystem in Canada and six in Algeria. Interviewees represent the worlds of research, industry and government. The results of this study allow researchers to distinguish between mechanisms that are sensitive to elements of context and those that do not. It will also contribute to

the design and adaptation of innovation models in developing countries and will serve as a tool to assist in the development of effective mechanisms for university-industry collaborations.

In order to meet the objective of this research, this article will present in the first section a literature review on innovation ecosystems and the place of the university within them. Then, in the second and third sections, the conceptual framework and research methodology will be presented. The discussion of the results obtained will be the subject of the fourth section. The last section will be devoted to the conclusion which will present a synthesis of the research work, the theoretical and practical implications as well as the limitations and future research work that can complement our work.

1. Literature review

Technology occupies a prominent place in innovation ecosystems, of which the university plays a decisive role in the production of new knowledge. Transforming an academic research result into an innovation requires efficient coordination between the actors involved in the value creation process leading to the implementation of these innovations, in other words an ecosystem conducive to technology transfer and innovation. The literature on this subject is structured around three axes: the challenges of technology within innovation ecosystems, the helix approach and the place of the university in innovation ecosystems (Table 1).

Table 1: Literature profile on the valorization of university research within emerging innovation ecosystems

Category	Subcategory	Author
Technology challenges within innovation ecosystems	Genesis and evolution of the concept	(Adner, 2006; Baiere, 2018; Gower, 2014; Yancity and Levian, 2004; Jacobides, Senamo, & Gower, 2018; Moore, 1993; Nambisan and Barron, 2013)
	Coordination within innovation ecosystems	(Adner, 2006; Adner and Kapoor, 2009; Clarysse, Wright, Bruneel and Mahajan, 2014; Dhanaraj and Parkhe, 2006; Geoffrey Parker, Van Alstyne Marshall and Choudary Sangeet Paul, 2016; Iansiti and Levien, 2004; Jacobides, Knudsen and Augier, 2006a; Williamson and De Meyer, 2012)
	Creating and perceiving value within innovation ecosystems	(Adner, 2016 ; Bilberg, Radziwon et Bogers, 2017 ; Clarysse et coll., 2014 ; Ritala, Agouridas, Assimakopoulos et Gies, 2013 ; Sherwani et Tee, 2018)
	Concept of technology	(Adner and Kapoor, 2015; Jacobides et al., 2018; Sherwani and Tee, 2018; Teece, 2007)
	The contribution of the propeller approach	(Carayannis et Campbell, 2009, 2010 ; Etzkowitz, 2003 ; Etzkowitz et Leydesdorff, 2000 ; Gibbons, 1994 ; Miller, McAdam, Moffett, Alexander et

The university's place in innovation ecosystems		Puthusserry, 2016 ; Porter, 2000 ; Schoonmaker et Carayannis, 2013 ; Vadrot, 2011)
	Factors and Performance Indicators of University-Industry Collaborations	(Albats, Fiegenbaum et Cunningham, 2018 ; Bruneel, D'Este et Salter, 2010a ; Galán-Muros, van der Sijde, Groenewegen et Baaken, 2017a ; Gander, 1986 ; Huang et Chen, 2017a ; Perkmann, Neely et Walsh, 2011 ; Plewa et coll., 2013a ; Thune et Gulbrandsen, 2014)
	Determinants of technology transfer	(Hsu, Shen, Yuan and Chou, 2015; Muscio and Nardone, 2012a; O'Shea, Allen, Chevalier and Roche, 2005; D. S. Siegel, Veugelers and Wright, 2007; D. Siegel, Waldman, Atwater and Link, 2004; D. Siegel, Waldman, & Link, 2003)

1.1.Technology challenges within innovation ecosystems

The following sections will present the genesis and evolution of the concept of ecosystems, the coordination between its actors, and the creation and perception of value within innovation ecosystems. The section closes with an analysis of the concept of technologies and innovation ecosystems.

1.1.1 Genesis and evolution of ecosystems

The concept of ecosystem has its roots in the ecological sciences. It was first used in the humanities by Moore (1993)which defines it as an economic community supported by a base of interacting organizations and individuals. The dimension of living things is closely linked to the concept of the ecosystem, which is distinguished by its developmental and evolutionary aspect. Its life cycle includes: birth, extension, leadership, and self-renewal or death. As in biology, each member of the ecosystem ultimately shares the same destiny on which its overall performance depends on the performance of all its elements (Iansiti and Levien, 2004). However, the concept does not reflect a simple form of organization based on a common interest around a given product or service. It includes all the actors that can affect, directly or indirectly, in the short or long term, a company's offer.

Researchers are increasingly interested in the concept of ecosystems and are trying to explain it further by developing typologies as well as forms that could be associated with each type of ecosystem. Baiyere (2018) highlights the founding work that has marked the evolution of this concept through business ecosystems (Iansiti and Levien, 2004; Moore, 1993)innovation ecosystems(Adner, 2006). Ecosystems are classified into three components: a "business ecosystem" component, focused on a company and its environment; an innovation ecosystem window focusing on an innovation or new value proposition and the actors brought together to support it, and then a platform ecosystem window, which looks at how actors organise themselves around a platform. An innovation ecosystem can take different forms: hub-based ecosystem, open source community, research and development consortium and crowdsourcing ecosystem (Nambisan and Baron, 2013). In the case of platforms, they

are classified into technological, supply chain and industrial platforms(Gawer, 2014). Despite a large and fruitful literature on the subject, the real distinction and boundaries between these different types of ecosystems remain blurred.

1.1.2 Coordination within innovation ecosystems

An ecosystem is the environment where a set of autonomous, but interdependent, actors collaborate in order to optimize the creation and perception of value. Its operation requires effective and permanent coordination. An ecosystem of innovations is self-organizing(Williamson and De Meyer, 2012). Nevertheless, the existence of a central actor that plays a decisive role in the stability of the system is often noted. This actor can be the "Hub firm" (Dhanaraja et Parkhe, 2006), the pivotal firm "Keystone" (Iansiti and Levien, 2004)or the so-called central actor(Clarysse et al., 2014)(Table 2). The role of the central actor is both strategic and operational. At the operational level, it must ensure coordination between upstream and downstream partners in the ecosystem(Adner et Kapoor, 2009). In terms of strategy, the central company must set up a common platform, set the goals, and hold itself accountable for the overall performance of the ecosystem(Iansiti and Levien, 2004). The strategy aims to increase the number of affiliated players in order to create centralization and gain certain powers to grow: bargaining power(Jacobides, Knudsen et Augier, 2006b), the value of the system through direct and indirect network externalities (Geoffrey Parker et al., 2016), and the likelihood of chance interactions between partners, which may generate new interactions and combinations which, in turn, will increase the overall value creation of the system. However, the position of leadership in an ecosystem often involves massive investments in resources over long periods of time (Adner, 2006).

Table 2: Leadership actors within ecosystems

Actors	Definition	Authors
Hub Firm	A system that possesses pre-eminence and power gained through individual attributes and a central position in the network structure, and that uses its prominence and power to play a leadership role by bringing together the dispersed resources and capabilities of the network members.	(Dhanaraja et Parkhe, 2006, 1350.2)
Pivot Firm (Keystone)	Keystones must make the health of its ecosystems a key business priority.	(Iansiti and Levien, 2004, p. 220)
Central player (Focal Firm)	The company that offers focal innovation and mobilizes ecosystem partners	(Clarysse et al., 2014, p. 2)

1.1.3 Creating and perceiving value within innovation ecosystems

The notion of value is at the centre of research on innovation ecosystems. The creation and perception of value are the main elements that justify the emergence and development of ecosystems through the alignment of the actors who interact so that a central value proposition materializes (Adner, 2016). Indeed, the interactions between the actors of a network within an ecosystem give rise to the creation of value (Sherwani et Tee, 2018). Value chains represent linear processes within knowledge

ecosystems and non-linear processes in the case of business ecosystems where value creation is carried out by groups of companies offering integrated solutions to end users (Clarysse et al., 2014). It is fundamental to distinguish between value creation that results from mutually beneficial collaborations between different partners thus generating overall value for their direct stakeholders (customers) and indirect stakeholders, as well as value perception which refers to discounted profit-taking at the enterprise and inter-company level(Bilberg et coll., 2017 ; Ritala et al., 2013).

The focal company uses tangible and intangible mechanisms to facilitate the creation and perception of value during the construction and management phases of the innovation ecosystem. The objective during the construction phase is to facilitate value creation and identify value capture. During the management phase, it is more about maintaining value creation and identifying opportunities to capture value(Ritala et al., 2013).

1.1.4 Concept of technology

Innovation ecosystems allow a wide range of actors, including partners and even competitors, to collaborate in order to create the conditions for successful innovations. The elements and configuration of an innovation ecosystem in which a new technology is developed determine its pace of substitution(Adner et Kapoor, 2016). The implementation of a technology often depends on other innovations upstream at the component level and downstream at the add-on level. Sometimes this dependence is deeper and spread over several levels. The stronger the dependence, the longer the pace of substitution. From this perspective, modularity within innovation ecosystems is one of the mechanisms that allows three possible configurations depending on the technological complementarities and dependencies of an innovation. For example, if an innovation is not dependent on any other upstream and downstream innovation, it means that it is part of a traditional relationship between suppliers and customers(Jacobides et al., 2018).

While innovation ecosystems facilitate the implementation of new technologies, this also poses risks for the dissemination and sharing of knowledge. Technological complementarities require a certain degree of collaboration and knowledge sharing, which means that companies need to acquire tools to protect their intangible assets(Sherwani et Tee, 2018). IP rights play a key role in this regard, not only through strategies for the protection of knowledge and knowledge, but also for the eventual commercialization of knowledge or through technologies and business models that are difficult to replicate(Teece, 2007).

1.2 The university's place in innovation ecosystems

The university is one of the main players in the construction of innovation ecosystems. Its role is to produce new knowledge and to ensure its transfer to the productive world in the first direction, to the companies that have to exploit it. The contribution of universities in terms of value creation is widely recognised. However, the overall performance of the ecosystem depends on the effectiveness of collaborations with companies. The objective of this section is to understand how to improve university-industry collaborations in order to succeed in technology transfer.

1.2.1 Knowledge production and exploitation: contribution of the Triple Helix approach

One of the impacts of globalization and the opening up of markets is the rise in competitive relations between companies. In such a landscape, knowledge and innovation are the main elements that provide competitive advantages to companies (Porter, 2000). Activities related to the process of producing, disseminating and exploiting knowledge are the focus of managers. However, the application of this knowledge, which is based on the quality of interactions between the various actors, remains the main challenge because of the existing convergences in terms of objectives, cultures, organizational processes and norms (Miller et al., 2016).

The prospect of creating an environment conducive to innovation has supported the evolution of linear models towards non-linear, collaborative and open models, thus promoting the rapprochement between research and industry and the transition from purely basic to applied research (Gibbons, 1994). Seeking to design models of knowledge production, the Triple Helix approach makes a significant contribution. A knowledge infrastructure is built by three parties in the institutional spheres: academia, industry and government (Etzkowitz, 2003 ; Etzkowitz et Leydesdorff, 2000).

In the Triple Helix model, stakeholders are both autonomous and interdependent. Indeed, the university is the source of new knowledge and technologies, the government represents the source of contractual relations that guarantees the stability of interactions and exchanges, and industry ensures processing and production operations (Vadrat, 2011). This approach has undergone several evolutions to include a fourth, then a fifth helix representing civil society and the environment respectively (Carayannis et Campbell, 2009, 2010).

The Triple Helix approach analyzes the phenomenon of innovation that results from a combination of knowledge, technology and culture between different parties cooperating within the same network (Schoonmaker and Carayannis, 2013). With this in mind, the approach provides a conceptual framework that defines the fundamental elements of a model for the production of knowledge and innovation. However, the methods and tools guiding the model development and the nature of the relationships that exist between the three stakeholders are the essential limitations of this approach. Thus, the question arises of the relevance of the triple helix and the performance of university-industry collaborations around the production of knowledge and the exploitation of new technologies.

1.2.2 Performance of University-Industry Collaborations: Factors and Indicators

Collaborative research is increasingly supported by public policies that encourage research-industry partnerships to stimulate economic growth (Gander, 1986). These mutually beneficial collaborations allow companies to exploit the university's reservoir of knowledge. For its part, the university aims to diversify its sources of funding and generate revenue from research products exploited by industry. The interest of these collaborations is obviously understood, however, their performance differs between the current that focuses on the obstacles related to collaborations as well as the mechanisms likely to mitigate them and the one that tries to establish performance indicators and the criteria for its evaluation. Divergence of vision and direction and organizational gaps (Perkmann et al., 2011) are often considered the first barriers to all university-industry collaborations.

The rapprochement between the academic world and the industrial world necessarily requires the establishment of mechanisms capable of moderating the obstacles that may arise throughout the process of collaboration between the two worlds. Diversification of programs and channels of collaboration, experience, trust (Plewa et coll., 2013b) and informal contact appear to be factors that help mitigate the effect of these barriers (Bruneel et coll., 2010a). The implementation of strategic

and operational mechanisms is likely to contribute significantly to the performance of collaborative activities between academia and industry (Galán-Muros et al., 2017a). The development of the programs that provide the funding opportunity appears to be one of the factors that increase the effect of certain mechanisms on the performance of collaborations (Huang et Chen, 2017a).

The performance of collaborations and its evaluation is a real challenge for many reasons, including: the intangible nature of the results of the project being collaborated; sustainability of project benefits, values and benchmarks (Perkmann et al., 2011). This distinction creates a divergence between authors who attempt to adopt several indicators. The final results of the collaboration (Bruneel et coll., 2010a)and the ability of universities to mobilize private funds (Thune et Gulbrandsen, 2014) reflect the performance of collaborations. Other authors emphasize the importance of adopting a dynamic collaboration lifecycle analysis with specific indicators for each stage(Perkmann et al., 2011) and to take into account factors related to the context of the projects studied (Albats et al., 2018).

1.2.3 Determinants of technology transfer

Technology transfer occupies a prominent place in university-industry collaborations. This can be done through processes ranging from scientific discovery to the formal or informal commercialization of the technology (D. S. Siegel et al., 2007). The performance of technology transfer is determined by the quality of the internal organization (Hsu et al., 2015). Other factors such as the size of the university and the composition of qualified human research, academic performance, interface structures and geographical position are responsible for the performance achieved by some institutions (Muscio et Nardone, 2012a). Siegel age l.(2003) indicate that a combination of internal, environmental and organizational factors affect the effectiveness of technology transfer.

The performance of technology transfer is evaluated on the basis of different indicators, classified into four categories: human, institutional-cultural, financial and commercial (O'Shea et al., 2005). However, these factors are interdependent. It is therefore difficult to determine precisely the influence of each factor on technology transfer. Nevertheless, it is noted that human capital is the most prominent category, including faculty, followed respectively by institutional-cultural resources, financial resources and, lastly, commercial resources(Hsu et al., 2015).

The performance of technology transfer is relatively based on the governance system put in place, its main compositions of which are identified as follows: academics who develop new technologies, managers of these new technologies, who ensure the liaison between academics and industry and the management of the intellectual property of university research products, and companies that have the vocation to commercialize these new technologies (D. Siegel et al., 2003). In addition, the governance system, motivation, incentive and organizational culture are factors that influence technology diffusion, which could explain some variations in performance levels between universities.

1.3.Conceptual framework

This study aims to answer the following question: how does the specific context of developing countries influence the effectiveness of university-industry collaboration mechanisms?

Algeria, like developing countries, in order to boost its economic growth, has introduced, through the development of policies to support innovation, measures and mechanisms aimed at promoting collaboration between research structures and industry. This institutionally supported networking is

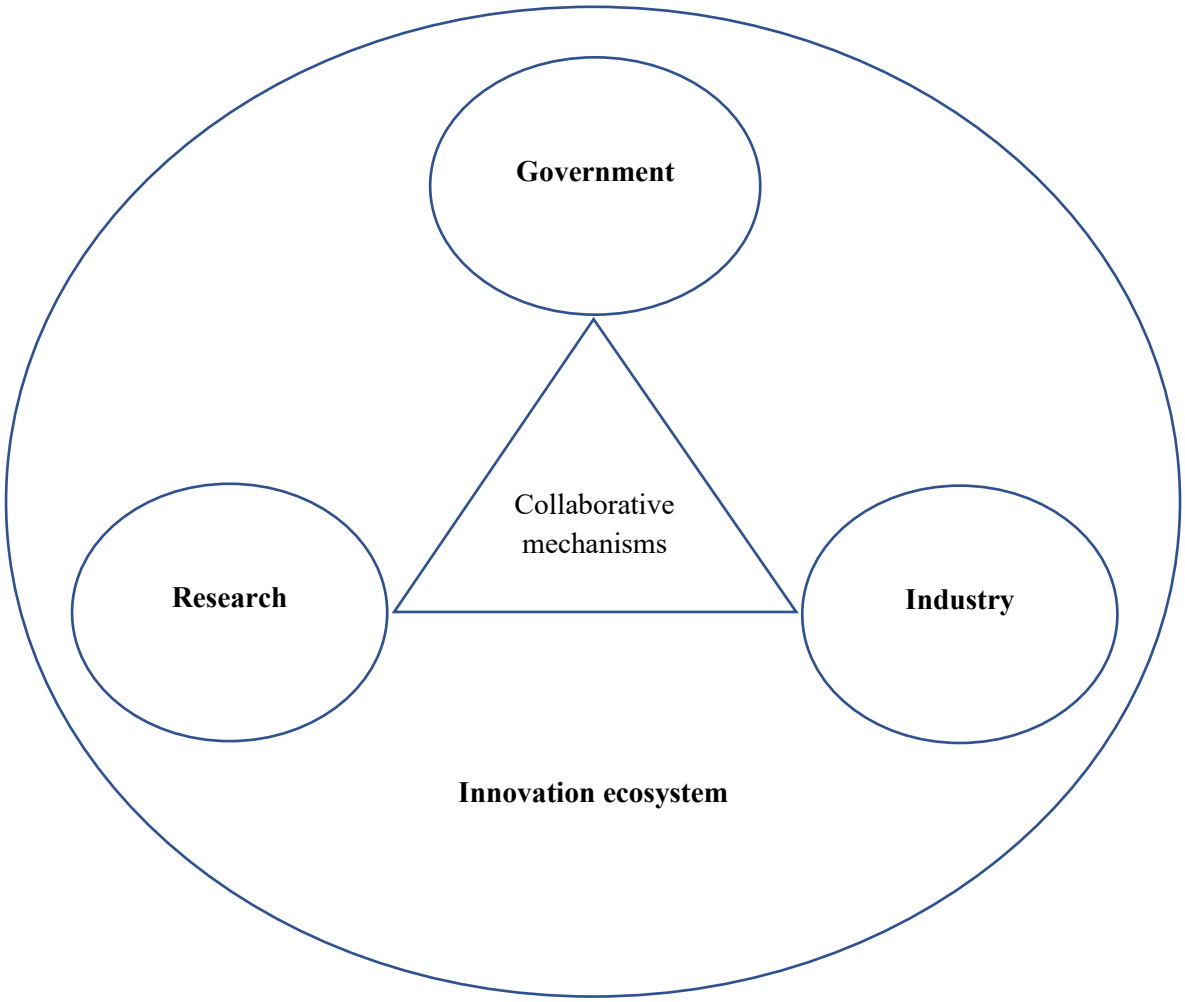
able to improve the transfer of knowledge and technologies to end-users. However, the success of the transfer depends on the university's internal resources (Hsu et al., 2015). Table 3 presents the factors of technology transfer by type of resource and by importance. In addition, the levels of collaboration between the three triple helix players are a fundamental element in terms of technology transfer (Carayannis et Campbell, 2010 ; Etzkowitz, 2003 ; Saad, Zawdie et Malairaja, 2008) Adding the ability of the ecosystem to create the necessary complementarities between the actors involved (Adner and Kapoor, 2009, 2015; Iansiti and Levien, 2004)in the creation and value proposition for the end consumer(Clarysse et al., 2014 ; Ritala et al., 2013). Figure 1 presents the framework for collaboration of actors within an innovation ecosystem. The mechanisms put in place play a decisive role in bringing together the three main spheres (research, industry and government).

Table 3: Ranking of technology transfer drivers by importance

Waist	**Factors**
Capital humain	Quality of the faculty Size of the Technology Transfer Office
Institutional / cultural resources	Incentive policy Experience with technology transfer offices Culture and tradition Interdisciplinary research
Financial Resources	Industry Funding Government Funding Intellectual property expenditure Commercialization of intellectual property
Business Resources	Patent portfolio Prototyping Social network Entrepreneurial capacity Invention Reporting Incubators

Spring: (Hsu et al., 2015)

Figure 1: Framework for collaboration of actors within an innovation ecosystem



In order to achieve the desired objectives in technology transfer activities, it is necessary to understand the links and implications of each factor in its environment and to focus on the most influential factors.

II– Methods and Materials:

Since the objective of this study is to compare research-industry collaboration mechanisms in industrialized and emerging countries in order to analyze the effect of contextual factors on the effectiveness of these mechanisms, we use the exploratory qualitative method.

Semi-structured interviews were conducted with individuals with a direct role in research-industry collaboration and technology transfer activities. These actors represent the three parts of the triple helix (Carayannis et Campbell, 2010 ; Etzkowitz, 2003 ; Etzkowitz et Leydesdorff, 2000). Indeed, individual interviews were conducted with twelve representatives of the three institutional spheres: university, industry and government, six in Canada and six in Algeria

In the Canadian case, the representatives of the academic sphere are: an advisor in research valorization and technology transfer from the Office of the Vice-Rector, Research, Creation and Innovation; an advisor from the development company; a researcher who has carried out research-industry collaboration projects. For the industry part: an interview was conducted with a representative of a company that has carried out research-industry collaboration projects. The government side is represented by an economic development advisor from the Government of Quebec; an economic development advisor with the Government of Canada.

In the Algerian case, the interviews carried out with the actors of the research part are: a vice-rector in charge of external relations; a researcher with a collaborative research project; a representative of a thematic research agency. For industry, a representative of a company with experience in collaborative research projects. The government side is represented by the first person in charge of scientific research and technological development and a director of studies in the industry sector.

Data collection in both countries was conducted using an interview guide structured into three categories of open-ended and straightforward questions with a voice recording. The interview began with the roles that the actors play in the collaboration. Then, it moved on to the coordination that takes place between the actors. The third category of issues related to collaborative mechanisms, which addressed how these mechanisms promote the coordination of interdependencies among ecosystem actors. A section on the experience of the actors was dedicated separately to the researcher and the company. The interview concluded with questions for all the actors on the learning achieved. The data collected was transcribed during the 24 hours following the interview session. The duration of each interview was approximately 90 minutes.

2. Overview of innovation in the countries studied

The issue of innovation is at the centre of public policy interest, both for industrialised and developing countries. In order to stimulate innovation at the national and regional levels, decision-makers develop incentive policies aimed at innovation actors. However, the technological challenges facing advanced and emerging economies are very different. While the former seek to optimize the innovation and commercialization processes of research, the latter are still groping around the issues of production, dissemination and exploitation of knowledge. In this section, an overview of the

innovation situation in an industrialized country (Canada) and another in a developing country (Algeria) is presented.

2.1.Overview of Innovation in Canada

Canada is a member of the Group of Seven (G7). It is the second largest in terms of gross domestic product (GDP) per capita after the United States. According to the ranking established by the Global Innovation Index (2018), the country is ranked 18th among the most innovative countries. These results are the result of major efforts by the public authorities to establish a knowledge-based economy. In this sense, the federal government plays a key role in promoting innovation and focuses its intervention on three main instruments: informational, legal and financial (Thrust & Litwin, 2011). The information policy aims to promote communication between and by the actors concerned on issues related to innovation and research policy in the country. R&D incentives were subject to a variety of programs. For example, the Industrial Research Assistance Program provides a variety of financial, technical and business services for the benefit of companies to help them gain a competitive advantage by undertaking Research and Development activities. With regard to innovation, taxation is one of the incentives used through the tax credit programme for scientific research and experimental development created in 1983. Financially, Canada spends 1.6% of its GDP on research and development activities, with businesses and university research contributing 51% and 41% of the total budget, respectively (Statistics Canada, 2017). For university research, external funding comes mainly from federal governments (23%), private non-profit organizations (10%), provincial governments and businesses (8%) for each (Statistics Canada, 2017). At the federal level, university research is funded through the three federal research councils specializing in the fields of health, natural sciences and social sciences and humanities. However, these initiatives do not sufficiently stimulate collaborations between research and academia(Woiceshyn et Eriksson, 2014). The other important funding instrument is the research chairs funded by the Canada Foundation for Innovation, which also provides support for the construction of infrastructure and the acquisition of research equipment.

When it comes to the protection of intellectual rights, each university has the latitude to define its own policy (Council of Canadian Academies, 2017). Overall, the latter seems to meet the expectations of companies (Kneller, Mongeon, Cope, Garner et Ternouth, 2014). For the period 2015-2016, the number of patents reached 3928, of which 2948 patents were held, 980 patents were pending, and 237 patents were gainfully employed (Statistics Canada, 2017). An amount of $31.8 million was revenue generated in 2015–2016 from the commercialization of intellectual property of departments and agencies in the federal public administration.

2.2.Overview of innovation in Algeria

With a view to strengthening its capacity for innovation and breaking with old practices, Algeria has introduced several reforms in this area. From the first years after its independence in 1962, Algeria moved towards a command economy in which the state totally controlled the means of production. Since the 1970s, the country has resorted to the massive importation of highly advanced technologies as part of the so-called "industrializing industry" policy. A policy that aims to achieve a certain independence in the scientific field, capable of reducing the technological gap that exists between developed and developing countries. At the beginning of the 1980s, a restructuring of the R&D function was undertaken by a few companies (Djeflat, 2012). During the 1980s and 1990s, several reforms were introduced. Nevertheless, the promulgation of Law 98-11 on scientific research and

technological development in 1998 was the real turning point in innovation policies in Algeria. Scientific research and technological development occupy a priority place, henceforth, it should accompany the overall development strategy outlined by the public authorities.

The main contributions of this law are the definition of an institutional and organizational framework for the conduct of research activities. The regulatory provisions also set the medium- and long-term objectives as well as the means to be mobilized to achieve them. In this sense, the Algerian national research plan is divided into two types of structures: 1) strategic bodies responsible for developing and guiding the implementation of the national scientific research policy, whose main actors are: The National Council for Scientific and Technical Research (CNRST), The National Council for the Evaluation of Scientific Research and Technological Development (CNE), The governing body, represented, since 2008, by the General Directorate for Scientific Research and Technological Development (DGRSDT), the Intersectoral Commissions (CIS), the Permanent Sectoral Committees (CSP), the thematic research agencies and the National Agency for the Valorisation of the Results of Research and Technological Development (ANVREDET). At the 2nd level are the operational structures for the execution and promotion of scientific research represented by : Public Scientific and Technological Establishments (EPST) and university research laboratories. At the level of the EPST, research activities are carried out by permanent researchers working full-time, while teacher-researchers work part-time at the level of university laboratories.

Algeria has real assets that can facilitate the construction of an effective innovation ecosystem, including a structured institutional system, a scientific and technical diaspora and a fairly strong human potential(Amdaoud, 2016). Nevertheless, the major challenge in this perspective lies in the prevalence of institutional and organizational fragmentation that prevents interactions between the different actors(Saad, 2004).

III-Results and Discussion :

3. Framework for collaborations and functioning of the ecosystem

In the Canadian case, there are no major obstacles to the operation of the system. The Government of Canada's Economic Development Advisor states that "The system is flexible, it is scalable and works well. He follows the evolution of the players." Coordination and communication between the actors guarantees the functioning of the system: "Coordination is done by people and the dynamics of the network where everyone recognizes what the other can do. Before collaboration, there is communication, without it nothing is possible. Here in the Quebec City region, there are no communication barriers," the economic development advisor for the Quebec government.

In the Algerian case, the national innovation system has undergone a significant evolution. However, it is still "in the construction phase", says the Algerian government's director of studies. A system characterized by the existence of barriers between the three propellers and the lack of continuity in the innovation value chain.

3.1.R-I Collaboration: Key Mechanisms

The case of Canada

In Canada, there are many mechanisms for collaboration. The most important is the collaborative research innovation program:

"One of the department's mandates is to strengthen collaborations between research and industry... through collaborative research programs that serve to encourage collaborations and technology transfer to industry," the Government of Canada's Economic Development Advisor.

The advantage of this mechanism lies in its ability to bring researchers and industry closer together and make direct contact:

"Now, researchers work through industrial chairs through programs that require partnerships between the university and industry," adds the V.R.T.T. advisor.

Applied research is consolidated by the development of programs on issues related to socio-economic challenges:

"More and more, the development of knowledge is done in an applied context but depending on the program," V.R.T.T. advisor

Another mechanism that increases collaborations is the availability of funds to finance innovation projects:

"The ministry supports both the intermediation organizations that allow the setting up of such projects and encourages the creation of companies. The department also funds collaborative research projects in several combinations," the Government of Canada's Economic Development Advisor.

Public aid in this area affects a wide range of actors and generates a multitude of services adapted to the needs of different project situations:

"We help non-profit organizations carry out innovation projects and financial assistance to SMEs for development projects and even for creation and start-up," the Government of Canada's Economic Development Advisor

Government funding sends a positive signal to investors:

"The ministry gives a certain credibility to these projects, once they arrive, the others will follow," the Quebec government's economic development advisor.

This financing is essential for innovative projects, characterised by a high risk that few taker organisations have:

"It's the project shows significant interest, there are certainly a lot of takers while the ministry is landing where no one wants to take," the economic development advisor for the Quebec government.

In addition to the risk, innovative projects require more aid in the start-up phase:

"It is our role to take risks, which are very high at the beginning and that banks or other organizations cannot bear," the Government of Canada's economic development advisor.

Within the ecosystem, collaborations are strengthened through the mechanism of intermediate structures or interface structures. Their role is to provide information services: "They help us find funding because there are many government programs so it's not easy to be aware of everything," the researcher.

They ensure that a framework favourable to collaboration is put in place:

"We intervene for contractual support and to ensure that the partner feels comfortable in his relationship with the research team," the research valorization and technology transfer advisor.

Intermediation structures also play the role of support:

"We try to take the results and put them in companies through a process of scientific and technological maturation but also through a whole process of commercial support," the advisor to the development company.

Intermediary structures also help to translate socio-economic issues into academic language, like industrial groupings.

Mastery of procedures for the protection of intellectual property rights is a significant mechanism in the process of technology transfer and innovation. This instrument provides credibility in terms of the originality of the invention and its applicability:

"For the granting agencies, when there is a patent, it gives more guarantees on the quality of the work and more originality beyond simple publication," economic development advisor to the Government of Canada.

Intellectual property management requires additional efforts:

"The researcher is a connoisseur, in his field yes, but when it comes to intellectual property issues, not all researchers know them," the researcher.

The costs generated by intellectual property protection are also exorbitant, which has led research institutions to apply restrictions on the budgets allocated in this area:

"Intellectual property is complicated, expensive and time-consuming," the researcher.

A study on the appropriateness is strongly recommended which depends on:

"Barriers to entry, and duration. The more barriers there are and the longer the duration, the more interesting the patent is," the advisor to the technology transfer company.

The scientific field of the invention is also a determinant:

"In the fields of life sciences there has been interest, but in the technological field, not," concludes the advisor to the valuation company.

The case of Algeria

The Department of Scientific Research is the main sector that launches research and innovation programs due to the different human, technological and financial resources at its disposal. With a special fund dedicated to the financing of research activities, the Ministry, through the General Directorate for Scientific Research and Technological Development (DGRSDT), launched two main national research programs between 2008 and 2014. These programmes aim to develop applied research according to socio-economic needs. Socio-economic operators are considered as partners in the development and implementation of these projects. In reality:

"They were not even aware of what is being conceived," the vice-rector in charge of external relations.

Communication between the company's researchers and engineers is one of the key barriers to the implementation of these programs. Also adding: "Low capacity and lack of skills at the level of companies", researcher; and lack of trust "Companies often ask us about the reliability of our results," said the vice-rector in charge of external relations.

The promotion of innovation and entrepreneurship in academic circles has led to the establishment of several support mechanisms for innovation and entrepreneurship outside the scientific research sector, such as entrepreneurship houses and technology and innovation support centers (CATI) set up respectively by the Ministries of Labour and Industry. This testifies to the degree of maturation of the entrepreneurial spirit among scientists and the openness of the university to institutional collaborations. The national strategy in this area is to be drawn up by the National Agency for the Exploitation of Research and Technological Development Results (ANVREDET). However:

"The operational structures that support innovation projects such as incubators are not yet functional," the director general of the scientific research sector.

The effort of the intermediation structures is relatively low:

"They exist, but they work on a voluntary basis and it can't last long," says the vice-rector in charge of external relations.

The special fund for scientific research and technological development makes it possible to cover a wide range of expenses related to the acquisition of equipment and the carrying out of research activities. This fund must meet the needs of managers:

"The fund is very rigid. It is subject to the public procurement code and it greatly hinders the progress of our activities," the researcher.

In order to strengthen innovation projects:

"It is planned to create a national innovation fund," the director of studies for the industry sector.

The availability of financial resources is fundamental, but:

"Financing is not the first element to consider," the director of studies in the industrial sector.

Other elements are more important: "The research programme, the framework for collaboration between the scientific institution and the company and the administrative procedures are the first factors that need to be improved", the company representative.

In an approach to innovation and technology transfer, the system for the protection of intellectual property rights plays an essential role. Mastering this component promotes a better flow of collaborations during and after the completion of projects. And yet, this field is not of sufficient interest to researchers for several reasons:

"The legislation does not allow the researcher to create a company based on his invention", director general of the scientific research sector.

Another obstacle lies in the difficulty of finding a patent holder:

"Companies prefer to buy technology that is already ready," director general of the scientific research sector.

The system of evaluating researchers, which is mainly based on scientific publications, weighs against inventors who file patents:

"Researchers are reluctant on intellectual property issues because of the advantages granted to publications and not to patents," vice-rector in charge of external relations.

From the point of view of companies, the patent is not of major importance:

"It's good to have a patent for an invention, but above all we are looking for a high-performance technology," the company's representative.

3.2.Collaborative mechanisms: effectiveness and determinants

In light of these results, we analyze the factors that determine the effectiveness of the mechanisms described above. We begin this part with the section on mechanisms to conclude with the overall framework of the development of these collaborations.

For innovation programmes based on collaborative research, this mechanism must set out the expected guidelines and objectives. It is important to cover all areas and to plan for corrective measures in the event of unforeseen situations emerging. The effectiveness of this mechanism is also based on the involvement of the various actors in the development of its programmes, in particular the industry and research parties. The role of intermediary structures in the dissemination of structured information is fundamental. Effectiveness also depends on the flexibility of management procedures and the latitude of the actors in charge of their implementation to make adjustments in order to optimize the objectives. On this point, the interviewees believe that in Canada, procedures are not really rigid and that within the framework, operational staff have the latitude to take the necessary measures to optimize their intervention. In the Algerian case, we have seen a strong rigidity of laws and procedures, which hinders the functioning of programs and the intervention of actors.

The financing of innovation projects is fundamental. This allows researchers and manufacturers to come together. However, it has been noted that, increasingly, budgets for funding basic research are being revised downwards. This can negatively impact the motivation of researchers who believe that:

"Basic research is like oxygen," Canadian researcher.

It is quite obvious that at the heart of the ecosystem is a main player who is the inventor:

"The researcher is at the heart of our business," says the representative of the technology transfer company.

Therefore, government funding must respect this balance between applied and basic research. The latter is above all a generator of new knowledge that necessarily feeds applied research. It is also necessary to consider the issue related to the international mobility of skills, hence the interest of the Sánchez Sánchez. Certainly, the stakes are higher for developing countries such as Algeria, but not neglecting it in the context of industrialized countries such as Canada. Within the ecosystem, all players participate in the creation of value, hence the importance of having a financing system that serves all stakeholders and during all stages of the project. What is noted in the Canadian case is the multitude of sources of funding dedicated to innovation, including that of industrialists, while in the Algerian case, innovation benefits from a single fund that is limited to research activities.

Intermediate structures are the element that creates bridges between researchers and industrialists. To fully ensure their role in the ecosystem, they must equip themselves with the necessary skills and resources to better master both the technological and commercial aspects of innovation. Another factor that determines the effectiveness of these structures is their ability to mobilize the right skills and resources at each level of innovation development. However, the fulfilment of their mission depends closely on the entrepreneurial spirit of researchers, the intellectual property system and technology transfer. In addition, intermediary structures aim to reduce the distance between those who create knowledge and those who have to exploit it. In both cases, the boundaries between the two still exist and the intermediaries specialize in only one part of the process.

At the level of the intellectual property rights mechanism, it is essential to engage in a reflection on several elements. Procedurally and managerially, all researchers and students must have basic knowledge of intellectual property rights management. Financially, the costs of protection are enormous. It is therefore important to adopt a strategy that focuses on the impact of the invention to be patented. In terms of the dissemination and exploitation of inventions, a fair model guaranteeing researchers their rights and industrialists their freedom must be conceived. This issue becomes more complex in open innovation models.

IV- In conclusion:

The objective of this research is to understand the influence of context-related factors on the effectiveness of research-industry collaboration mechanisms. This meant analysing the framework and environment in which these collaborations took place by conducting a comparative study between an industrialised country (Canada) and another developing country (Algeria). With this in mind, two approaches have been mobilised. Innovation ecosystems, largely in response to the Canadian context, and the triple helix compatible with the Algerian context and which helps to bring together innovation actors in three spheres: research, industry and government.

In the context of innovation ecosystems, the company is at the heart of the system. It is considered the main player on which collaborations are based and which plays the most important role in value creation. In the context of the triple helix, the actors are classified into three equal categories in terms of importance. Thus, this research took into account the belonging of the actors without considering the boundaries that separate the different actors, admitting that all actions and reactions are carried out within an innovation ecosystem.

The study led to the identification of four collaborative mechanisms in the two cases studied. These are innovation programmes focusing on collaborative research, funds to finance innovation projects, intermediary structures and intellectual property rights. For each mechanism, there are interrelated factors that determine its effectiveness. In the Canadian case, there are no major obstacles to collaboration between the actors, which testifies to the effectiveness of the mechanisms put in place. However, it is essential to improve managerial practices within research institutions and to promote the entrepreneurial spirit in the scientific community. In addition, an additional effort is recommended to increase the effectiveness of the IP mechanism.

Concerning the Algerian case, the major obstacle in this context lies in the development of sectoral public policies which, often, create boundaries between sectors. This creates situations that are unfavourable to the functioning of the ecosystem, which reduces the effectiveness of the mechanisms put in place. Inspired by the Canadian case, developing countries such as Algeria must draw up a global innovation policy that defines the framework for collaboration between the various actors and takes into account the factors determining the effectiveness of the mechanisms.

Like any other work, this research faces limitations. Starting with the size of the sample and its composition. Another limitation is related to the mechanisms identified according to the cases studied. With a view to addressing these limitations, it is proposed to conduct broader research on other countries and other innovation actors.

Thanks

We thank all those who contributed to the realization of this research. In particular, all the staff of Université Laval as well as all those who agreed to participate in the interviews conducted in Canada and Algeria.

References:

Adner, R. (2006). Tailor your innovation strategy to your innovation ecosystem. *Harvard Business Review*, *84*(4), 98‑107.

Adner, R., & Kapoor, R. (2016). Innovation ecosystems and the pace of substitution: re-examination of technological S-curves: re-examination of technological S-curves. *Strategic Management Journal*, *37*(4), 625-648. https://doi.org/10.1002/smj.2363

Bruneel, J., D'Este, P., & Salter, A. (2010a). Investigate factors that reduce barriers to collaboration between academia and industry. *Research Policy*, *39*(7), 858-868. https://doi.org/10.1016/j.respol.2010.03.006

Bruneel, J., D'Este, P., & Salter, A. (2010b). Investigate factors that reduce barriers to collaboration between academia and industry. *Research Policy*, *39*(7), 858-868. https://doi.org/10.1016/j.respol.2010.03.006

Carayannis, E. G., & Campbell, D. F. J. (2009). "Mode 3" and "Quadruple Helix": towards a fractal innovation ecosystem of the 21st century. *International Journal of Technology Management*, *46*(3/4), 201-234. https://doi.org/10.1504/IJTM.2009.023374

Carayannis, E. G., & Campbell, D. F. J. (2010). Triple helix, quadruple helix and quintuple helix and how are knowledge, innovation and the environment related to each other? : a proposed framework for a transdisciplinary analysis of sustainable development and social ecology. *International Journal of Social Ecology and Sustainable Development*, *1*(1), 41‑69. https://doi.org/10.4018/jsesd.2010010105

Dhanaraj, C., & Parkhe, A. (2006). Orchestrating innovation networks. *Journal of the Academy of Management*, *31*(3), 659-669. https://doi.org/10.5465/amr.2006.21318923

Djeflat, A. (2012). Algeria, from technology transfer to the knowledge and innovation economy: trajectory and perspectives. The CREAD Notebooks n°100.

Etzkowitz, H., and Leydesdorff, L. (2000). The Dynamics of Innovation: From National Systems and "Mode 2" to a Triple Helix of University-Industry-Government Relations. *Research policy*,

Gander, J. P. (1986). The economics of the links between university research and industry. *Technology Foresight and Social Change*, *29*(1), 33-49. https://doi.org/https://doi.org/10.1016/0040-1625(86)90004-1

Gawer, A. (2014). Bridging the different perspectives on technology platforms: towards an integrative framework. *Research Policy*, *43*(7), 1239-1249. https://doi.org/10.1016/j.respol.2014.03.006

Huang, M.-H., and Chen, D.-Z. (2017a). How to improve the performance of academic innovation in university-industry collaboration? *Technological Forecasts and Social Change*, *123*, 210-215. https://doi.org/10.1016/j.techfore.2016.03.024

Iansiti, M., & Levien, R. (2004). Strategy as ecology. *Harvard Business Review*, *82*(3), 68-78.

Jacobides, M. G., Cennamo, C., & Gawer, A. (2018). Towards a theory of ecosystems. *Strategic Management Review*, *39*(8), 2255-2276. https://doi.org/10.1002/smj.2904

Jacobides, M. G., Knudsen, T. and Augier, M. (2006a). Benefiting from innovation: value creation, value appropriation and the role of industrial architectures. *Research Policy*, *35*(8), 1200-1221. https://doi.org/10.1016/j.respol.2006.09.005

Moore, J. F. (1993). Predators and prey: a new ecology of competition. *Harvard Business Review*, *71*(3), 75-86.

Muscio, A. and Nardone, G. (2012a). The determinants of university-industry collaboration in food sciences in Italy. *Food Policy*, *37*(6), 710-718. https://doi.org/10.1016/j.foodpol.2012.07.003

O'Shea, R. P., Allen, T. J., Chevalier, A., & Roche, F. (2005). Entrepreneurial orientation, technology transfer and performance of companies derived from American universities. *Research Policy*, *34*(7), 994-1009. https://doi.org/10.1016/j.respol.2005.05.011

Perkmann, M., Neely, A., & Walsh, K. (2011). How should companies evaluate the success of university-industry alliances? A performance measurement system: How should companies measure the success of university-industry alliances? *R&D Management*, *41*(2), 202-216. https://doi.org/10.1111/j.1467-9310.2011.00637.x

Plewa, C., Korff, N., Johnson, C., Macpherson, G., Baaken, T., & Rampersad, G. C. (2013a). The Evolution of Links between Universities and Industry – A Framework. *Journal of Technology Engineering and Management*, *30*(1), 21-44. https://doi.org/10.1016/j.jengtecman.2012.11.005

Plewa, C., Korff, N., Johnson, C., Macpherson, G., Baaken, T., & Rampersad, G. C. (2013b). The Evolution of Links between Universities and Industry – A Framework. *Journal of Technology Engineering and Management*, *30*(1), 21-44. https://doi.org/10.1016/j.jengtecman.2012.11.005

Porter, M. E. (2000). Location, Competition, and Economic Development: Local Clusters in a Global Economy. *Economic Development Quarterly*, *14*(1), 15-34. https://doi.org/10.1177/089124240001400105

Razak, A. A. and Saad, M. (2007). The Role of Universities in the Evolution of the Triple Helix Innovation Culture Network: The Case of Malaysia. *International Journal of Management of Technology and Sustainable Development*, *6*(3), 211-225.

Saad, M. (2004). Issues and challenges arising from the application of innovation strategies based on the triple helix culture. *International Journal of Management of Technology and Sustainable Development*, *3*(1), 17-34. https://doi.org/10.1386/ijtm.3.1.17/0

Saad, M., Zawdie, G., & Malairaja, C. (2008). The Triple Helix Strategy for Universities in Developing Countries: The Experiences of Malaysia and Algeria. *Science and Public Policy*, *35*(6), 431-443. https://doi.org/10.3152/030234208X323316

Siegel, D. S., Veugelers, R., & Wright, M. (2007). Technology Transfer Offices and Commercialization of Academic IP: Results and Policy Implications. *Oxford Review of Economic Policy*, *23*(4), 640-660. https://doi.org/10.1093/oxrep/grm036

Siegel, D., Waldman, D., & Link, A. (2003). Assessing the Impact of Organizational Practices on the Relative Productivity of University Technology Transfer Offices: An Exploratory Study. *Research Policy*, *32*(1), 27-48. https://doi.org/10.1016/S0048-7333(01)00196-2

Teece, D. J. (2007). Explain dynamic capabilities: the nature and micro-foundations of a company's (sustainable) performance. *Strategic Management Review*, *28*(13), 1319-1350. https://doi.org/10.1002/smj.640

Thune, T., & Gulbrandsen, M. (2014). Dynamics of collaboration in university-industry partnerships: do the initial conditions explain the development models? *The Journal of Technology Transfer*, *39*(6), 977-993. https://doi.org/10.1007/s10961-014-9331-5

Vadrot, A. B. M. (2011). Reflections on Mode 3, the Co-Evolution of Knowledge and Innovation Systems and its Link to Sustainable Development: A Conceptual Framework of "Epistemic Governance". *International Journal of Social Ecology and Sustainable Development*, *2*(1), 44-52. https://doi.org/10.4018/jsesd.2011010104

Williamson, P. J., & De Meyer, A. (2012). Ecosystem Advantage: How to successfully harness the power of partners. *California Management Review*, *55*(1), 24-46. https://doi.org/10.1525/cmr.2012.55.1.24

How to cite this article by the APA method:

Rabah FRAGUA and Sophie Veilleux, (2025). Modelling the process of valorization of university research within emerging innovation ecosystems: a comparative study between Algeria and Canada, Roa Iktissadia Review, Algeria: University of El-Oued.15 (01), 147-168.