

Scientific research as a vector of the entrepreneurial university: The prospect of open innovation within start-ups

BERBAR Mouloud¹

¹ Mouloud MAMMERI University of Tizi-Ouzou, mouloud.berbar@ummtto.dz

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Abstract:

The valorization of scientific research is assimilated to the principles of activating a resource, however, it requires the establishment of appropriate mechanisms.

The valorization of scientific results from research consists of including them in a dynamic of enrichment, favorable to the creation of economic and social added value; entrepreneurship consists of a determining factor of this finality.

Creating start-up based on the results of scientific research requires an integrated approach, focused essentially on innovation, and this in all its dimensions, thus we speak of start-ups or even university spin-offs.

Keywords: Valorization of research, entrepreneurship, entrepreneurial university, open innovation, start-up.

Jel Classification Codes: : L26, O36, M13

Corresponding author: BERBAR Mouloud, e-mail: mouloud.berbar@ummtto.dz

1. INTRODUCTION

The university, as an institution for the production of knowledge and understanding, intervenes via two main channels, namely, pedagogy and scientific research; In the era of globalization of trade, and of economies in general, economic growth remains a strategic objective, and requires diversification in the economic fabric, in this wake, entrepreneurship remains the pivot of the economies of the 21st Century.

The university plays a role in the value chain of promoting entrepreneurship, and this by having a double stake. Indeed, it contributes to training students in the different mechanisms of entrepreneurship, by promoting the operational aspect of business creation, and this, by offering training dedicated to this, and this, on the different levels of higher education (Bachelor's, Master's, Doctorate).

The university's contribution to promoting entrepreneurial dynamics is also carried out through scientific research, carried out in laboratories and research centers; however, this requires an economic and entrepreneurial valorization of the results of scientific research.

The valorization of research takes place in several forms; economic, technological, social, etc., the latter can be assimilated to a melting pot more or less oriented towards entrepreneurship, in this sense, the result of the research, as a resource, will be the subject of entrepreneurial activation, and will be valorized within the framework of a company or a Start-up.

It should be emphasized that the valorization of research is based on four structuring elements, namely, regulation, university strategy, technical progress, the economic

environment and the entrepreneurial spirit, this is, according to this author, the organic square of the valorization of research (Laperche, 2002).

In Algeria, this reality is becoming more and more concrete, following the various efforts made in this area by the Ministry of Higher Education and Scientific Research, as well as the Ministry of Start-ups.

Through our contribution, we will answer the following question: *what is the role of scientific research in promoting the entrepreneurial university favorable to the launch of start-ups in Algeria?* We will try to identify a model of entrepreneurial promotion based on the valorization of research, favorable to open innovation in the ecosystem of start-ups in Algeria.

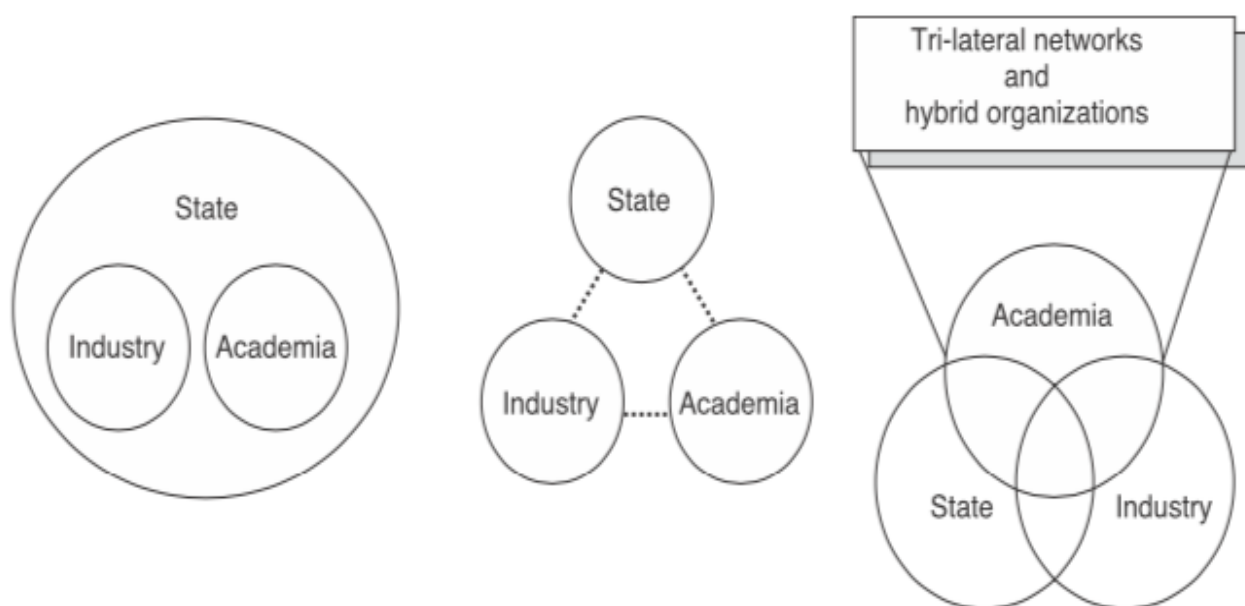
In this contribution, we will revisit the notion of the entrepreneurial university based on the triple helix model, then we will relativize the concept of scientific research to that of the knowledge economy while examining the role in the diffusion of innovations, then we will highlight the mechanisms for valorizing scientific research and their role in promoting new ideas, favorable to the launch of start-ups, finally, we will base our analysis on open innovation, as a key factor in the entrepreneurial valorization of research and the success of start-ups.

2. The entrepreneurial university: a reading based on the triple helix model

The entrepreneurial university refers to the new mission assigned to the company, and relates to its influence on the economic and social sphere. This notion is introduced by Etzkowitz in 1993, by developing the triple helix model (Etzkowitz, 1993). It is a question of taking into consideration endogenous and exogenous factors, which influence the entrepreneurial orientation of the university.

This model corresponds to an objective representation of the university's influence on the economic environment, that is to say a characterization of the productive combination of the actors of the third mission of the university.

Fig.1. The Triple Helix Model (University-Industry-Government)



Source : (Etzkowitz, 2003, p. 302)

Innovation is determined by this model, the latter, composed of the university, industry and government, allows the university to embrace an entrepreneurial logic, which will be a catalyst for producing applied knowledge, connected with the market, based on a model of open, interactive and responsible innovation for the production of technological development, for its part, the company seeks to rub shoulders with the university environment, on the other hand the government would try to intervene through regulatory missions, the hybridization of the institutions of this model, would be summarized by an endogenous process of innovation, the three segments of the model in question evolve in four stages (Etzkowitz, 2003, p. 301):

- The first step, during which each of the propellers is subjected to isolated transformations, internal to each institution; while being in a logic of common interest, in this sense, the university intervenes through these three missions (pedagogy, research and valorization of research), the government grants research subsidies to arrive at an entrepreneurial university.
- The second step: the interactions between the propellers are materialized by formal actions of technological transfer from the university to the industry, the government for its part, formalizes these initiatives by patents, labels, brands, etc. and encouragements for the universities so that they can innovate.
- The third step: The previous transformations would give rise to the launch of a new superposition of networks and organizations in favor of innovation.
- The fourth step: this period is characterized by the culmination of the model as a whole on society.

So it's about innovating within each segment of the triple helix, to achieve innovation.

3. Scientific research: prerequisites for the knowledge economy

To insert scientific research into the economy and for development purposes, the knowledge economy seems to us to be the discipline that allows us this link . Indeed, there is an active relationship between the knowledge economy and economic performance, and African countries have called for consolidating the components of the knowledge economy (Amavilah & Rodríguez Andrés, 2024), which materializes in an important role in the diffusion of technology and in economic growth; this reasoning has given rise to a knowledge-based economy.

The knowledge economy is concerned with the production of knowledge and information, as well as the use associated with it (OCDE, 1996); knowledge is therefore associated with a resource, which scientific research directs towards the aims of innovation.

The knowledge economy, assimilated to the knowledge and post-industrial economy (Henri & Plante, 2019b), it characterizes the intensive use of knowledge in production and service activities (Foray, 2000), it focuses on its reproduction and its diffusion.

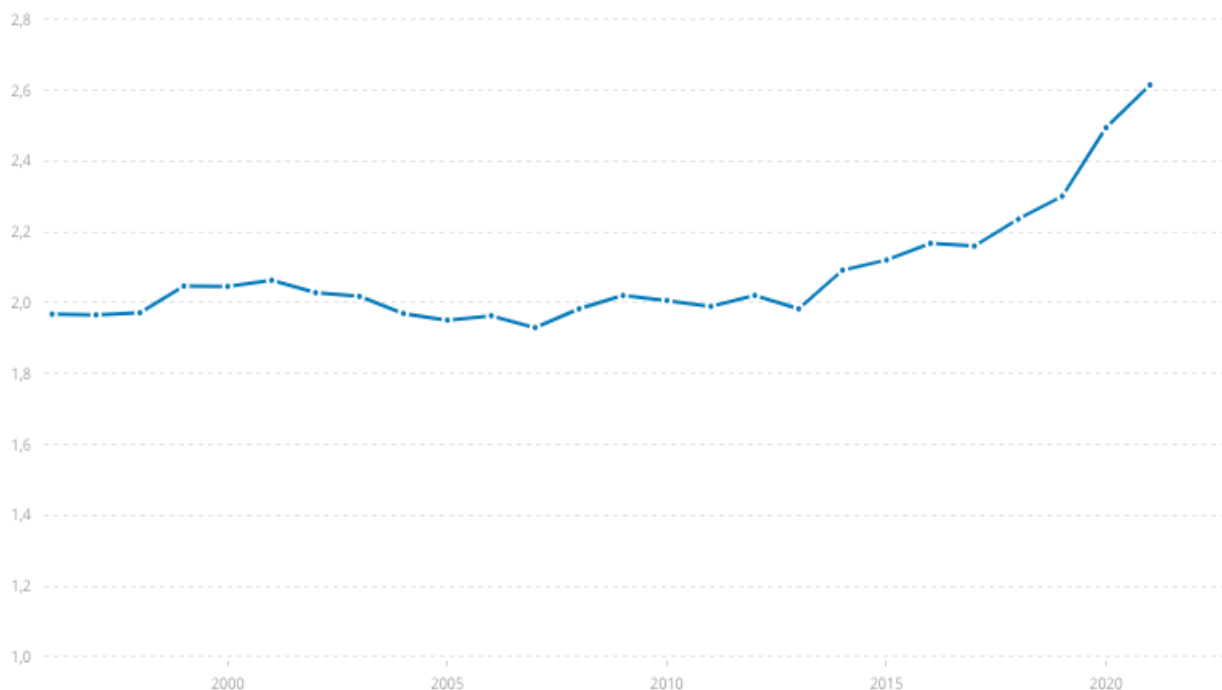
Knowledge can therefore change form, on the one hand, and create new knowledge, on the other. It plays an important role insofar as it gives its holder the ability to select information ;

this can be explained by the dynamic evolution of the main variables of the knowledge economy.

The knowledge economy is based on a triptych composed of economy, geography and knowledge, the interactive link between these variables is ensured by public policies, which establish infrastructures dedicated to the production and dissemination of knowledge, which will be responsible for an innovative technological transfer to the economic sphere, which for its part, nourishes knowledge, by valuing it (Leydesdorff & Meyer, 2003), it should be emphasized that scientific research fuels innovation, which in turn catalyzes the knowledge economy (Leon-Roa, et al., 2024).

The economic cost incurred in the production and dissemination of knowledge is a major factor in the evaluation of the approach in terms of cost/benefit; the graph below illustrates the expenditure incurred by countries in terms of research and development.

Fig.2. Research and development expenditure as a percentage of GDP worldwide (1996-2021).



Source :

(https://donnees.banquemondiale.org/indicateur/GB.XPD.RSDV.GD.ZS?end=2022&momo_recent_year_desc=false&start=1996&view=chart, consulté le 03/10/2024, à 15h.)

The chart shows a continued increase in spending on research and development, reaching 2.61% of GDP in 2021, globally.

4. The mediating role of university scientific research in the dissemination of innovations

The realization of the entrepreneurial university cannot be carried out independently of the innovation effort that the university is supposed to carry out, in an interactive and open logic,

this is dependent on the valorization of innovative ideas, carried by researchers. The entrepreneurial commitment of universities is dependent on its academic commitment to innovation, the results of which are subject to valorization (Feola, Parente, & Cucino, 2021). The university plays a mediating role between research and the economic environment, in this sense, it must simultaneously combine research with another mission, namely, the development of the corresponding results (Chang, Yang, & Chen, 2009).

University scientific research is considered to be public research and the realities differ from one country to another. In Algeria it is considered to be a non-commercial public service because the financing is not ensured by a market price which must cover at least the production cost.

The financing of the activity comes rather from compulsory contributions (taxes, social contributions, various taxes, etc.), or from voluntary contributions, in particular donations in cash or in kind; four pillars of knowledge are highlighted (Chen & Dahlman, 2005, p. 4):

- Public action: supported by economic support and resources in favor of the creation and dissemination of knowledge.
- Human capital, trained, flexible and capable of adapting its skills in order to enhance knowledge.
- An innovation system, bringing together companies and knowledge players, namely universities and research.
- An infrastructure adapted to the processing and dissemination of information.

Knowledge is produced and disseminated in public institutions (schools, universities, training centers, research centers, laboratories, public companies, etc.) and it is financed by public funds, as is the case in Algeria;

5. Mechanisms for promoting scientific research: what role in promoting start-ups?

Before developing the consistency of the mechanisms for valorizing scientific research, it is appropriate to make a theoretical return to the notion of start-up.

The start - up corresponds as an entrepreneurial experience and a very small beginning business that provides a space for self-realization, an opportunity to develop and implement unusual and risky ideas in order to bring a new way of satisfying already existing needs or further still to create new needs among individuals to be satisfied (Slávik, 2019).

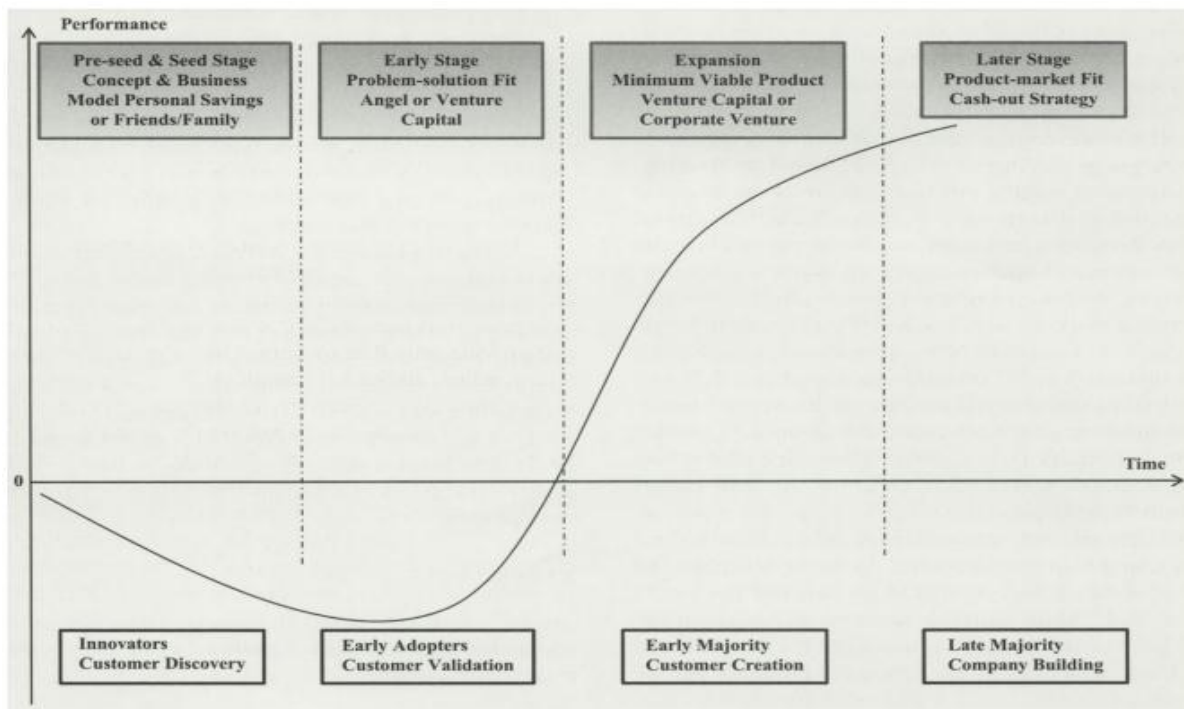
The strategy of concentration through differentiation remains the one that reigns within a start-up, which can be explained by the fact that it must target the market shares that are not very satisfied or those that are not satisfied at all given the innovative character that they enjoy. They adopt a speed management because speed in decision-making is considered a key factor of success and therefore a prerequisite for being able to exist on the market (Gaujard, 2008).

Start-ups are characterized by a highly centralized organic organization where decisions are made only by the managers. They tend to favor specialized or niche marketing that allows them to offer a highly differentiated product to the consumer. As for innovation, it is strongly encouraged because it constitutes the pivot or essential element of their

sustainability. Their financing is mainly based on the personal contributions of their initiators (Nurcahyo & al, 2018).

The contribution of research in the development of a start-up occurs in each phase of the life cycle of a start-up, as presented in the figure below.

Fig 01: S- Cuve Model of entrepreneurship, start-up funding, and Customer Development



Source: (Overall & Wise, 2015, p. 31).

The theory The "S" curve explains the life cycle of a start-up, weighted to customer development and corresponding financing methods, it highlights four phases (Overall & Wise, 2015, pp. 31-32):

The first step of this life cycle is dedicated to discovering the customer through interviews and studies in order to propose and adapt the solution to the problem. The appropriate financing methods are those from the family and friends environment as well as from the founders.

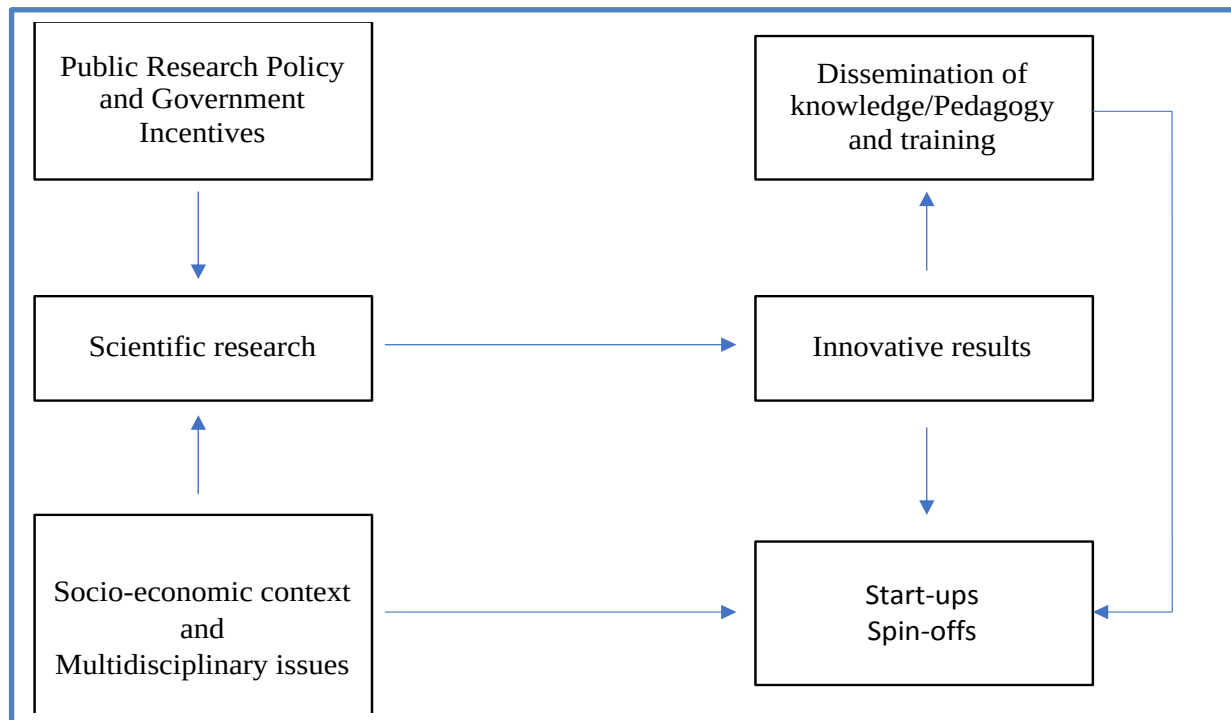
It is during the second stage that the validation of the customers to be satisfied is carried out, and to know if the market is ready to pay for the proposed solution, during this stage the company reaches the profitability threshold, the outcome and the ultimate objective of this stage is to adapt the market to the product, it ends when the market is found. The financing issues can extend to solicitation of venture capital companies, participatory financing (crowdfunding).

Once the product is market fit, and the solution can be produced, the creation of the company begins with expansion and increased sales, which will be accompanied by increased venture capital investment, following the reduction of uncertainty. These actions mark the third stage of the S-model of the life cycle.

The fourth and final stage is supposed to lead to the actual creation of the company, for this, it is imperative to know if the company can be profitable. During this phase the expansion will continue and marks the final stage of customer development. To finance these activities, it is possible to contract risky or subordinated debts.

The start-up can be likened to an entrepreneurial exercise, the latter corresponds to a combination of five factors which is characterized by a novelty found in the product, in the production method, in the penetration of a market, in the supply as well as in the organizational framework. (Barot, 2015)

Fig.4. Mechanisms for the entrepreneurial valorization of research results



Source: Developed by the researcher.

This diagram illustrates the impact of scientific research on the launch of start-ups, in fact, from public aid and guidance, research institutions (research centers, university laboratories), undertake to address the problems faced by other economic actors, this process would lead to innovative results, which will materialize through the launch of start-ups or university spin-offs, on the one hand, and on the other, through a transfer of knowledge through publication and training mechanisms, in turn, the latter will engage students in project engineering allowing them to launch their own start-ups.

In a logic of general interest, scientific research is financed by the State, the latter takes charge of the development of the strategy and the allocation of the necessary means, however, it should be emphasized that it can be of private obedience and financed by companies, the latter submit their problems and their intentions of innovation to researchers, which it finances exclusively or partially by private funds.

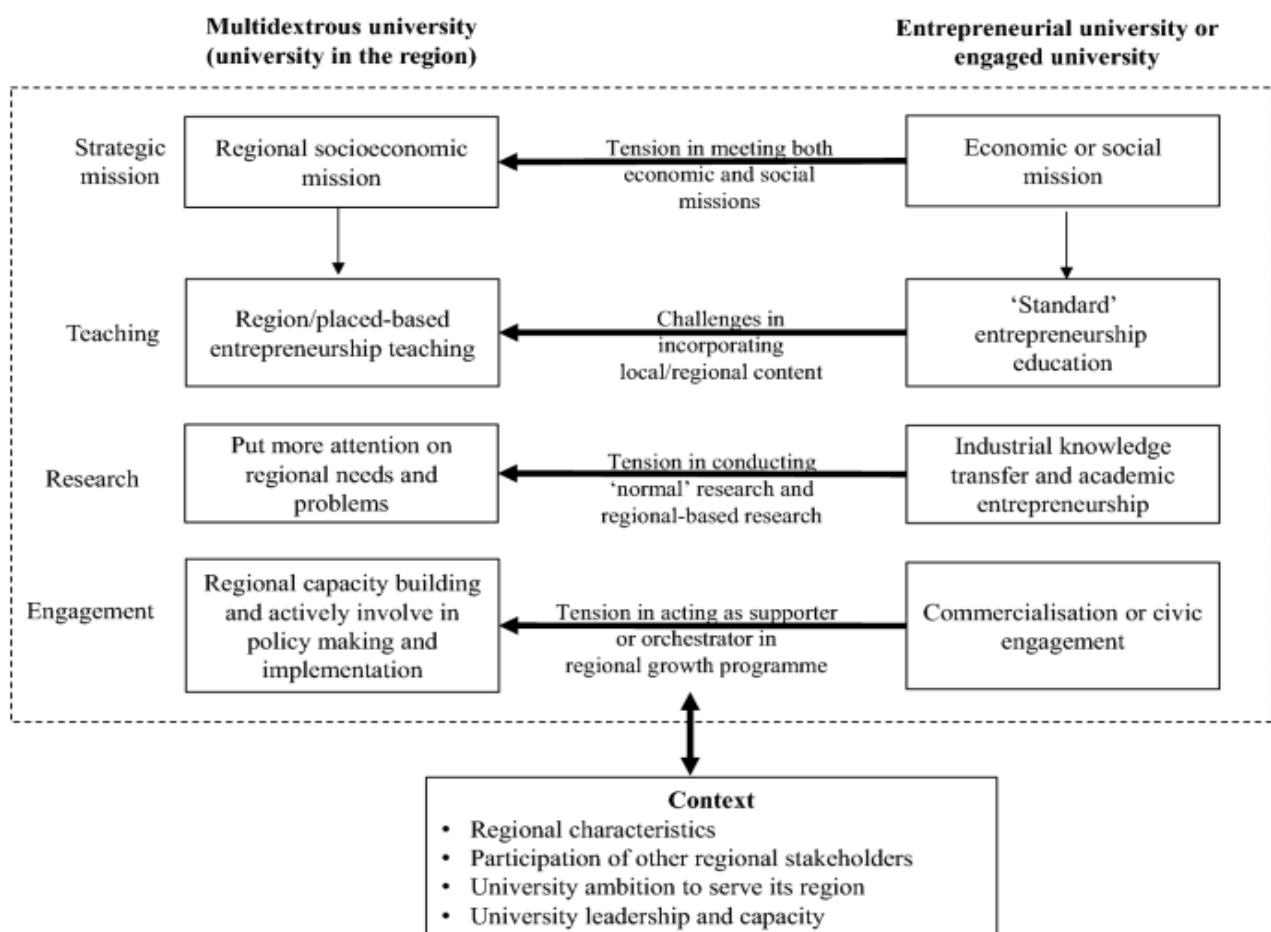
Valorization of research results is embodied by market mechanisms, such as labels, patents and copyrights, which can be made available to economic players (public institutions, companies, etc.), and which will result in spin-offs conducive to the creation of added value.

Referring to the work of (Bruyat, 1993, pp. 299-344) we can distinguish three stages of the entrepreneurial process. Indeed, the first is called the triggering of the entrepreneurial process, and this, from an internal or external dynamic, the second stage consists of the total commitment of the entrepreneur and it refers to the idea that the latter dedicates himself and devotes himself in terms of funds, time and efforts to realize his project. Finally, the last stage is that of the sustainability, failure or growth of the company created.

We can distinguish two types of entrepreneurship namely opportunity entrepreneurship and necessity opportunity entrepreneurship (Barot, 2015). Entrepreneurship refers to the idea that the entrepreneur perceives a business opportunity and creates a business as a career choice. While necessity entrepreneurship is the fact that the entrepreneur finds in the creation of a business a source of income and therefore a way to meet a survival need (Diandra & Azmy , 2020, p. 238).

The entrepreneurial role of the university is carried out through an integrated strategic approach, involving multidisciplinary missions, the figure below illustrates a model of multi-dexterity of the university, which energizes the three main missions of the university, namely, teaching, research, and the commercialization (valuation) of the corresponding results, by developing entrepreneurial impacts, which lead to development.

Fig.5. A multidisciplinary university model



Source: (Thomas, Pugh, Soetanto, & al, 2023, p. 2068)

The analysis of the entrepreneurial process informs us about the primordially of innovation which can enrich each phase of the process, the viability of the start-up is dependent on innovation coming from outside, by rubbing shoulders with the different actors in its environment, this is open innovation.

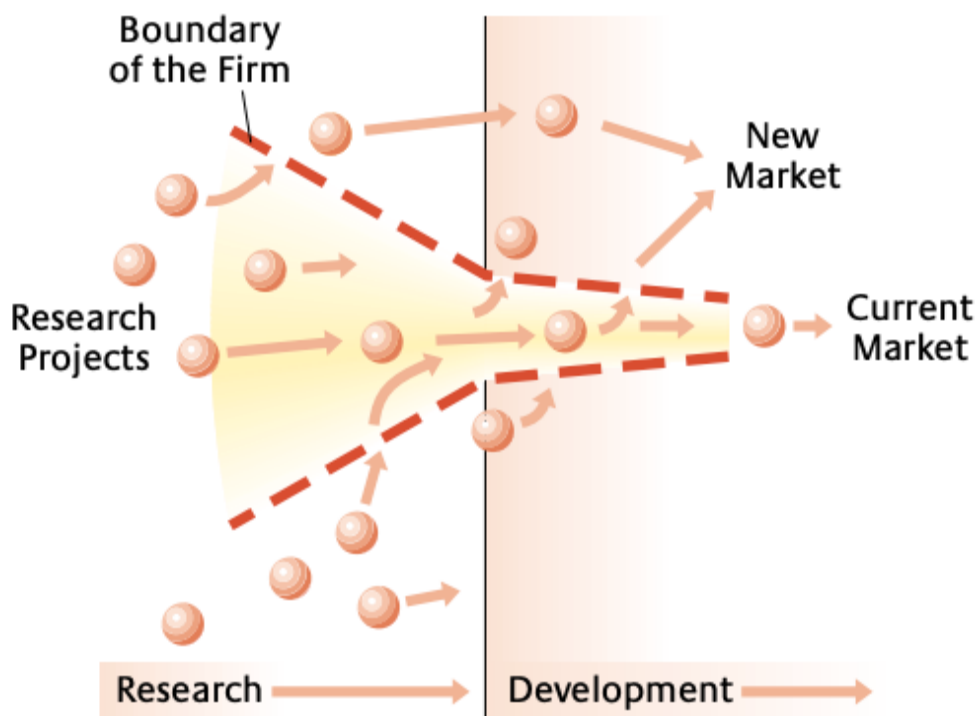
6. Open innovation: a key factor in the entrepreneurial valorization of research and the success of start-ups.

Open innovation consists of innovation that originates at the external level of the company, it is a process that emanates from the knowledge and information provided by organizations external to the company (Chesbrough & Bogers , 2014).

The philosophy of open innovation consists of connecting the company and its ecosystem, in particular the institutions producing knowledge and innovative ideas, namely universities, scientific research, etc.

This phenomenon would lead to objective interaction, particularly with universities which are predisposed to put their research results in favor of companies. To this end, scientific research would serve start-ups through an innovation process, resulting from the knowledge and ideas developed in the various research laboratories.

Fig.6. Open innovation mechanisms



Source : (Chesbrough H. , 2003, p. 37)

The open innovation model is characterized by a fluidity of information circulation between research and companies as shown in the figure above; in fact, this type of innovation assumes a fluidity in the circulation of innovation between the company and its environment (Chesbrough H. , 2003).

In the context of analyzing the role of scientific research on open innovation and the promotion of innovative start-ups, we can put a hook for another type of innovation, which favors both endogenous and exogenous factors in the innovation process, this is frugal innovation, this consists of innovating using few resources (Radjou, Prabhu, & Ahuj, 2012), this type of innovation does not reduce its quality and its socio-economic impact, at this stage, scientific research can play a role in particular in the capitalization of business plans associated with the creation of a company from the valorization of scientific results.

Endogenous determinants are linked to the ingenuity of the entrepreneur through the development of a frugal spirit.

The exogenous determinants of frugality come from the multidisciplinary nature of frugal innovation. Indeed, it is largely based on an integrated strategy that aims to adapt innovation to the conditions of the start-up's anchoring territory and to the new concerns of customers.

Networking platforms for students, researchers and companies to propose innovative solutions are examples of the concretization of innovative forms of collaboration, between scientific research and open innovation in the service of the development of start-ups. The impetus of an entrepreneurial university through dynamics of research valorization, will be confronted with the mastery of artificial intelligence tools, because the latter can hinder the reliability of the scientific result, in particular when it is mobilized to simulate results independently of the ethical principles of scientific research.

7.Conclusion

There contribution of the universities has there promotion of dynamism of entrepreneurship involves the involvement of researchers and students in the treatment of innovative themes and problems, the impact of which is both economic and social.

The pillars of popularization identified by Laperche (2002) remain relevant and require adaptation to the different requirements of each field of research, on the one hand, and on the other, support adapted to start-ups resulting from the valorization of research results.

In Algeria, colossal efforts are being made to bring the university closer to the economic environment, whether through teaching or scientific research, efforts to promote scientific research are also being made, and supported by the National Agency for the Promotion of Scientific Research and Technological Development (ANVREDET), the creation of incubators, decree 12-75, the creation of the Business-University Liaison Office (BLEU), the commission for the labeling of start-ups, innovative projects and incubators, are examples that demonstrate the interaction between the university and its socio-economic environment.

The triple helix model (university, industry and government) can explain Algeria's commitment to connecting the university and its socio-economic environment; it highlights the interactions that exist between the three actors, placing innovation and its driving role in the harmonious dynamics of this triptych at the center.

Entrepreneurial support is an older concept than the start-up, in fact, this approach is carried out on indicators forming a more or less standard model, this is explained by the fact that a

traditional company has a known and stable business model, unlike the start-up which is looking for a business model, in the sense that the idea holder must test several strategies and actions, in order to arrive at a value proposition that would be at the origin of a future company, for this purpose, there is no pre-established, certified model, dedicated to supporting start-ups. This observation informs us about the need to adapt the philosophy of supporting a start-up and the corresponding measures.

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