INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN ECONOMICS & MANAGEMENT SCIENCES

OPEN ACCESS JOURNAL

Vol 12, Issue 3, (2023) E-ISSN: 2226-3624

# Entrepreneurs and Inventors in Academia: Research Valorization and Entrepreneurship

Mounia Diamane
Professor, ESCA School of Management
Email: mdiamane@esca.ma

**To Link this Article:** http://dx.doi.org/10.6007/IJAREMS/v12-3/19326 DOI:10.6007/IJAREMS/v12-i3/19326

**Published Online:** 20 September, 2023

**Abstract**

This paper provides a comprehensive examination of diverse research valorization methods in academia. It emphasizes the role of academic spin-off ventures in different valorization approaches and highlights the challenges involved in transitioning university inventors into entrepreneurs. In conclusion, the paper presents an overview of patent filing activities and the emergence of businesses resulting from research endeavors in an emerging context, with a specific focus on Morocco. Despite a notable rise in the number of patents filed by universities in the country, the establishment of such enterprises remains relatively uncommon.

**Keywords:** Entrepreneur, Inventor, University Research Valorization, Entrepreneurship, Emerging Context

## Introduction

The journey from academic research to entrepreneurial innovation is often a challenging and transformative one. In the realm of university research, the transition from generating knowledge as a public good to harnessing that knowledge for economic and societal benefits is a complex endeavor (Arrow, 1962). Within this context, the creation of academic spin-off companies emerges as a promising avenue for the valorization of university research, serving as a bridge between academia and industry (Flesia, 2006). Spin-offs not only act as drivers of economic growth but also contribute significantly to the generation of high-skilled employment opportunities (Emin, 2003).

However, this transformation is far from straightforward, as it involves navigating uncertainties, risks, and the intricate process of translating academic findings into competitive and sustainable businesses. Moreover, for university researchers, transitioning into entrepreneurs presents psychological challenges as they grapple with the task of bridging the gap between their roles as academics and business leaders. This "schizo" transformation (Frémiot, 2007) of the university inventor into an entrepreneur forces them to strike a delicate balance between reducing time and cost to bring the product to market and their desire to develop a product or process that meets the rigorous standards of their peers in the scientific community. In other words, the inventor-entrepreneur must satisfy the dual

recognition/sanction mechanisms that characterize their unique status, namely the market and the scientific community (Frémiot, 2007).

The primary objective of this paper is to provide a comprehensive overview of various research valorization methods within the academic context. Special emphasis is placed on the active involvement of academic spin-off ventures across different valorization approaches, along with an exploration of the challenges associated with the transformation of university inventors into entrepreneurs. In concluding this contribution, we present a synthesis of patent filing activities and business creations arising from research efforts in an emerging context, with a specific focus on Morocco.

**Who is an Inventor?**

In a legal context, "the recognition of the legal status of an inventor requires intellectual involvement in the conception and development of the invention. Merely having an idea is not sufficient to be considered the inventor of the object resulting from that idea. The inventor must be able to demonstrate intellectual contribution to the realization of the invention, regardless of the degree of their contribution. Thus, co-authors of publications or manuscripts related to the present invention do not necessarily qualify as co-inventors[1]".

The concept of invention is legally tied to three primary criteria: novelty, inventive step, and industrial applicability. These criteria are cumulative (Gnintedem, 2012). Novelty means that nothing identical has been made available to the public before the patent application date. In other words, the invention must have no prior art in the state of the art. Beyond novelty, inventive step (non-obviousness) is another criterion for patentability. An inventive step means that, for a person skilled in the art, the invention does not derive in an obvious manner from the state of the art. The last criterion for patentability concerns industrial applicability. An invention is considered industrially applicable when it presents a specific, convincing, and credible utility.

Vivès (1948) asserts that "while most people are myopic, inventors stand out for the acuity of their vision," thus they are named inventors, "not because they themselves created something that did not exist, but because they discovered it while it was hidden". In other words, an inventor is someone who sees and enables others to see what was concealed in the hidden folds of the sciences and arts inherited from the ancients (Luisa and Hélène, 2004). "Invention is merely the final link in a continuous chain of knowledge, which is built collectively" (Chevalier, 1878).

In her book "Inventing the Industrial Revolution: The English Patent System, 1660-1800", historian MacLeod (2002) deeply studied the evolution of the representations of the inventor figure in the 17th and 18th centuries. During this time, inventors were seen as fraudsters and cheaters and received no recognition from society; their destiny was oblivion and anonymity (Jarrige, 2007). However, starting from the 1820s-1830s, the negative image associated with inventors was challenged in favor of human creativity and ingenuity. Several indicators measure the evolution of the inventor's image in British society: "the proliferation of portraits of inventors proudly posing next to their works, such as Arkwright next to the spinning machine or James Watt next to technical drawings; or even the increasing space they occupy in biographical dictionaries. For some, the role of the inventor even becomes more valuable than that of soldiers who die on the battlefield" (Jarrige, 2007).

[1] Research, Innovation, and Creation Support Service (SARIC) at the University of Sherbrooke, Quebec, Canada

In other words, the Victorian era was the heyday of inventors (Pérez and Verna, 2009). During this time, inventors acquired an exceptional position and established themselves as true national heroes. The celebration and heroization of the inventor figure generated growing interest within British society.

For example, in 1834, an enormous marble statue in honor of James Watt, the inventor of the steam engine, was erected in Westminster Abbey. Lord Liverpool, the Prime Minister of the Crown, referred to Watt as “one of the most extraordinary men England has given birth to, one of the greatest benefactors of mankind”. He declared that "his inventions have immeasurably increased the resources of his country and even those of the entire world."
However, the social esteem enjoyed by inventors began to decline at the end of the 19th century. During this era, inventors were no longer considered national heroes. The fading of inventors' glory was explained by the rise of scientists, engineers, and entrepreneurs, all of whom enjoyed professional identities and elite statuses (Pérez, 2009). Engineers and entrepreneurs gradually took over and replaced inventors in public celebration.
Following Christine MacLeod's work on England, Gabriel Galvez-Behar provides an excellent study of the French case. In his thesis, "For Fortune and Glory: Inventors, Industrial Property, and the Organization of Invention in France (1870-1922)," Galvez-Behar (2004) highlights the anonymization and invisibility of inventors in France. In France, inventors were never elevated to the same status as they were in Victorian England. "In France, the figures of the writer and the victorious general were never truly rivaled by those of the inventors" (Jarrige, 2007).
The inventor is primarily a complex historical and social construct that varies based on locations, eras, cultures, and disciplines.

**The Inventor in The University Context**

Within the academic context, the concept of an inventor raises several legal issues, notably the determination of the individual to whom the authorship of the invention belongs, and the legal status of research team members in relation to the university (Pépin, 2007).
Research activities conducted within universities often culminate from collaborative efforts involving a team of researchers. This team typically comprises researchers with varying statuses. One can identify one or more primary researchers supported and surrounded by professors, temporary researchers, students, or doctoral candidates. This scenario creates a genuine legal dilemma concerning the identification of the "true" inventor – that is, the person to whom the invention rightfully belongs. Confronted with this challenge, even universities with substantial resources can find themselves perplexed when addressing this intricate situation.
In Morocco, despite the significant surge in the number of patents filed by universities over the past decade, the legal framework pertaining to patent management in the university context is still in its nascent stages. Indeed, "At the regulatory and procedural level, there exists no uniform specific law for Moroccan public universities governing the procedures for monitoring invention patents and contracts for technology transfer and research valorization" (Nahid & Mossedek, 2015). This situation is primarily attributed to "the underutilization of Article 7 of Law No. 01.00, which enables the valorization of research and innovation within universities, as well as the absence of implementing regulations for this law [...] Article 18 of Law No. 17-97 concerning the protection of industrial property, as amended and supplemented by Law No. 23/2013, pertaining to salaried inventors, does not specify the extent of these provisions for inventor civil servants, even though in practice, civil servant

researchers are obligated to declare the invention, and potentially its exploitation, to the university" (Nahid & Mossedek, 2015). This assessment remains valid as of the year 2023.

**The University Inventor and The Challenge of Research Valorization**

**Valorization, commercialization, and transfer : three distinct concepts**

Valorization is a generic, polysemic, and multidimensional term, with definitions varying across countries, organizations, and stakeholders (Melviez, 2008; Sedogo, 2009). A literature review reveals that the notion of valorization often encompasses differing and even contradictory realities.

A survey of the literature highlights that the concept of valorization is at times inaccurately equated with other terms, such as the commercialization of research outcomes, intellectual property commercialization, technological commercialization, technology transfer, and knowledge transfer, to name a few.

Table 1 exemplifies the array of interpretations and definitions attributed to the concept of valorization. These definitions originate from institutional texts of select national and international organizations renowned for their expertise in valorization matters.

Table 1

*Definitions of the valorization concept*

| Country | Organization | Definition of the Valorization Concept |
|---|---|---|
| Morocco | Moroccan Office of Industrial and Commercial Property [Undated] | Valorization encompasses a set of activities aimed at adding value to research outcomes across all domains of research (scientific, technological, social, etc). The valorization process, overseen by valorization companies, concludes with a technology transfer or the commercialization of a finished product. |
| France | Socrates-Leonardo da Vinci Agency [Undated] | Valorization can be defined as the process of disseminating and exploiting project outcomes with the aim of optimizing their value, enhancing their impact, and integrating them into training systems and practices. |
| | National Evaluation Committee (CNE) [2004] | Valorizing, transferring, and harnessing activities and methods that enable the creation of greater value from academic knowledge and expertise entails rendering research results, knowledge, and skills usable or marketable. |
| Canada | Ministry of Economic and Regional Development of Research [2004] | The valorization of university research can be defined as the set of activities aimed at increasing the value of research outcomes and, more broadly, at enhancing knowledge. Valorization is not solely limited to the commercial exploitation of research results; it also involves the dissemination and exchange of knowledge across all fields of expertise. |
| | UNIVALOR | [...] a process aimed at enhancing the commercial value of research outcomes. |

| Country | Organization | Definition of the Valorization Concept |
|---|---|---|
| | Valorization Company [2004] | |
| | Canada – Council of Science and Technology Advisory (CCST) – Fortier Report [1999] | A process that involves commercializing new products and services based on the inventions and discoveries of university researchers. |
| Belgium | Federal Planning Bureau [2002] | The valorization of research results is the process implemented to ensure that university research has a genuine economic impact and leads, directly or indirectly, to new or improved products or processes exploited by existing companies or created for this purpose. |
| Australia | Australian Center for Innovation [2002] | A process aimed at transforming ideas, knowledge, and inventions arising from university research into practical and marketable applications (Translation of the CST). |
| United Kingdom | Office of Science and Technology [2004] et Innovation Report [2003] | [...] refers to the transfer of ideas, expertise, and inventions stemming from university research to industry and society at large, with the aim of developing new products and services |
| United States | U.S. Department of Commerce [2003] | [...] A process that involves converting scientific research findings into new technologies and transferring them to industry for commercial production |
| | Association of University Technology Managers (AUTM) [2004] | "A process referring to the formal transfer to industry of discoveries resulting from university research and the commercialization of these discoveries in the form of new products and services" |

*Source: Adapted from A. Grisé (2005)*

An analysis of the table above reveals the multiplicity of meanings encompassed by the concept of "valorization." Indeed, a close reading of these definitions demonstrates that the concept of valorization comprises three distinct realities, namely: "valorization" itself, "transfer," and "commercialization" (Grisé, 2005).

**Valorization**

The objective of valorization, quite literally, is to "add value" to research outcomes. In common parlance, valorizing research results refers to popularizing or disseminating them. It aims to bring researchers out of their ivory towers (universities, research centers, laboratories) and engage them with the broader society.

Melviez (2008) defines valorization as any activity related to commercialization and transfer, without necessarily encompassing the sum of activities inherent in these two notions.

In contrast to transfer and commercialization activities, valorization is not limited to assigning a market value to research results. Indeed, the Canadian Council of Science and Technology (2005) distinguishes between two types of valorization: market-oriented valorization (commercial valorization) and non-market-oriented valorization (social valorization).

The first type of valorization involves the commercial exploitation of research results (commercialization and technological transfer). The second type is not focused on the market value of research; instead, it pertains to the development and dissemination of practical applications or solutions derived from research or the expertise of researchers. The goal of this second type of valorization is to address a social problem or improve a situation (Fabrizio, 2006).

Valorization of research is a polysemic concept with interpretations that vary depending on the involved actors, their expectations, and their interests (Butare, 2010). Between 2007 and 2009, an in-depth survey was conducted in Burkina Faso involving various stakeholders and organizations interested in the theme of valorization (CNRST, public universities, ministerial departments, inventors, innovators, etc.). Butare (2010) synthesizes the main lessons learned from this survey and distinguishes six categories of understanding and acceptance of the concept of valorization: academic or professional valorization, scientific valorization, technological valorization, social valorization, economic valorization, and political valorization.

- Academic valorization of educational content

For some actors, valorization involves incorporating research findings into the design of educational materials and training modules for students or professionals. In this case, the primary goal of valorization is to update and enrich education.

- Scientific valorization

For many researchers, especially in the field of humanities and social sciences, the concept of valorization is equated with the dissemination and enhancement of research findings through scientific publications in peer-reviewed journals, specialized books, presentations at international conferences, posters, and more. From this perspective, the main objective of valorization is to contribute to knowledge dissemination and the advancement of science. In return, valorization provides researchers, research teams, and universities with considerable academic visibility and credibility.

- Technological valorization

For researchers operating in the field of new technologies, valorization is synonymous with using research results to develop new products, processes, or services, or to enhance existing products, processes, or services. In this case, it is essential to emphasize the central role of technology transfer organizations and industrial property protection, especially through patent applications.

- Social valorization

This interpretation of valorization places particular emphasis on the social utility of research. Indeed, for many actors, valorizing research results involves using them to address social issues and improve people's lives (health, education, cultural level, political awareness, etc.).

- Economic valorization

Within a socio-economic context, valorizing research results means using them to contribute to a country's economic development and enhance its competitiveness. In this case, the aim is to utilize research results to produce new goods and services, create innovative businesses, and generate employment opportunities.

- Political valorization

For many policymakers, valorizing research results means using them to better formulate, execute, and evaluate policies and decision-making in general.

**Commercialization**

The commercialization of university research results is the process of commercializing new products and services based on the inventions and discoveries of university researchers[2].

The commercialization of research results encompasses two complementary aspects. The first focuses on the commercial exploitation of all forms of creations protected by intellectual property rights (inventions of products and processes, literary and artistic works, software, etc.). The second aspect pertains to the commercialization of the expertise of university researchers resulting from research work conducted in various disciplinary sectors through collaborative activities (consulting, collaborative research, contract research, etc)[3].

Research commercialization can take various forms. A study by the Quebec Federation of University Professors (FQPPU) on the commercialization of research results and university expertise in Quebec universities identifies the main forms of research commercialization (Table 2).

Table 2

*The main forms of research commercialization*

| Discipline | Examples of Commercialization Activities | Type of IP Protection |
|---|---|---|
| Arts, Letters, and Communications | Exhibitions and sale of artistic works<br>Consultation with museums<br>Concerts and sale of musical works<br>Sale of literary and dramatic works<br>Sale of CDs and software | Copyright (artistic, musical, literary, dramatic works, and software) |
| Social Sciences and Humanities / Education | Consultation and research contracts, especially for public, semi-public, and international organizations.<br>Sale of educational materials and software. | |
| Management | Consultation and research contracts, especially for the industry.<br>Creation of spin-off companies (consulting services).<br>Sale of software. | |
| Natural Sciences, Engineering, Computer Science, and Health | Inventions (products and processes).<br>Establishment of spin-off companies (consulting services and technology-based businesses). | Patents (products and processes) |

[2] Advisory Council on Science and Technology in its Fortier Report of 1999, Council of Science and Technology of Quebec, 2006, op. cit., p. 6, cited in David Melviez, op. cit., 2008.

[3] Definition provided by the Council of Science and Technology, Research Valorization at the University, 2005.

| Discipline | Examples of Commercialization Activities | Type of IP Protection |
|---|---|---|
| | Consultation and research contracts, especially for the industry. | |

*Source : Herreyre, 2009*

**Technology Transfer**

The Association of University Technology Managers (AUTM) defines technology transfer as "the formal transfer process to industry of discoveries resulting from university research and the commercialization of these discoveries in the form of new products and services"[4].

In contrast to valorization and the commercialization of research, technology transfer excludes collaborative activities related to the commercialization of university researchers' expertise (consulting, collaborative research, contract research, etc) and focuses solely on the commercialization of research results by transferring them to industry. Additionally, unlike the commercialization and valorization activities, which aim to enhance research results from all disciplinary areas, technology transfer is primarily concerned with results from disciplines with a "scientific and technological" nature (life sciences, biotechnology, computer engineering, chemistry, etc.).

The technology transfer process consists of several key stages, as outlined by Grisé (2005):

- Detection and identification of inventions with significant commercial potential.
- Evaluation of the technological and economic potential of the invention through feasibility studies and market research.
- Development of a proof of concept or feasibility demonstration.
- Formulation of a valorization strategy.
- Protection and management of intellectual property through patent applications.
- Selection of a method for exploiting the invention (licensing, creating spin-offs, etc.).
- Project monitoring.

It is worth noting that the technology transfer process is managed in some countries by Technology Transfer Offices (TTOs). As their name suggests, TTOs are tasked with supporting scientific research activities and facilitating the transfer of research results. Their primary role is to foster collaboration between the university and external partners (companies, government agencies, competitiveness clusters, associations, etc).

**The main modes of valorization of university research**

In addition to teaching and research activities, universities play a significant role in valorizing the results of their research. Research valorization encompasses all activities related to commercialization and technology transfer.

The three main mechanisms for valorizing university research cited in the literature are: service provision, granting exploitation licenses to existing companies, and the creation of spin-offs (Jones-Evans and Klofsten, 1998). The table below (Table 3) summarizes the main modalities of university research valorization.

[4] Definition from the Association of University Technology Managers, 2004, as cited in the Council of Science and Technology of Quebec, 2006, op. cit., p. 7, as referenced in Melviez David, op. cit., 2008, p. 44.

Table 3
*Main Modes of Valorizing University Research as Cited in the Literature*

| Valorization Modes | Specifics |
|---|---|
| Service Provision | · Involves the exploitation of knowledge or know-how mastered and developed by the university researcher or their research laboratory (knowledge, techniques, methodologies, etc) for the benefit of an external partner ;<br>· The communication of know-how can take various forms: training, consulting, expertise, research contracts, exchanges and internships, delivery of plans, bundles of documents, technical files, audio-visual material, computer programs, etc ;<br>· The service provided, based on a specific request from the partner, entails an obligation to deliver results but does not necessarily require a creative contribution from the researcher or their laboratory. |
| Licensing | This mode of valorization involves the holder of a patent (researcher, research laboratory, university, etc.) granting exploitation rights of their patent to a third party (Mendes, Date not specified) to allow them to manufacture or exploit the patented invention for a specified period or within a designated territory (Ménard, 1994) ;<br>Licensing can be a significant source of funding for universities when they own the intellectual property rights to research results (Bray and Lee, 2000). |
| Business Creation (Spin-off) | - A spin-off is a new company created from a university by members of the scientific or teaching staff with the aim of exploiting knowledge or technologies that have been developed there, through commercial activities(Surlemont et al. 2001) ;<br>-This mode of valorization makes a tangible contribution to employment and economic development and can be a significant source of revenue for the university (Doutriaux, 1987; Bray and Lee, 2000).<br>-The creation of spin-offs also helps maintain close ties with the world of research ;<br>-The interest of this type of enterprise goes beyond just job creation; it also involves its ability to act as an interface between university research and the private sector (Mustar, 1997).<br>-In the case of research valorization through the creation of spin-offs, and unlike licensing, the university has a dual mission. It not only ensures technology transfer but also participates in the process of creating a new company." |

**Entrepreneurship as A Mode of Valorizing University Research**

Entrepreneurship stemming from academic research represents just one potential avenue for valorizing university research (Harmon et al., 1997). Unlike other valorization methods (such as licensing and service provision), creating businesses, known as spin-offs, is a less common phenomenon. Nevertheless, the economic impact of this form of valorization is substantial (Siegel, 2013).

Indeed, in addition to contributing to employment by hiring highly qualified personnel (doctoral students, recent PhD graduates, researchers, etc), the establishment of university spin-offs ensures that inventions have not been acquired by foreign companies, thus safeguarding local economic and social benefits (Emin, 2003).
Furthermore, « the high tacit content of knowledge transferred to the market through the creation of new businesses can often only be achieved through this means. This prevents such knowledge from remaining confined within the academic sphere » (Bonnet et al. 2014). In other words, in certain situations, inventions cannot be valorized through a simple licensing arrangement due to their tacit and non-transferable nature, necessitating the continuous involvement of their inventor.
Table 4 summarizes the key advantages and disadvantages of business creation (spin-offs) in comparison to the most common mode of valorization, namely licensing (Emin, 2003).

Table 4
*Comparison of Two Modes of Valorization: Licensing and Business Creation*

| **Advantages** | **Disadvantages** |
|---|---|
| **Licensing Agreement** | |
| Rapid return on investment<br>Security<br>Simplicity (relies on a simple contract)<br>. | Unsuitable for transferring emerging and disruptive technologies<br>Separates the inventor from the application of their invention (i.e., reduces the chances of improvement or further development)<br>Risk of conflicts during royalty sharing<br>Does not necessarily involve economic benefits in the university's region, may even lead to dispersion abroad |
| **Business Creation** | |
| Local economic benefits<br>Job creation<br>Suitable for transferring emerging and disruptive technologies<br>Facilitated transformation of scientific knowledge into products and services | Uncertainty<br>Complexity<br>Lengthiness |

*Source : Emin (2003)*

Despite the numerous advantages of valorizing research through entrepreneurship, this method of valorization is, in some cases, a last resort. Indeed, the emergence of this particular type of company presents many challenges related to uncertainty, risk, and the complexity of transforming university research results into competitive and sustainable firms. From the perspective of the university inventor, creating a spin-off entails numerous psychological challenges associated with the difficult transformation of a researcher into an entrepreneur. If not managed properly, this transformation can become a source of failure for their business.

**The University Inventor and The Entrepreneur**

During the process of transforming the university inventor into an entrepreneur, knowledge originating from the research laboratory undergoes a change in status, transitioning from a public good to a private asset with contrasting characteristics. The 'marketization' of scientific knowledge, which involves transforming an intellectual project (a public good) into a commercial organization exploiting an innovative product or process (a private good), is a sensitive and complex process. According to Arrow (1962), scientific knowledge is a public good characterized by two fundamental elements: non-excludability and non-rivalry.

- *Non-excludability of knowledge:* Scientific knowledge is a non-excludable good. Unlike a private good, a public good (Samuelson, 1954) is defined by its non-excludability. Non-excludability means that there is no technical or legal mechanism to deprive individuals of the use of the good. In the specific case of scientific knowledge stemming from university research laboratories, it seems challenging to prevent third parties from using the produced knowledge (Demsetz, 1970).
- *Non-rivalry of knowledge:* Non-rivalry occurs when one individual's consumption of a good does not diminish its use by others. Unlike marketable goods, knowledge from university research is an inexhaustible resource, with an infinite number of individuals able to use the same knowledge without diminishing its quantity or quality for others.

These two particular characteristics—non-rivalry and non-excludability—result in a third characteristic of scientific knowledge: *cumulativeness*. Scientific knowledge is a cumulative good characterized by increasing returns. Indeed, “knowledge fuels knowledge (...) the more we learn, the more we are capable of discovering new ideas. And unlike physical resources, the number of things to discover is limitless[5]”. Unlike private goods, scientific knowledge becomes not only a consumer good but also a tool for producing even more significant knowledge.

It is important to note that the university inventor and the entrepreneur are two significant actors in the innovation process. « Researchers and entrepreneurs share the quality of keen observers. They are inventive, possess insatiable curiosity, and have the desire to develop expertise related to usage. However, there exists a cultural gap between them—the culture of entrepreneurship » (Al Rubaee, 2015).

To become an entrepreneur, the university inventor must undergo a 'schizo-transformation' summarized by Fremiot (2007) in three elements: culture, time, and skills.

**Culture**

To embark on the entrepreneurial journey, the university inventor must change their culture. “Being the first to publish a discovery can no longer be their primary objective. Instead, they need to build a competitive advantage in a market, often international, and maintain it” (Blondel, 2002). Table 5 summarizes the main differences between academic culture (the university researcher) and the business world (the entrepreneur).

[5] Paul Romer (Nobel Prize in Economics, 2008) in an interview with the newspaper "Le Monde" on June 10, 1997.

Table 5
*Cultural Differences Between the Researcher and the Entrepreneur*

| The University Researcher | The Entrepreneur |
|---|---|
| General and rapid knowledge dissemination | Non-disclosure of knowledge |
| Decision-making by consensus | Performance-based decision-making |
| Financial disinterest | Profit-seeking |
| Recognition by peers (academic community) or through publications | Recognition/sanction system established by the market |

*Source : Frémiot (2007)*

This cultural divergence thus compels university inventors seeking to create their own businesses to transform their culture, thinking logic, and their system of recognition and motivation.

**Time**

University inventors have different time horizons compared to entrepreneurs. "While the former engage in discovery projects without predefined time limits, the latter invest in projects that are pre-defined in terms of time and costs, in other words, projects with money as the common denominator" (Frémiot, 2007). University inventors generally have “all the time” to conceive and create new products or processes, whereas entrepreneurs do their best to reduce both time and cost required for their product's development. This shortening of time can be a reason for failure for the researcher-entrepreneur. In fact, under the entrepreneur's hat, the researcher-entrepreneur will attempt to minimize costs and the time needed for product development. However, from the researcher's perspective, any technological failure due to a lack of time can damage their reputation (Frémiot, 2007). This "schizo" transformation of the university inventor into an entrepreneur forces the inventor-entrepreneur to strike a balance between reducing time and cost to market the product and their desire to develop a product or process that meets the requirements of their peers (the scientific community). In other words, the inventor-entrepreneur must satisfy the two recognition/sanction mechanisms that characterize their unique status, namely the market and the scientific community (Frémiot, 2007).

**Skills**

The skills required in the academic world differ from those in the business world. The university inventor possesses the knowledge (know-what) and scientific understanding of the laws and principles governing how things work (know-why). However, their learning abilities related to « know-how » and « know-who » are more limited. It is therefore challenging for a university inventor to establish legitimacy in the market and gather the human and financial resources necessary to successfully carry out their entrepreneurial project. One of the major sources of failure for a young company stemming from university research is "the lack of complementary resources (scientific and commercial) required for its development and success" (Fremiot, 2007). In other words, a university inventor coming directly from the academic world suffers from isolation that is incompatible with the demands of entrepreneurship. To address this situation, the university inventor must open up to others and surround themselves with a management team that shares their vision and provides the support and skills needed throughout the creation and development process of their

company. "However, while it is theoretically evident that this openness is indispensable (Blondel, 1998), its practice is extremely delicate. Faced with different strategic logics and cultures, the researcher-entrepreneur will be trapped between those who prioritize the 'push of their technology' and those who favor the 'market opportunity.' This positioning 'between the two' or 'straddling the world of knowledge and that of business practices' (Blondel, 1998) raises the thorny dilemma posed by the transformation of a researcher into an entrepreneur" (Fremiot, 2007).

**University Research Valorization in Morocco: Current State**

The year 2000 marked a major turning point in the history of Moroccan universities. "The country embarked on a process aimed at establishing a national ecosystem that promotes the development of national scientific research in general, and innovation and the valorization of research results in particular" (El Youssoufi Attou and Arouch, 2015).

In Morocco, the promotion and valorization of university research are currently among the major concerns of the government[6]. Besides its academic dimension, university research also contributes, through industrial valorization and the creation of innovative companies (university spin-offs), to the economic and social development of the country.

Law 01-00, concerning the reform of higher education in Morocco, has opened up new prospects for Moroccan universities. Article 7 of this law highlights the Moroccan legislator's intention to provide universities with new tools to strengthen their entrepreneurial activities and better contribute to the socio-economic development of the country. This article stipulates that "within the framework of the missions assigned to them by this law, universities may, by agreement, provide paid services, create incubators for innovative companies, exploit patents and licenses, and market the products of their activities".

Many Moroccan universities have embraced this initiative, starting with the first step, which is the filing of invention patents.

**The Development of Patent Culture within Moroccan Universities**

Although the culture of patent filing by universities is relatively recent in Morocco, universities are the primary patent filers at the national level. For instance, in 2015, the share of invention patents filed by Moroccan universities constituted 49% of the total patent applications originating from Morocco. This trend of patent filing by universities has continued, reaching 53% in 2021 (Figure 1).

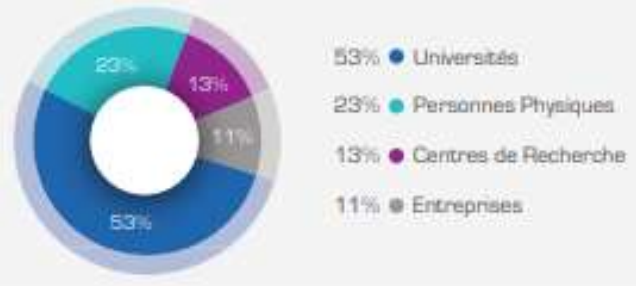


Figure 1: Breakdown of Moroccan-origin patent applications by type of applicant
*Source: Industrial and Commercial Property Bulletin in Morocco 2021 – OMPIC*

[6] Report from the Directorate of Scientific Research and Innovation in Morocco: "National Strategy for the Development of Scientific Research by 2025" [Online], www.enssup.gov.ma

It should be noted that a total of 1,131 patents were filed by Moroccan public and private universities between 2008 and 2020 (Figure 2).

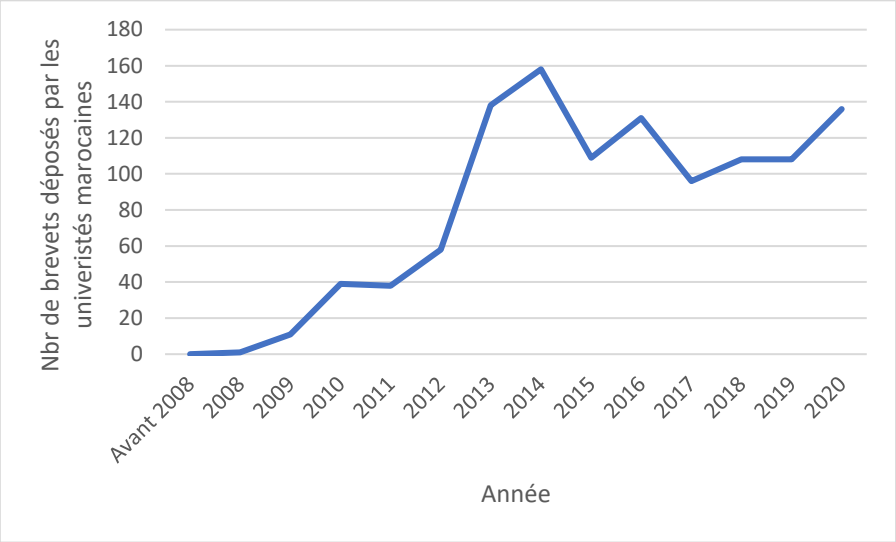


Figure 2. Evolution of patent applications filed by universities in Morocco
*Source: Author's compilation based on OMPIC activity reports from 2006 to 2021*

The increase seen in some universities over the past decade reflects the efforts made by the government to develop the national research and innovation system. This is exemplified by the role of OMPIC (the Moroccan Office of Industrial and Commercial Property), which plays a crucial role in raising awareness, providing training, and disseminating information to benefit university researchers and research laboratory leaders.

**A wide gap between the number of patents filed and the number of innovative companies established**

The act of patenting an invention is not an end in itself; rather, it serves as a stepping stone toward its valorization, as noted by (Jones-Evans and Klofsten, 1998). The establishment of academic spin-off companies represents one of the viable avenues for harnessing the potential of university research (Flesia, 2006). This mode of valorization offers several distinct advantages. Notably, in addition to its role in contributing to employment through the recruitment of highly skilled personnel, including doctoral candidates, recent Ph.D. graduates, and research staff, the creation of university spin-offs serves as a safeguard against the potential acquisition of the invention by foreign enterprises. Furthermore, it ensures local economic and social benefits (Emin, 2003).

Moreover, it is often the case that the high tacit content of knowledge transferred to the market through the establishment of a new enterprise can best be achieved through this means. This approach prevents such valuable knowledge from remaining confined solely within the academic domain, as noted by Bonnet et al. (2014). In other words, in certain situations, the invention cannot be adequately valorized through a simple licensing arrangement due to its inherently tacit and non-transferable nature, necessitating the continuous involvement of its inventor.

However, despite the concerted efforts by governmental authorities to foster bridges between research and entrepreneurship[7], and despite the technological knowledge and expertise possessed by university inventors, a relatively small fraction of these inventors capitalize on the outcomes of their research endeavors. To illustrate, according to a study conducted on a sample of 131 university inventors by Nahid and Mossadek (2015), the rate of patent exploitation does not exceed 4%. "A mere 4% of patent depositors have succeeded in exploiting their invention patents by establishing start-ups with the support of industrial partners, albeit without generating profits for their universities. In contrast, the vast majority, constituting 96%, have been unable to derive any form of benefit from their patents" (Nahid and Mossadek, 2015). It was not until 2021 that the first instance of transferring a patent from a public university to a private sector enterprise was documented in Morocco[8].

**Conclusion**

The establishment of companies stemming from university research, known as spin-offs, represents a promising strategic path for fostering innovation and generating opportunities for high-skilled employment. This approach to valorization presents numerous challenges related to uncertainty, risk, and the complexity of transforming university research outcomes into competitive and sustainable firms. From the perspective of the university inventor, creating a spin-off presents several psychological challenges linked to the difficulty of transitioning from a researcher to an entrepreneur. If not managed properly, this transformation can become a source of failure for the enterprise.

In the Moroccan context, the observed gap between the number of patent applications filed and the number of innovative companies created clearly indicates a substantial untapped potential for invention within Moroccan universities. Despite possessing technological knowledge and expertise, many university inventors struggle to profit from their patented inventions and take the leap into establishing a spin-off company.

Moreover, concerning existing research efforts, unlike other countries where the phenomenon of university spin-off creation is relatively or extensively developed (Emin,2003 ; Sciarelli et al., 2021 ; Li et al., 2022 ; Prokop,2021 ; Miranda et al., 2018 ; Su et al., 2013 ;Fernández-López, 2019), there is limited research focusing on the Moroccan context. This observation could open the door to numerous research avenues aimed at understanding and explaining the reasons behind the low rate of spin-off creation in Morocco. The goal is not to turn all inventors into entrepreneurs but rather to enable them to consider entrepreneurship as a potential avenue for valorization.

In conclusion, this research offers both theoretical and practical contributions. From a theoretical standpoint, it helps fill a gap in our understanding of the challenges that university inventors face when trying to start their own companies.

[7] Report from the Directorate of Scientific Research and Innovation in Morocco: "National Strategy for the Development of Scientific Research by 2025" [Online], www.enssup.gov.ma (accessed on 20/01/2015).

[8] This patent pertains to the 'production, formulation, and recycling of a biofungicide and biostimulant product based on Tricoderma Aspirilum.' The transfer agreement for this patent was executed in 2021 between Ibn Tofail University in Kenitra, Morocco, and ATRACO, a company specializing in the commercialization of agricultural products based in Casablanca (Source: Ibn Tofail University of Kenitra website).

In a practical sense, the study's findings carry significant implications for Morocco's innovation landscape. They emphasize the untapped potential within Moroccan universities and the hurdles faced by inventors in bringing their patented ideas to life. By recognizing these challenges, this research encourages policymakers and stakeholders to consider tailored support mechanisms and initiatives. Such efforts can assist inventors in bridging the gap between research and entrepreneurship, potentially leading to economic growth, job creation, and technology transfer in the country.

**References**

Arrow, K. (1962). Economic welfare and the allocation of resources for invention. In The rate and direction of inventive activity: Economic and social factors (pp. 609-626). Princeton University Press.

Blondel, D. (1998). Le rôle spécifique du scientifique dans le processus d'innovation. IMRI, WP, 98(05).

Bonnet, J., De Lema, D. G. P., Martinez-Abarca-Pastor, C., Rizzo, U. (2014). Les déterminants de la création de spin-off académiques. Une comparaison internationale dans les établissements supérieurs de Caen, Carthagène et Ferrare (No. 201417). Center for Research in Economics and Management (CREM), University of Rennes 1, University of Caen and CNRS.

Bray, M. J., Lee, J. N. (2000). University revenues from technology transfer: Licensing fees vs. equity positions. Journal of Business Venturing, 15(5), 385-392.

Bray, M. J., Lee, J. N. (2000). University revenues from technology transfer: Licensing fees vs. equity positions. Journal of Business Venturing, 15(5), 385-392.

Butare, I. (2010). La valorisation des résultats de recherche et de l'innovation comme facteur de développement en Afrique: l'exemple du Burkina Faso.

Demsetz, H. (1970). The private production of public goods. The Journal of Law & Economics, 13(2), 293-306.

Dolza, L., Vérin, H. (2004). Figurer la mécanique: l'énigme des théâtres de machines de la Renaissance. Revue d'histoire Moderne et Contemporaine, (2), 7-37.

Doutriaux, J. (1987). Growth pattern of academic entrepreneurial firms. Journal of Business Venturing, 2(4), 285-297.

El youssoufi Attou, O., Arouch, M. (2015). État des lieux du système national de l'innovation technologique au Maroc. International Journal of Innovation and Scientific Research. Vol. 20 No. 1 Jan. 2016, pp. 83-89.

Emin, S. (2003). L'intention de créer une entreprise des chercheurs publics: le cas français (Doctoral dissertation, Grenoble 2).

Fabrizio, K. (2006). Absorptive capacity and innovation: evidence from pharmaceutical and biotechnology firms [Workingpaper].

Fernández-López, S., Rodeiro-Pazos, D., García González, F., & Rodríguez-Gulías, M. J. (2019). Determinants of high-growth university spin-offs in Spain. Journal of Science and Technology Policy Management, 10(4), 890-904.

Flesia, E. (2006). Valorisation de la recherche, innovation et création d'entreprises. Géographie, économie, société, 8(1), 149-158.

Fremiot, E. (2007). Les incubateurs publics: une innovation organisationnelle pour la politique de valorisation de la recherche (Doctoral dissertation, Université Paris-Dauphine).

Galvez-Behar, G. (2004). " Pour la fortune et pour la gloire": inventeurs, propriété industrielle et organisation de l'invention en France, 1870-1922 (Doctoral dissertation, Lille 3).

Grisé, A. (2005). La valorisation de la recherche universitaire : clarification conceptuelle. Conseil de la science et de la technologie, Québec

Harmon, B., Ardishvili, A., Cardozo, R., Elder, T., Leuthold, J., Parshall, J., Smith, D. (1997). Mapping the university technology transfer process. Journal of business venturing, 12(6), 423- 434.

Herreyre, K. (2009). Préparation de l'offre de services, Propriété intellectuelle et valorisation des résultats de la recherche universitaire, UQAC

Jarrige, F. (2007). Les inventeurs, héros déchus du progrès technique. A propos de Christine MacLeod, Heroes of Invention. Technology, Liberalism and British Identity, 1750-1914, Cambridge, Cambridge University Press.

Jones-Evans, D., Klofsten, M. (1998). Technology transfer. Science and Public Policy, 25(6)

Li, H., Yang, X., & Cai, X. (2022). Academic spin-off activities and research performance: The mediating role of research collaboration. The Journal of Technology Transfer, 47(4), 1037-1069.

Lowe Gnintedem, P. L. (2012). L'homme-inventeur, Perspectives (Journal du Réseau français des Instituts d'Etudes Avancées), n°8, 2012, 16-17 pages.

MacLeod, C. (2002). Inventing the industrial revolution: The English patent system, 1660-1800. Cambridge University Press.

Melviez, D. (2008). La valorisation-Une étude de cas internationale. Université de Montréal, 105 pages.

Ménard, C. (1994). La nature de l'innovation organisationnelle: éléments de réflexion.

Miranda, F. J., Chamorro, A., & Rubio, S. (2018). Re-thinking university spin-off: A critical literature review and a research agenda. The Journal of Technology Transfer, 43(4), 1007-1038.

Mustar, P. (1997). How French academics create hi-tech companies: the conditions for success or failure. Science and Public Policy, 24(1), 37-43.

Nahid, H., Mossadek, T. (2015). État des lieux de l'exploitation des brevets d'invention des universités publiques marocaines. Propriété industrielle – Revue LexisNexis JurisClasseur.

Pépin, L. (2007). The History of EU Cooperation in the Field of Education and Training: how lifelong learning became a strategic objective. European Journal of Education, 42(1), 121-132.

Pérez, L., Verna, C. (2009). La circulation des savoirs techniques du Moyen-âge à l'époque moderne. Nouvelles approches et enjeux méthodologiques. Tracés. Revue de sciences humaines, (16), 25-61.

Prokop, D. (2021). University entrepreneurial ecosystems and spinoff companies: Configurations, developments and outcomes. Technovation, 107, 102286.

Samuelson, P. A. (1954). The pure theory of public expenditure. The review of economics and statistics, 387-389.

Sciarelli, M., Landi, G. C., Turriziani, L., & Tani, M. (2021). Academic entrepreneurship: founding and governance determinants in university spin-off ventures. The Journal of Technology Transfer, 46, 1083-1107.

Sedogo, M. (2009). Programme de valorisation des résultats de recherche et des innovations au Bukina Faso. Rapport de consultation. Ministère des enseignements secondaire supérieur et de la recherche scientifique, FRSIT/ CNRST. Projet de valorisation des résultats de recherche et des innovations technologiques. 102 pages.

Siegel, D. (2013). Academic Entrepreneurship : lessons learned for university administrators and policymakers. in Creating competiveness, Audretsch, D., Lindenstein Walshok, M., 2013, EE publishing, 116-135.

Su, D. J., Sohn, D. W., & Sohn, S. (2013). Chinese policy to stimulate university-industry linkages in Nanjing. STI Policy Review, 4(2), 74-95.

Surlemont, B., Wacquier, H., Pirnay, F. (2001). Les spin-offs universitaires belges en l'an 2000: une analyse économique. Contribution au rapport d'indicateurs STI belge-SSTC.

Vivès, J. L. (1948). De Disciplinas, Libro I, part. II, ch. 2, Obras completas, t. II, Madrid, 1948, p. 531.