



ORIGINAL

## Moroccan Public Universities Confronting the Challenge of Patent Valorization: Potentialities and Realities

### Las universidades públicas marroquíes ante el reto de la valorización de patentes: Potencialidades y realidades

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#### ABSTRACT

This study examines the intricate dynamics of patent valorization within Moroccan higher education institutions, highlighting a pronounced contrast between the efficiency of patent generation and the inherent challenges in their commercial exploitation. Leveraging a qualitative methodology, particularly through in-depth interviews with key stakeholders involved in the patent valorization process within public universities, the research uncovers the primary obstacles that impede the transformation of university patents into marketable innovations. These obstacles include a lack of specifically allocated funding for post-patent development phases, a deficiency in marketing and entrepreneurship skills among academic staff, limited interactions with the industry, and a regulatory framework perceived as restrictive. Based on these observations, we propose a set of strategic recommendations on two levels: national and university. Nationally, we recommend the establishment of dedicated valorization funds to finance key commercialization phases, a substantial revision of the regulatory framework to simplify and encourage the valorization process, and the implementation of incentive mechanisms to strengthen collaborations between universities and the industrial sector. Within university settings, it is crucial to integrate specialized training programs for researchers and valorization managers focused on intellectual property management and technology transfer, and to bolster existing valorization structures. These structures should be equipped with the necessary resources to efficiently identify and support patentable innovations. Furthermore, it is advised to promote the creation of incubators and accelerators within universities to support innovative startups emerging from academic research. The ultimate aim of this contribution is to provide strategic guidance for enhancing the effectiveness of university patent valorization, thereby fostering innovation and contributing to Morocco's economic development.

**Keywords:** Patent Valorization; Intellectual Property; Technology Transfer; Innovation Ecosystem; Legal Framework; Economic Impact.

#### RESUMEN

Este estudio examina la dinámica compleja de la valorización de patentes dentro de las instituciones de educación superior marroquíes, destacando un contraste pronunciado entre la eficiencia en la generación de patentes y los desafíos inherentes en su explotación comercial. Utilizando una metodología cualitativa, especialmente a través de entrevistas en profundidad con actores clave involucrados en el proceso de

valorización de patentes dentro de las universidades públicas, la investigación revela los principales obstáculos que impiden la transformación de patentes universitarias en innovaciones comercializables. Estos obstáculos incluyen la falta de financiación específicamente asignada para las fases de desarrollo post-patente, una deficiencia en habilidades de mercadeo y emprendimiento entre el personal académico, interacciones limitadas con la industria y un marco regulatorio percibido como restrictivo. Basado en estas observaciones, proponemos un conjunto de recomendaciones estratégicas en dos niveles: nacional y universitario. A nivel nacional, recomendamos la creación de fondos de valorización dedicados para financiar las fases clave de la comercialización, una revisión sustancial del marco regulatorio para simplificar y fomentar el proceso de valorización, y la implementación de mecanismos de incentivos para fortalecer las colaboraciones entre las universidades y el sector industrial. Dentro de los entornos universitarios, es crucial integrar programas de formación especializados para investigadores y gerentes de valorización enfocados en la gestión de la propiedad intelectual y la transferencia tecnológica, y fortalecer las estructuras de valorización existentes. Estas estructuras deben estar equipadas con los recursos necesarios para identificar y apoyar eficazmente las innovaciones patentables. Además, se aconseja promover la creación de incubadoras y aceleradoras dentro de las universidades para apoyar a los startups innovadores que emergen de la investigación académica. El objetivo final de esta contribución es proporcionar orientación estratégica para mejorar la efectividad de la valorización de patentes universitarias, fomentando así la innovación y contribuyendo al desarrollo económico de Marruecos.

**Palabras clave:** Valorización de Patentes, Propiedad Intelectual, Transferencia Tecnológica, Ecosistema de Innovación, Marco Legal, Impacto Económico.

## INTRODUCTION

In the global arena of innovation, the patent for invention stands out as a strategic tool for the promotion and protection of technological advancements. Patents are not merely key indicators of a country's inventive performance; they also constitute an essential technological reservoir, poised for exploitation to stimulate economic and social progress.<sup>(1)</sup> This universal truth resonates with particular acuity in Morocco, where the activity of patent filing, although growing, raises questions about the efficacy of their conversion into tangible commercial successes.<sup>(2)</sup> Despite a legal and institutional framework seemingly conducive to innovation, represented by the World Intellectual Property Organization (WIPO)<sup>(3)</sup> and the Moroccan Office of Industrial and Commercial Property (OMPIC), the transition of academic inventions from the laboratory to the market remains hindered by several challenges.

Morocco, through its policies and innovation support infrastructures such as OMPIC and the TISC network (Technology and Innovation Support Centers),<sup>(4)</sup> has made significant efforts to harmonize its legislation with international standards in intellectual property and to facilitate the commercial valorization of inventions.<sup>(5)</sup> However, practice reveals a more nuanced reality: the relatively stable number of invention patents filed by Moroccan universities does not systematically translate into a proportional increase in their economic exploitation. This observation raises a crucial scientific issue: despite an apparently robust institutional structure and an increasing volume of patents generated, what obstacles persist to the commercial exploitation of university patents in Morocco?

This work aims to explore this fundamental query, focusing on identifying the factors that limit the commercial valorization of patents within Moroccan higher education institutions and proposing a set of strategic recommendations to enhance the valorization of university patents. By examining current legislation, existing innovation support mechanisms, and institutional practices, this study seeks to derive a holistic understanding of the challenges and opportunities within the Moroccan intellectual property landscape. In doing so, our work aspires to contribute to the dialogue on how Morocco, and by extension other countries in similar situations, can overcome these obstacles to fully realize the economic and societal potential of their academic innovations.

## LITERATURE REVIEW

In the current context, marked by increased global competition and the imperative of innovation, the valorization of university patents emerges as a crucial vector for economic development and societal progress.

<sup>(6)</sup> Academic institutions, as crucibles of research and innovation, face the major challenge of transforming their discoveries into tangible and marketable technological advances. This approach, which encompasses the protection of intellectual property rights, commercialization, and the creation of spin-off companies, holds strategic importance for strengthening the links between scientific research and the economic fabric.

<sup>(7)</sup> Given this observation, the analysis of patent valorization strategies, both internationally and within the specific Moroccan context, becomes a necessity to evaluate effective practices, identify success standards, and

recognize the obstacles inherent to this process.

### Conceptual Framework of University Patent Valorization

The valorization of university patents constitutes a fundamental pillar in the landscape of innovation and technology transfer on a global scale.<sup>(6)</sup> This section aims to establish a detailed conceptual framework, enabling an understanding of the stakes and dynamics underlying the transformation of academic discoveries into technological and commercial advancements. By precisely delineating key terms and highlighting the strategic importance of patent valorization, we lay the necessary groundwork for an in-depth exploration of valorization strategies, both nationally and internationally.

#### Key Definitions

Patent valorization refers to the process by which knowledge, inventions, and innovations generated within universities are converted into practical applications, marketable products, or services. This process encompasses various activities, such as the protection of intellectual property rights through patent filings, license negotiations, as well as the development of industrial partnerships and the creation of startups or spin-offs. Valorization is thus considered an essential mechanism for technology transfer, allowing the results of academic research to be channeled into the economic and societal sector.<sup>(8)</sup>

University patents refer to intellectual property rights granted for inventions resulting from research conducted in the academic setting. These patents play a crucial role by providing legal protection to inventions, thereby facilitating their commercial exploitation and integration into industrial processes or innovative products. They represent a strategic lever for universities, enabling them to generate revenue through licensing agreements or the creation of derivative economic entities, while stimulating innovation within the broader economic ecosystem.<sup>(9)</sup>

#### Importance of Patent Valorization

The valorization of university patents falls within a logic of maximizing the socio-economic impact of academic research. By facilitating the transition of innovation from the laboratory to the market, valorization significantly contributes to the dynamization of the knowledge economy, the creation of skilled jobs, and the emergence of disruptive technologies. This process is also instrumental in strengthening the innovation capacities of countries, by encouraging investments in research and development (R&D) and promoting a culture of entrepreneurship within academic institutions.<sup>(9)</sup>

In summary, the conceptual framework of university patent valorization underscores the crucial importance of this process in actualizing the economic and societal benefits of academic research. Through the definition of key terms and the examination of the strategic importance of valorization, this section lays the necessary groundwork to grasp the multiple dimensions of patent valorization in universities, thereby opening the path to a more detailed analysis of strategies and practices on both a national and international scale.

#### International Strategies for University Patent Valorization

The valorization of university patents is a crucial dimension of the global innovation ecosystem, revealing a multiplicity of strategic practices adapted to the regulatory, economic, and cultural contexts specific to each country. This section delves deeper into the exploration of international valorization models,<sup>(10)</sup> by highlighting the various approaches adopted to stimulate and maximize the technology transfer from the university to the industry, as well as the concrete strategies implemented to achieve these objectives.

##### General Overview of International Models and Practices

Internationally, the valorization of university patents is manifested through a wide range of strategic models, each reflecting the peculiarities of the innovation system in which it operates. In the United States, the Bayh-Dole Act of 1980 marked a decisive turning point by allowing institutions receiving federal funding to own, patent, and commercialize the results of state-funded research. This legislation has generated an environment conducive to academic entrepreneurship, catalyzing the creation of technology transfer offices (TTOs) within universities to manage patents and facilitate the commercialization of innovations.<sup>(11)</sup>

In Europe, the preferred approach places greater emphasis on the importance of cross-border cooperation and institutional support for technology transfer. The European framework, through initiatives such as the Framework Programme for Research and Innovation, has encouraged the networking of universities, research centers, and companies, aiming to stimulate collaborative innovation and the valorization of research outcomes on a supra-national scale.<sup>(12)</sup>

Asian countries, such as South Korea and Japan, have also developed robust strategies for the valorization of university patents, focusing on strong national policies to support R&D, entrepreneurship education, and tax incentives for companies investing in university research. These countries are distinguished by a close integration between universities, businesses, and governments, thereby facilitating an efficient technology

transfer.<sup>(13)</sup>

### Patent Valorization Strategies in Practice

The strategies implemented for the valorization of university patents vary according to the objectives and resources available. Among the common practices are:<sup>(14)</sup>

**The establishment of Technology Transfer Offices (TTOs):** These specialized entities play a key role in managing patents, negotiating licenses, and supporting the creation of companies stemming from university research. Their expertise helps to maximize the commercial potential of innovations and facilitates interactions between researchers and industrial partners.

**Incubation and acceleration programs:** To support university entrepreneurs in the critical development phase of their startups, many universities establish incubators and accelerators. These programs offer resources such as workspace, business management advice, access to networks of mentors and investors, as well as startup funding.

**Strategic partnerships with industry:** Direct collaboration between universities and companies allows for the valorization of patents through joint research projects, licensing agreements, and the development of new products. These partnerships facilitate knowledge transfer and align university research with market needs.

**Governmental support policies:** State interventions, in the form of favorable legislation, research grants, and tax incentives for companies collaborating with universities, are crucial levers for stimulating the valorization of university patents.

In conclusion, the international valorization of university patents reveals a complex landscape of strategies and models, each adapted to the peculiarities of its innovation ecosystem. Understanding these diverse approaches offers enriching perspectives for decision-makers and innovation managers, highlighting the importance of a coherent strategic framework, supported by suitable policies and specialized structures, to optimize technology transfer and maximize the socio-economic impact of university research.

### National Strategies for University Patent Valorization in Morocco

In Morocco, the valorization of university patents has become a strategic priority to boost innovation and economic development.<sup>(15)</sup> The Moroccan Office of Industrial and Commercial Property (OMPIC) stands at the heart of this dynamic, offering essential services for the protection and promotion of intellectual property. Through the filing and management of patents, as well as awareness-raising and training for relevant stakeholders, OMPIC plays a key role in strengthening the patent valorization system at the national level.

<sup>(16)</sup> This approach aims not only to secure innovations from university research but also to encourage their commercial exploitation.

Meanwhile, the emergence of dedicated technology transfer structures within Moroccan universities marks an important step in the professionalization of patent management. These structures, although recent, constitute an essential pillar for the effective implementation of valorization strategies. They provide customized support to researchers, from patent filing to the search for industrial partnerships, thus facilitating the transition of innovation from the laboratory to the market. This initiative reflects an awareness of the importance of framing the valorization process with specialized skills tailored to the challenges of innovation.<sup>(17)</sup>

Morocco has also committed to supporting entrepreneurship and innovation through the establishment of incubators and accelerators.<sup>(18)</sup> These support spaces are crucial for emerging technological startups, providing them with an environment conducive to their development. By offering mentorship, facilitated access to funding, and networking opportunities, these structures play a decisive role in the success of companies stemming from university research. This entrepreneurship support complements patent valorization efforts, as it contributes to transforming innovations into commercial successes.<sup>(19)</sup>

The establishment of public-private partnerships proves to be another key strategy for patent valorization in Morocco. By fostering collaboration between universities and the industrial sector, these partnerships enable a smoother and more efficient technology transfer.<sup>(20)</sup> Joint research projects, industrial chairs, and co-development programs are modalities that strengthen the links between academic research and market needs. This synergy among the various actors in the innovation ecosystem is fundamental to accelerate the commercialization of innovations and maximize their economic and social impact.<sup>(21)</sup>

Finally, the adaptation of legislative and regulatory frameworks plays a crucial role in the effectiveness of the patent valorization system. The revision of legislation related to intellectual property, aimed at simplifying patent filing procedures and implementing incentives for research and innovation, constitutes a significant advancement. These legislative adjustments are essential to create an environment conducive to innovation, ensuring effective protection of inventions, and stimulating investment in research and development.<sup>(22,23)</sup>

These various initiatives demonstrate Morocco's commitment to the valorization of university patents. However, the full realization of this potential requires a coherent and integrated approach, relying on continuous evaluation and adaptation of strategies to the realities on the ground. Strengthening institutional capacities, increased collaboration between universities and the private sector, as well as a clear policy to



support innovation, are all levers to be mobilized to ensure the success of patent valorization in Morocco.

### **Standards for successful patent valorization in the academic environment**

In exploring patent valorization within the academic milieu, it is important to examine success standards as well as the obstacles encountered in this process, both internationally and locally in Morocco. This analysis allows for a nuanced understanding of the criteria that define the success of patent valorization and the challenges to overcome in order to optimize the impact of university innovation.

Success standards in university patent valorization are multidimensional and include several key indicators. Among these indicators, the number of patents filed by universities and their quality, measured in terms of innovation and commercial potential, are often cited. Additionally, the effectiveness of technology transfer, evaluated through the number and value of licensing agreements concluded with the industrial sector, as well as the success of startups stemming from university research, are relevant measures of valorization success. These standards not only reflect the ability to generate patentable innovations but also to transform them into viable commercial applications, thus contributing to the knowledge economy and societal value creation.<sup>(24)</sup>

However, achieving these success standards is hindered by a range of barriers and obstacles. At the international level, challenges often include insufficient funding for research and development, gaps in researchers' entrepreneurial skills, and complexities related to intellectual property regulation. Other obstacles may be related to the institutional culture of universities, where commercial valorization of research may be perceived as secondary to academic publications.<sup>(17)</sup>

In Morocco, these obstacles are also present and may be amplified by local specificities. Funding for research and innovation remains a major challenge, limiting universities' ability to pursue research projects with high valorization potential. Furthermore, the development and professionalization of technology transfer structures are still ongoing, which can hinder the effectiveness of the valorization process. Collaboration between universities and industry also requires significant impetus to facilitate technology transfer and commercial exploitation of innovations.<sup>(25)</sup>

In summary, although the path to successful valorization of university patents is fraught with obstacles, the adoption of targeted strategies and the establishment of a conducive environment can significantly enhance research and innovation capabilities. For Morocco, as for other countries, the challenge lies in the ability to adapt, innovate, and collaborate to transform scientific potential into technological and commercial advancements beneficial to society as a whole.

### **State of Affairs of University Patent Valorization in Morocco**

Morocco, like many developing countries, faces a significant challenge in terms of innovation and the valorization of university research. While the country has made significant progress in adopting legislation and policies favoring the protection of intellectual property, challenges remain regarding the effective implementation of these measures and the promotion of an environment conducive to innovation.

Morocco has implemented various programs to support academics in patent filing. For instance, the Industrial Innovation Program aims to support 100 qualified projects to develop and strengthen patents, covering 80 % of the patenting process costs.<sup>(26)</sup> This program serves as a response to challenges such as low research funding, limited scientific productivity, and low innovation capacity in the country.<sup>(27)</sup>

The patent system in Morocco has also been strengthened by topic-based programs to support scientific research, including patent applications filed by Moroccan university researchers. Additionally, the launch of the Inventor Assistance Program (IAP) in 2015 has created further opportunities for the country to enhance support for its local talents and to benefit more from its natural creative resources.<sup>(28)</sup> This initiative has expanded the pool of patent professionals capable of offering their services pro bono via the IAP.<sup>(29)</sup>

Furthermore, to enhance its support for innovation, Morocco has also established a network of Technology and Innovation Support Centers (TISCs) to increase the number of patent applications filed by residents.<sup>(28)</sup> The country has also encouraged the creation of incubators for innovative businesses aiming at exploiting patents and valorizing research or technology results.<sup>(30)</sup>

Several measures and mechanisms have been implemented to institutionalize intellectual property protection mechanisms in research institutions and encourage researchers to file patents. These efforts have had a very positive impact (significant progress) on the number of patents filed originating from universities. These measures mainly include:<sup>(31)</sup>

1. Regular coordination between OMPIC and the Ministry responsible for research;
2. Introduction, for the first time in 2009, of a budget category in universities' budgets to cover the costs of patent filing and related annuities;
3. Decisions by the Board of Directors of OMPIC to grant significant reductions on filing fees to university depositors;
4. Strengthening of OMPIC's support system for universities;
5. Introduction of a performance indicator 'patent filed and accepted' in development contracts

between the State and universities;

6. Establishment of TISC branches in all public universities;
7. Organization of workshops and awareness campaigns on various aspects of IP, particularly patents;
8. Provision of training sessions for universities on patents (disclosure, information searches, patent management, licensing, etc.);

The number of patent applications filed by universities increased from 12 % patents in 2009 to 49 % patents in 2015 and 57 % patents in 2022.<sup>(32)</sup>

Regarding the regulatory framework, Morocco has ratified several international agreements related to intellectual property, including the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement) of the World Trade Organization (WTO)<sup>(33)</sup> and is a member of the World Intellectual Property Organization (WIPO).<sup>(34)</sup> The country has also enacted national legislation on intellectual property, notably Law No. 17-97 on the protection of industrial property.<sup>(35,36)</sup>

However, despite these advancements, the number of patents filed by Moroccan universities remains low compared to other countries. Intellectual property statistics from WIPO indicate that Morocco ranks 68th globally in terms of patent filings, far behind countries like China, the United States, or Germany.<sup>(37)</sup>

Several factors may explain this situation. The lack of awareness among university researchers about the importance of intellectual property protection and the valorization of their research, as well as the lack of collaboration between universities and businesses, is another obstacle to the valorization of university patents.<sup>(38)</sup>

Additionally, insufficient funding for university research is another challenge to overcome. The latest statistics from the World Bank show that Morocco only allocates 0,7 % of its gross domestic product (GDP) to research and development (R&D), well below the global average of 2,55 %.<sup>(39)</sup>

In conclusion, while Morocco has made progress in intellectual property protection, challenges remain regarding the valorization of university patents. It is essential to enhance awareness among researchers about the importance of intellectual property protection, improve the links between universities and businesses, and increase funding for university research to foster an environment conducive to innovation.

## METHODS

The methodological approach adopted for this research on patent valorization within Moroccan public universities is situated within a qualitative framework, prioritizing a deep understanding of the perspectives and practices of key actors in this process. The development of a semi-structured interview guide is the cornerstone of this approach, allowing for an exhaustive exploration of the multiple dimensions of patent valorization. This guide was developed following a focus group session involving the research team. This initial step facilitated the integration of strategic axes that formed the foundation of the guide: Institutional and policy framework, patent management, collaboration and partnerships, financing and resources, impact and success measures and training and awareness.

The relevance and suitability of the interview guide to the specific context of Moroccan universities were ensured through a validation process conducted in collaboration with officials from Hassan 1st University of Settat, specializing in patent valorization. This validation process allowed for the refinement of questions and ensured that the themes addressed were significant and relevant to the research objectives.

On the other hand, a benchmarking methodology was adopted to compare the national strategies for patent valorization in Moroccan universities with recognized international practices. This comparison was based on an exhaustive analysis of scientific literature and relevant institutional reports. This approach allowed for the formulation of specific recommendations for improving patent valorization strategies in the Moroccan university context. Furthermore, we established an overview of the patent registration activity of Moroccan universities, relying on the annual reports of the Moroccan Office of Industrial and Commercial Property (OMPIC), while highlighting essential statistical data related to patents.

Access to participants and the richness of the data collected were significantly facilitated by the use of professional networks to which I belong, specifically the Association for the Promotion of Innovation, Transfer, and Exploitation of Knowledge (PRINTES) and the Technology and Innovation Support Centers (TISC) network. These affiliations opened privileged communication channels with experts and university officials directly involved in patent valorization, thereby enriching the quality and diversity of the testimonies collected.

The selection of universities participating in the study was driven by a concern for representativeness and diversity, including Sidi Mohamed Ben Abdellah University in Fez, Mohammed V University in Rabat, Chouaib Doukkali University in El Jadida, Hassan II University in Casablanca, and Hassan 1st University in Settat. This selection aimed to cover a broad spectrum of institutional and geographical contexts, thus enabling an understanding of the different realities of patent valorization within the Moroccan university landscape. Before conducting the interviews, solicitation letters were sent to the relevant officials, outlining the research objectives and formalizing the request for participation. This preliminary step was complemented by visits to facilities dedicated to patent valorization, offering an immersion into the direct environment of valorization

practices.

Data collection was conducted in accordance with the fundamental ethical principles of research, ensuring the anonymity and confidentiality of the information gathered.

The interpretation of data from the interviews was carried out on a personalized basis due to the human scale of the samples studied. This nuanced analytical approach allowed for the extraction of precise insights on the challenges and successes of patent valorization in Moroccan universities, as well as on possible improvement strategies.

## RESULTS

In this section of our work, we present a detailed analysis of the data collected during our study on patent valorization in Moroccan public universities. This section comprehensively outlines the results obtained from interviews with university officials, compares patent valorization strategies internationally, and analyzes official statistics related to patent filings at the Moroccan Office of Industrial and Commercial Property (OMPIC) up to 2022. We also explore the significant contribution of universities and research centers to the Moroccan innovation landscape. This section highlights the challenges, successes, and future prospects of patent valorization, providing an overview of current dynamics and potential avenues for improvement to enhance the impact of academic research on the economic and technological development of Morocco.

### Summary of interview results

As part of this in-depth study on patent valorization within Moroccan public universities, interviews were conducted with university officials directly involved in this process. The aim was to identify specific challenges encountered in the Moroccan academic environment and to identify success factors that have emerged despite these obstacles. This analysis also seeks to formulate strategic recommendations, based on the perceptions and experiences of key stakeholders, to enhance patent valorization in Moroccan universities.

#### *Analysis of Encountered Challenges*

**Financial Resources Shortage:** A major constraint identified is the limited funding allocated to research and patent valorization. Officials point to insufficient budgetary allocation that does not cover the costs associated with the development and commercialization of innovations. This financial gap hampers the researchers' ability to carry out applied research projects and to successfully commercialize them.

**Valorization Skills:** The analysis also reveals a deficit in intellectual property valorization skills among academic staff and members of technology transfer offices (TTO). The lack of knowledge about patenting procedures, commercialization strategies, and market dynamics constitutes a significant barrier to the effective exploitation of patents.

**Industry-University Collaboration:** Interviews highlight limited interaction between universities and the industrial sector. This limited collaboration reduces opportunities for technology transfer and joint development of innovative products or services. Officials suggest that incentivizing mechanisms could stimulate these partnerships essential for patent valorization.

**Regulatory and Institutional Framework:** Difficulties related to the regulatory and institutional framework have also been highlighted, including heavy bureaucracy and complex patenting procedures. These administrative constraints lengthen the timelines for protecting inventions and sometimes discourage valorization initiatives.

#### *Success Factors*

**Training and Awareness Initiatives:** Training programs aimed at researchers and TTO staff have been implemented to address the lack of skills in intellectual property management. These initiatives contribute to better preparation of the actors involved in patent valorization and foster a culture of innovation within universities.

**Increase in Patent Filings:** Despite the challenges, a significant increase in the number of patents filed by Moroccan universities has been observed. This success reflects a heightened awareness of the importance of intellectual property protection and a strengthened commitment to innovation.

#### *Strategic Recommendations*

**Enhancing Funding:** It is imperative to increase funding dedicated to research and patent valorization. This could include establishing specific funds for prototype development and commercialization, as well as tax incentives for companies investing in university R&D.

**Skills Development:** Continuous training for researchers and TTO staff in patent valorization should be a priority. This includes entrepreneurship, intellectual property management, and marketing strategies, to equip key actors with the necessary tools for effective innovation valorization.

**Facilitating Collaborations:** Creating collaboration platforms between universities and industry, facilitated by government policies and incentives, can boost technology transfer. Strategic partnerships should be encouraged

to fully exploit the commercial potential of university patents.

**Simplification of Regulatory Framework:** Reform of the regulatory framework is necessary to streamline patenting procedures and reduce bureaucracy. Such reform should aim to make the patent valorization process more agile and attractive for researchers and investors.

In conclusion, while substantial challenges hinder patent valorization in Moroccan public universities, notable progress has been made. Recommendations from interviews with university officials provide a roadmap for improving the valorization process, focusing on funding, skills development, industry-university collaboration, and regulatory reform. Adopting these strategies could significantly increase the success rate of patent valorization, thus contributing to innovation and economic development in Morocco.

**Table 1.** Summary of interview results

Category	Description
Analysis of Encountered Challenges	<ul style="list-style-type: none"> <li>-Insufficient Financial Resources: Budgetary constraints hinder covering the costs of research and valorization.</li> <li>-Valorization Skills Gap: Lack of expertise in intellectual property management.</li> <li>-Industry-University Collaboration: Limited interaction impedes technology transfer.</li> <li>-Regulatory and Institutional Framework: Heavy bureaucracy and complex patenting procedures.</li> </ul>
Success Factors	<ul style="list-style-type: none"> <li>-Training and Awareness Initiatives: Training programs to enhance intellectual property skills.</li> <li>-Increase in Patent Filings: Growing awareness and commitment to intellectual property protection and innovation.</li> </ul>
Strategic Recommendations	<ul style="list-style-type: none"> <li>-Strengthening Funding: Increase funding for research and patent valorization.</li> <li>-Skills Development: Prioritize continuous training in patent valorization.</li> <li>-Facilitating Collaborations: Establish platforms for collaboration between universities and industry.</li> <li>-Simplifying Regulatory Framework: Reform the framework to simplify patenting procedures</li> </ul>

### **Benchmarking of national strategies for valorizing university patents in Morocco with international practices**

The comparison between international strategies for valorizing university patents and those implemented in Morocco highlights both similarities and significant divergences, reflecting common ambitions as well as specific challenges within each context.

#### *Similarities*

**Intellectual Property Protection:** Similar to international practices, Morocco places crucial importance on intellectual property protection as the foundation of patent valorization. The Moroccan Office of Industrial and Commercial Property (OMPIC) plays a role similar to patent offices in other countries, facilitating patent filing and promoting intellectual property awareness.

**Technology Transfer Structures:** The establishment of technology transfer offices (TTOs) within Moroccan universities aligns with a global trend aimed at professionalizing patent management and encouraging technology transfer to industry, a well-established practice in countries such as the United States and several European states.

**Support for Entrepreneurship:** The development of incubators and accelerators to support technology startups stemming from university research is a strategy adopted both in Morocco and internationally, recognizing the importance of entrepreneurship in valorizing innovations.

#### *Divergences*

**Maturity of TTOs:** Technology transfer offices in Morocco are relatively new and in the developmental phase, unlike countries like the United States where TTOs are well-established and have played a major role in patent valorization for decades. This difference in maturity affects the ability to effectively manage patents and negotiate licensing or partnership agreements.

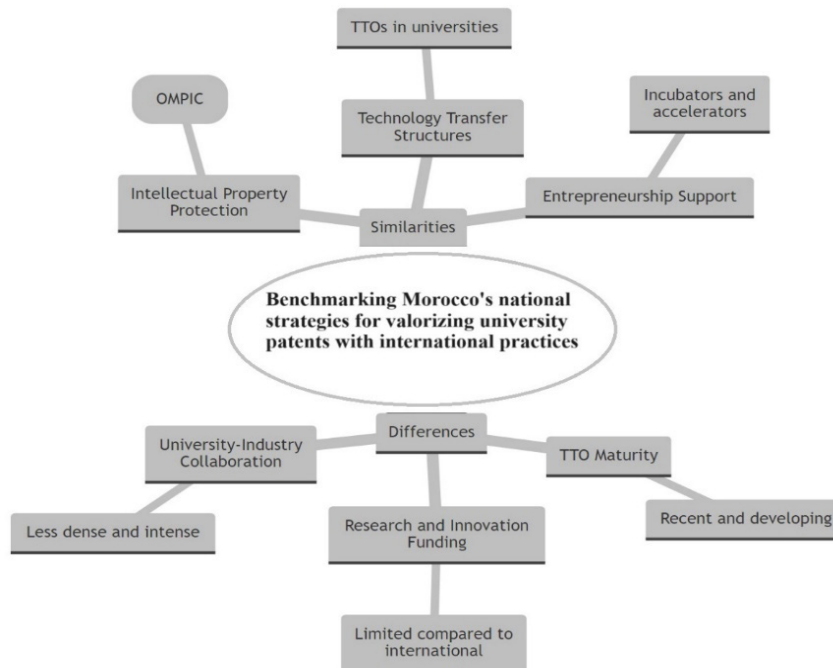
**Research and Innovation Funding:** While progressing, funding systems for research and innovation in Morocco remain limited compared to the resources available in regions like Europe or North America. European Union programs offer substantial resources for the development and commercialization of innovations, highlighting the need for Morocco to increase investments in this area.

**University-Industry Collaboration:** Although efforts are made to encourage public-private partnerships in Morocco, the density and intensity of collaborations between universities and industry are higher in countries with a long tradition of patent valorization. These countries benefit from mature innovation ecosystems where



interactions between academic research and the industrial sector are highly institutionalized.

In conclusion, the comparison reveals that while Morocco has adopted key strategies in line with international trends for the valorization of university patents, gaps remain, particularly in terms of the maturity of technology transfer structures, funding for research and innovation, and the depth of university-industry collaborations. To bridge these gaps, Morocco could draw inspiration from successful international models by strengthening the institutional capacities its TTOs, increasing investments in research and innovation, and fostering an environment conducive to strategic partnerships between universities and the industrial sector.

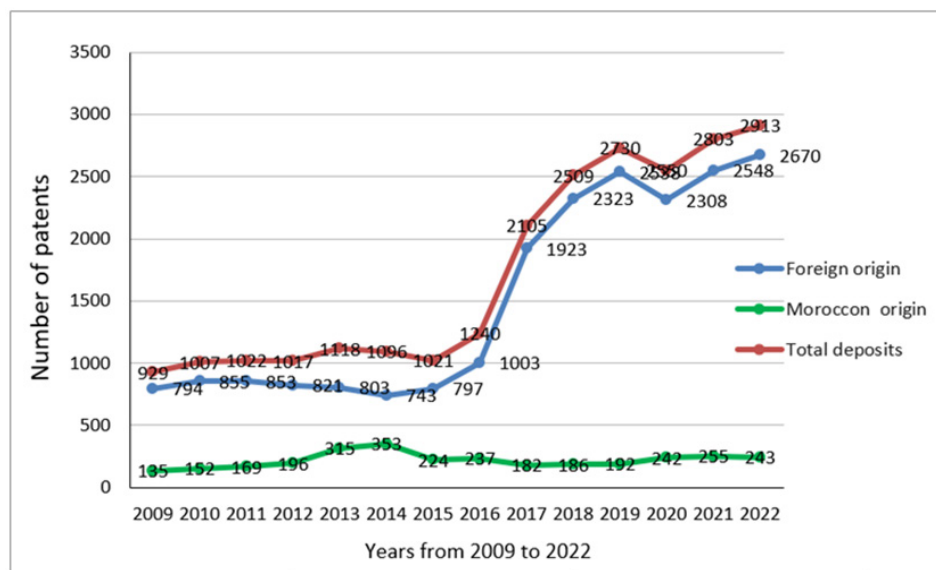


**Figure 1.** Benchmarking Morocco's national strategies for valorizing university patents with international practices

### Invention Patents in Morocco: Statistics

We will present the official statistics that illustrate the evolution of invention patent (IP) filings at OMPIC up until 2022, as well as the contribution of universities and research centers to the development of inventive activity and IPs in Morocco.<sup>(40)</sup>

#### *Evolution and Distribution of Invention Patent (IP) Application Filings by Applicant Origin (2009-2022)*

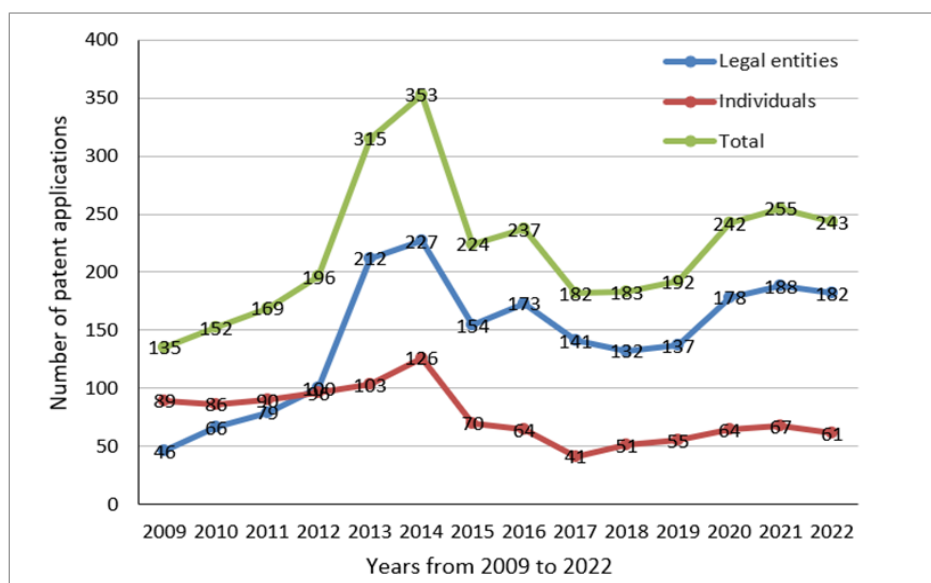


**Figure 2.** Evolution of Invention Patent (IP) Application Filings by Applicant Origin (2009-2022)

Source: <sup>(32)</sup>

During this period (2009 to 2022), the distribution of patent applications clearly shows the predominance of foreign-origin filings, which account for approximately 87 %. Conversely, those of Moroccan origin seldom exceed 13 %.

#### *Evolution of Moroccan-Origin Invention Patent Application Filings by Applicant Type (2009-2022)*



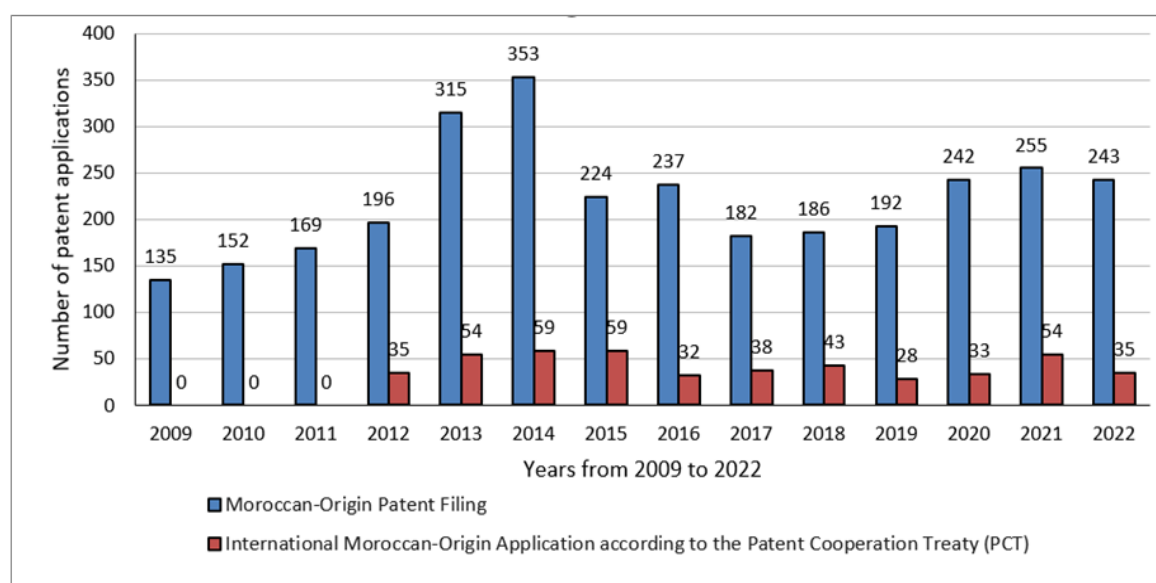
**Figure 3.** Evolution of Invention Patent (IP) Application Filings by Type of Applicant (2009-2022)

Source: <sup>(32)</sup>

During this period (2009 to 2022), there is an upward trend in the filings of Moroccan-origin invention patent applications by legal entities until the year 2014, after which a slight decrease and a downward trend in filings by natural persons is observed.

Indeed, the average over these 14 years for legal entities is 65 % (an increase from 34 % in 2009 to 75 % in 2022), while the average for natural persons is 35 % (a decrease from 66 % in 2009 to 25 % in 2022). This can only be explained by the very positive evolution of Moroccan-origin invention patent filings by universities and research centers, as we will see in the following sections.

#### *Evolution of International Filings of Moroccan-Origin Invention Patent Applications according to the Patent Cooperation Treaty (PCT) (2009-2022)*

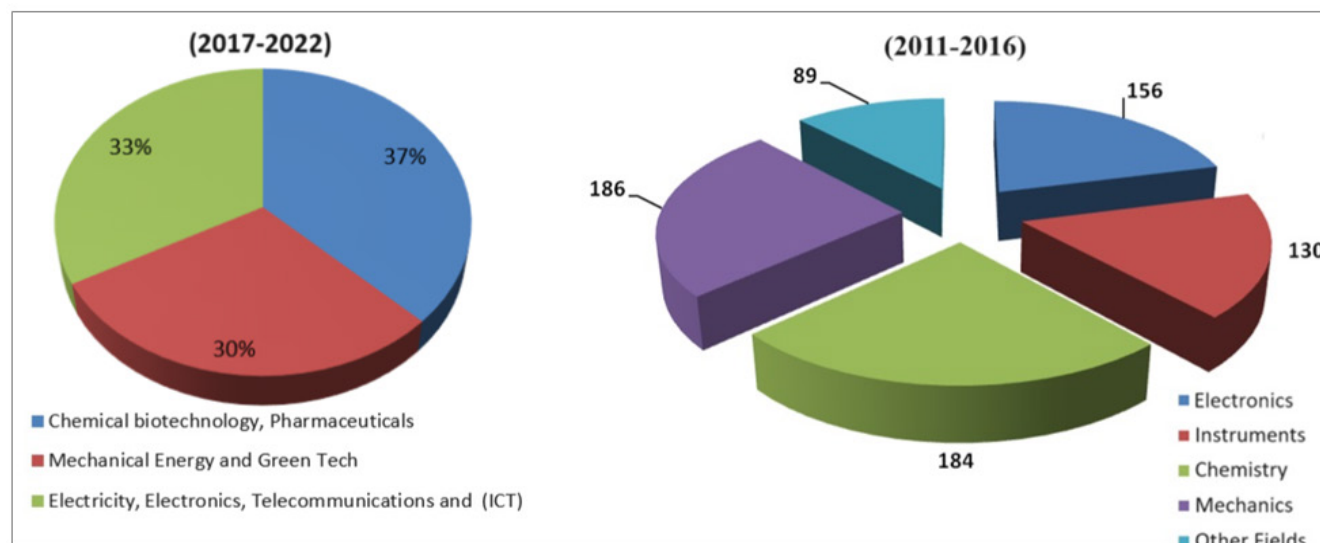


**Figure 4.** Evolution of International Filings of Moroccan-Origin Invention Patent Applications according to the Patent Cooperation Treaty (PCT) (2009-2022)

Source: <sup>(32)</sup>

The activity of filing international invention patent applications of Moroccan origin according to the Patent Cooperation Treaty (PCT) only began in the year 2012, and a significant increase in international filings is noted: with 35 applications in 2012 compared to 54 applications in 2021.

*Evolution and Distribution of Moroccan-Origin Invention Patent Application Filings by Technological Field (2009-2022)*

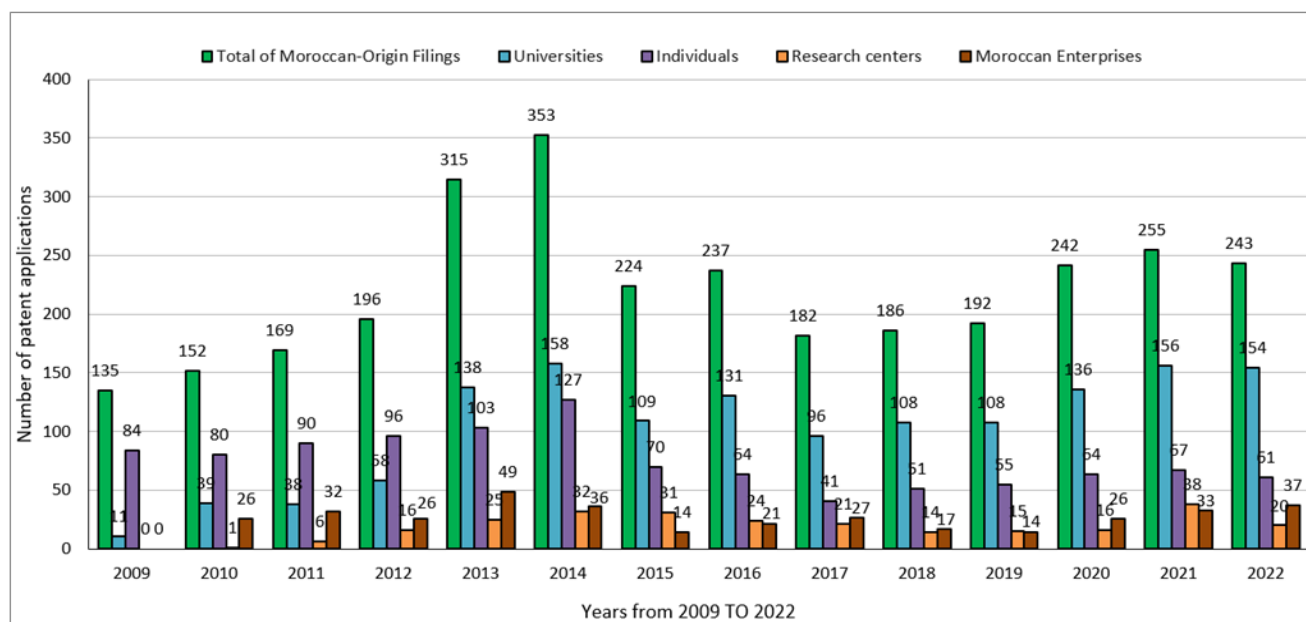


**Figure 5.** Distribution of Moroccan-Origin Invention Patent Application Filings by Technological Field  
Source: <sup>(32)</sup>

The distribution by technological field of Moroccan-origin invention patent applications shows that it encompasses various domains, with chemistry and mechanics being the most dominant, closely followed by electronics and instruments.

**Invention Patents in Moroccan Universities and Research Centers**

*Evolution by Type of Applicant for Moroccan-Origin Invention Patent Applications (2009-2022)*



**Figure 6.** Evolution by Type of Applicant for Moroccan-Origin Invention Patent Applications (2009-2022)  
Source: <sup>(32)</sup>

The evolution (2009 to 2022) of the filings of invention patent applications of Moroccan origin, distributed according to types of applicants, shows that filings from universities have seen a significant increase: with

154 applications filed in 2022 compared to 11 in 2009. Similarly, those made by research centers: with 20 applications filed in 2022 against 0 in 2009.

During the period (2013 to 2022), there is a predominance of invention patent applications of Moroccan origin by universities and research centers followed by individual inventors. Whereas filings from companies do not exceed 12 %.

### Portfolio of Patent Applications Filed by Universities and Research Centers

The evolution of the number of patent applications per Moroccan establishment for the period 2010-2019, according to IMIST,<sup>(41)</sup> reveals that 79,2 % of the total portfolio of Patent Applications by universities and Research Centers is concentrated in the Rabat-Casablanca axis, with a predominance of the three Rabat institutions (International University of Rabat, Mohamed V University, and MASCIR) holding 63,1 % of the portfolio.

## DISCUSSION

Within the Moroccan academic landscape, a significant evolution has been observed in the field of intellectual property, particularly through a notable increase in the number of patent filings by universities and research centers. This trend, highlighting a heightened commitment to the dissemination of IP culture and the protection of inventions, saw the total number of patent filings by universities and research centers accounting for 64,26 % on average during the four years (2018-2022) compared to Moroccan-origin filings.<sup>(42)</sup> However, despite this effort, given the very limited number of patents valorized during the same period,<sup>(43)</sup> questions arise regarding the relevance and efficiency of the IP strategies adopted by these universities.

Indeed, universities have encouraged patent filing during these years with a vision of disseminating IP culture and protecting inventions. However, they have done so without considering the economic dimension of patents, which remains the main reason for the protection system's existence.<sup>(38)</sup>

With the evolution of patent portfolios of some highly active universities in the field (UM5R, UHP, USMBA, etc.) and the pressure of budgetary expenses related to them, these universities have begun to change their approach to these issues by developing valorization activities and collaboration with businesses. Thus, the economic dimension has started to strongly emerge from 2014 onwards.

On another note, international comparison reveals the dominance of invention patents registered by companies pursuing this path as part of their international market development strategy.<sup>(44)</sup>

In Morocco, the share of companies in terms of patent applications for inventions does not exceed 11 % on average over the past decade, which reflects the weakness of inventive activities and technological development within the national economic fabric. This weakness could be leveraged by universities by engaging with national companies and positioning themselves as operators in technological development and technology transfer capable of meeting the innovation needs of these companies at lower costs and risks, at least in the initial phases of project development.

The continuity and success of activities throughout the technology transfer value chain are, of course, dependent on the quality of the national innovation policy in place. This policy should propose and implement various mechanisms, tools, and infrastructures to support both universities and businesses along the technology transfer value chain and ensure the conditions for the success of this collaboration.<sup>(18)</sup>

Interviews with university officials have highlighted several major obstacles to patent commercialization. Among these obstacles, insufficient funding for the post-patenting development phase, deficiencies in commercial and entrepreneurial skills among researchers, weak collaborations with the industrial sector, and a restrictive regulatory framework stand out as the most prevalent. These elements serve as barriers to transforming patented inventions into marketable products or services, thereby limiting their impact on economic development and innovation in the country.

Given these findings, it is imperative to develop and implement strategic recommendations aimed at overcoming these obstacles. Firstly, allocating funds dedicated to patent commercialization is crucial. This involves creating specific financing mechanisms, such as maturation funds or prototype development assistance, which could facilitate the transition of innovation from the laboratory to the market. These funds would cover the costs associated with concept validation, feasibility studies, and early-stage commercialization, thus addressing the lack of financial resources dedicated to this critical phase.

Secondly, strengthening entrepreneurial and intellectual property management skills within the academic community is essential. This could be achieved through the implementation of targeted training programs for researchers and technology transfer office personnel. These programs should cover practical aspects of innovation commercialization, including licensing negotiation, market strategies, and spin-off company creation. The goal is to equip university stakeholders with the necessary tools to navigate effectively in the innovation ecosystem and maximize the commercial outcomes of their research.

Thirdly, encouraging and structuring collaborations between universities and the industrial sector is a priority. Establishing incentive mechanisms for co-development of applied research projects and for creating



strategic partnerships could stimulate technology transfer and foster the integration of innovations into industrial applications. These collaborations could benefit from flexible contractual frameworks and dedicated exchange platforms, thus strengthening the links between the academic and economic spheres.

Finally, a revision of the regulatory framework related to patent commercialization is necessary. Simplifying administrative procedures related to patent filing and the creation of research-based companies, and loosening regulations governing public-private partnerships, could significantly reduce bureaucratic barriers. Adopting legislation more favorable to innovation, inspired by international best practices, would contribute to creating a more conducive environment for patent commercialization.

In summary, the implementation of these recommendations requires a coordinated approach and strong commitment from governmental, academic, and industrial stakeholders. Such a strategic and integrated approach is essential for overcoming the obstacles to patent valorization and for fully leveraging the innovation potential of Moroccan public universities, thereby contributing to the country's economic development and technological advancement.

## CONCLUSIONS

Within the Moroccan academic ecosystem, the proliferation of patent filings by universities and research and development (R&D) centers marks a significant shift towards the recognition and protection of innovation. This evolution reflects a clear intent by these institutions to align their research efforts with a rigorous intellectual property strategy. However, the connection between the quantitative success of patent filings and their effective economic valorization reveals a notable disparity, highlighting the complexities and challenges inherent in the process of monetizing innovations.

The initiatives undertaken by academic institutions, such as establishing strategic partnerships and creating incubators, are explicitly aimed at overcoming the barriers to patent valorization. These mechanisms are designed to facilitate technology transfer and the commercialization of research outcomes, with the support of the Moroccan Office of Industrial and Commercial Property (OMPIC), which has developed dedicated operational tools for this purpose. These tools aim to maximize the exploitation of patents as levers for the protection and valorization of inventions.

Despite these efforts and the substantial progress made by Morocco in improving its legal framework for patents and copyrights, the transition from research to commercially viable innovation remains hindered by several factors. These obstacles underscore the need for a more in-depth reflection on the modalities of patent valorization, which must consider both the commercial potential and the scientific value of innovations.

Thus, while the record of patent filings in Morocco is encouraging, reflecting a positive dynamic in the protection of intellectual rights, the economic valorization process of these patents is still in a maturation phase. This observation calls for an integrated strategy, mobilizing governmental, academic, and industrial actors, to address the challenges of commercial valorization. It is imperative that future developments in this area favor a holistic approach, incorporating commercial dimensions from the initial phases of research and patent development. Only a coherent and collaborative policy will enable the quantitative increase in patent filings to be converted into significant commercial successes, thus contributing substantially to Morocco's economic development and innovation.

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