

**Analysis of the current state of scientific research in Morocco: A study derived from Moroccan publications indexed in the SCOPUS database**

**Analyse de l'état actuel de la recherche scientifique au Maroc : une étude issue des publications marocaines indexées dans la base de données SCOPUS**

**BAAKIR Houssam**

Doctor in Management Sciences  
ENSA Berrechid  
Hassan First University - Morocco  
LAMSAD Laboratory

**ELLIQUA Hanane**

Teacher-researcher and Doctor in Management Sciences  
ENSA Berrechid  
Hassan First University - Morocco  
LAMSAD Laboratory

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**Abstract:**

Scientific research has played and continues to serve a critical function in the social and economic growth of nations. By predicting issues, shedding light on different concerns, and proposing solutions, it provides valuable insights and critical information to policymakers. Nevertheless, these stakeholders have a responsibility to classify issues, guide research, exploit its results, and thereby enhance the value of scientists' work. From this angle, the questions raised are expected to stimulate current dynamics of interconnection between different research and scientific communication activities and enhance the efficiency of scientific institutes' contributions. This article provides an examination of the current situation of scientific research in Morocco, focusing on its historical evolution, existing challenges, and future perspectives. The study examines the development of scientific research from the colonial period to post-independence, emphasizing the persistent disparities between the education system and industrial requirements. A significant aspect of the research consists of analyzing scientific papers published between 1996 and 2024, obtained from the Scopus database, to analyze trends in the Bibliometric indices, the citable documents and non-citable documents, cited documents and uncited documents, external cites, international collaboration, external cites and self-cites, open access output, and the domains addressed by the researchers. The survey highlights notable developments in Morocco's scientific activity. The findings indicate the requirement for better cooperation between academic research and industrial fields to foster a knowledge-based economy. Recommendations are presented to strengthen Morocco's scientific capabilities, support innovation, and reinforce the collaboration between research entities and industry.

**Keywords:** scientific research, Research publication, Scopus database, Knowledge economy, Research reforms.

**Résumé :**

La recherche scientifique a joué et continue de jouer un rôle essentiel dans la croissance sociale et économique des nations. En anticipant les problèmes, en éclairant les différentes préoccupations et en proposant des solutions, elle fournit des éclairages précieux et des informations cruciales aux décideurs politiques. Néanmoins, ces acteurs ont la responsabilité de classer les problématiques, d'orienter la recherche, d'exploiter ses résultats et, ainsi, de valoriser le travail des scientifiques. De ce point de vue, les questions soulevées devraient stimuler la dynamique actuelle d'interconnexion entre les différentes activités de recherche et de communication scientifique et améliorer l'efficacité des contributions des instituts scientifiques. Cet article examine la situation actuelle de la recherche scientifique au Maroc, en se concentrant sur son évolution historique, les défis existants et les perspectives d'avenir. L'étude examine le développement de la recherche scientifique de la période coloniale à l'après-indépendance, en soulignant les disparités persistantes entre le système éducatif et les besoins industriels. Un aspect important de la recherche consiste à analyser les articles scientifiques publiés entre 1996 et 2024, obtenus à partir de la base de données Scopus, afin d'analyser les tendances des indices bibliométriques, des documents citables et non citables, des documents cités et non cités, des citations externes, de la collaboration internationale, des citations externes et auto-citations, de la production en libre accès et des domaines abordés par les chercheurs. L'enquête met en évidence les évolutions notables de l'activité scientifique au Maroc. Les résultats indiquent la nécessité d'une meilleure coopération entre la recherche universitaire et les domaines industriels pour favoriser une économie fondée sur la connaissance. Des recommandations sont présentées pour renforcer les capacités scientifiques du Maroc, soutenir l'innovation et renforcer la collaboration entre les entités de recherche et l'industrie.

**Mots clés :** Recherche Scientifique, Publication de Recherche, Base de données Scopus, Economie de la connaissance, Réformes de la recherche.

## Introduction

Scientific research is one of the key drivers in the quest for a knowledge-based society and a major contributor to growth Valavanidis, A., (2016). Research indicates that scientific research has an enormous influence on growth and its intelligent incorporation into the knowledge economy Bastalich, W. (2010). Supported in advance by excellent education, scientific research is essential to the development of society, its wealth and the well-being of all citizens. All nations have their own scientists and require a science strategy to promote knowledge as a human asset and, especially, to boost their public plans Han, X., Xu, Q., (2024). As a consequence, developed nations, now caught up by emerging nations, have been able to keep up a performing quality of research and innovation by implementing suitable policies and making considerable investments, which have created beneficial repercussions for their economies in specific and for their societies generally Glantz, L. H., Annas, G. J., Grodin, M. A., (2024). Nowadays, it is the knowledge economy that guarantees competitive advantage in a climate of globalization, where competition is centered on knowledge, innovation, and on the adoption of international rankings and indices of scientific production and excellence Insee, K., & Suttipun, M. (2023). In various nations, to guarantee the progress of research, a state-of-the-art information technology infrastructure and considerable investment are devoted to it. At the same time, the developments of the digital technology revolution have drowned society in information Richey, R. C., (2013). Yet the information that travels endlessly on digital content platforms and social networks does not always qualify as knowledge. It is education, training and scientific research that enable us to interpret this information, generate it scientifically and convert it into knowledge Bell, B. S., Tannenbaum, S. I., (2017). In this respect, the quality of education and the progress of R&D combine to form a knowledge-based society Aliu Mulaj, L., (2022). Nevertheless, in order to enhance its competitiveness in the increasingly globalized knowledge economy, the kingdom needs to keep investing in scientific research to enhance its innovation capabilities Katić, A., Kiš, T., Čosić, I., (2015). In the current paper, we have aimed to clarify the development of the national sciences in the kingdom, which have replaced the colonial legacy, and to investigate the relevance of the hypothesis that scientific institutions need to assume an increasingly central role. Since they constitute veritable growth drivers, notably in nations that have yet to break out of their underdevelopment cycle. This examination will allow us to establish a framework on which we will base our analysis, while highlighting the key recommendations regarding the true role that scientific research is expected to fulfill. The significance of the association between scientific publication and innovation differs from

one country to another, based on the level of industrialization and the encouragement offered to scientific research by firms and Higher education. In fact, acquiring a competitive advantage relies on creating a powerful relationship between scientific knowledge and technological innovation. This highlights the fact that the contributions of corporations, academics and laboratories to knowledge generation differ from one nation to another. Encouraging this interaction would enhance the responsiveness of scientific research to various economic and social requirements A. Mercier, (2012). By seeking to elucidate these highly intricate interactions, scientific research is also expected to shed light on the decisions and choices that are required between goals that are frequently in conflict with each other (productivity, protection of the environment, etc). The mission of scientific research is not only to offer explanations for these contradictions, but also to seek to surmount them by offering harmonizing solutions Foray, D., Mowery, (2012). In the Kingdom, the present situation indicates that training for technical and scientific staff is inadequate. Training establishments generally suffer from a general lack of financial and logistical resources and are therefore often left out of the mainstream of scientific innovation, in the lack of effective policies to enable scientific research to demonstrate its potential to enhance economic development H. Yūjirō (1998). M. Kleiche (2002) points out that, in this context, the university is viewed as the main source of research scientists, and the majority of scientists in the kingdom operate in universities. They perform their investigations on their own initiative, as they have neither instructions nor requests. As a result, they are generally separate from the economic sphere Kerak, E., (2014). Conversely, R&D is more organized in some large (semi-public) firms and government agencies, which attract scientists from key strategic sectors to tackle more specific, targeted problems. Nevertheless, despite the fact that scientific research in the kingdom has become institutionalized, it has not yet been transformed into a truly innovative process designed to satisfy the requirements of the country's economic spheres. The Structural Adjustment Plan of the 1980s demonstrated a significant disparity between training and job market offers. L. Jaidi (1992) points out that the Kingdom has specialized industries in fields ranging from textiles, agri-food exports, building materials and low-value-added consumer goods to phosphate mining. These sectors do not develop new products or implement sophisticated technologies. Furthermore, the goals of overseas corporations frequently do not match the country's development needs. Their impact on science boost is limited. These firms often hold their laboratories in their country of provenance and are naturally not concerned by the further development of local universities and R&D institutes. It appears that combining the

interests of industry and executives to advance science is no simple matter. For the research community, market constraints, evolving modes of production and all the transformations affecting their surroundings call on them to develop innovative responses. But scientific and technical inventions are not determined purely by economic forces P. Lelong (1964). It's a matter of human and financial potential, which must be placed at the scientific research's service in order to generate the necessary decisions. These concerns in a multitude of fields have resulted in the production of articles and book chapters, and the spread of valuable information and solutions. Based on this introduction, we will present a historical overview of the development of science in this context, before setting out the main challenges confronting scientific research in countries like Morocco, and the various tools available to tackle them.

## **1. Scientific research in the kingdom: birth and barriers**

### **1.1. The protectorate era: the emergence of colonial scientific research**

Two pivotal events shaped the world during the nineteenth century and resulted in significant transformations: the industrial revolution and colonialism. They are closely associated, as the industrialization of the economy speedily caused a scarcity of raw materials, which required the access to new markets (or resources...) as yet unexploited (the colonies). Economic development had emerged as an approach to domination as valid and forceful as military force. In 1880, Moulay Hassan first endorsed the convention of the Madrid Congress, held by twelve Western states. This was the initial phase of the economic protectorate A. Ayache (1957). It was the colonial phase that brought modern science. Very early on, colonists engaged researchers to investigate the recently won land. Supervising attainable resources and conserving the human capital were the key purposes of colonial plan. Scientific research in this period has advanced especially in the disciplines of agronomy, medicine and geology. Furthermore, during the era from 1920 to 1955, Morocco provided a Muslim university education program. The origin of the university embodies its entire essence, as the kingdom claims to have one of the oldest universities on the planet. This is the university mosque of Al Qarawiyin, the scientific capital Fez, which was established in the ninth century Siddiqi, R. (2018). Al Qarawiyin and the adjacent medersas were the leading universities of learning in the kingdom through the protectorate. Lessons were conducted in Arabic and comprised mathematics, astronomy, history and geography. In 1938, the Bulletin Official reported the launch of a Franco-Moroccan Scientific Research Commission. The intended goal was to

determine scientific research of special relevance to Morocco, and to verify that it had been accomplished M. Kleiche-Dray (2002). As noted by Ch. Bonneuil (1999 and 2001), the colonial disciplines left a remarkable inheritance, especially in areas (agriculture, medicine and geology). This legacy was gathered and improved after autonomy. It was initially enhanced by the expansion of universities and then appropriated in the 1970s with the state takeover of academic centers, the Moroccanization of research and teaching jobs in the university, and the multiplication of new institutes.

### **1.2 Post-independence: an increase in academic and scientific research**

The dominant difficulty in the period of independence was guaranteeing rapid qualification of national administrative staff P. Laberge (1987). The university was created quickly to support several fields of the economy. The research institutes created in the era of the protectorate were incorporated into the universities, where research had become professional as college education prospered. The five-year plans of the 1970s focused on the promotion of private investment and recommended the reform of economic fields suited to generating foreign currency; executive training has gradually matured. Whether in reaction to political policy or the necessity of developing a base of national skills, a new field was created and speedily reinforced by the establishment of new advanced engineering centers or institutions. This is a main characteristic of Moroccan higher education A. Chiadli, H. (2010), which divides executive training from the university. This division, which has emerged in higher education, has resulted in scientific research of the academic form in universities and of the technological form in institutes and labs. After independence, the university environment has experienced remarkable progress. Actually, the number of academics climbed by 15% a year. It persisted at this level till the 1990s. The number of students grew by 100% every 5 years. It was well after this, in a progressively rising competitive economic market, that the Moroccan government focused its interest on boosting the scientific capacity embedded in its universities. In the 1990s, scientific and technical research became more critical. Initially, the lack of alignment between training programs and the requirements of the job market required the design of professionally tailored courses at university. As a result, collaboration with the production framework has grown, and research has been realigned. Next, taking part in a rising competitive market economy, and the vision of integrating into the European Economic Zone, have driven the necessity of quality in

products targeted at these trade zones, the upgrade of industrial complexes and the potential for innovation.

### **1.3 Beginning in the 2000s: the reshaping of the national research structure**

This hybrid university structure, which remained until the beginning of 1980s, was still divided between a traditionalism that had endured for many eras and a more contemporary style of teaching, which was viewed as alienating, regardless of its crucial role in the kingdom's progress. The duality of such a model has driven the encouragement of scientific research and innovation to emerge as frequent themes in political debate. H. Boutaleb Joutei (2002) states that the shift to the "locomotive of modernization" university has required a strategy of optimizing scientific research to the necessities of scientific advancement. These measures have not had the expected impact on boosting social and material conditions, nor on the technological status in the kingdom's industries, which are enduring weak added value.

#### **1.3.1. The university's function in fostering scientific research**

In Morocco, the university grew to excellence after autonomy, as the primary provider of the teachers and administrative employees, which the kingdom most required, as we have mentioned. At the same time, engineering institutes with limited student bodies were expanding. These technical institutes, launched on the proposition of the ministries, were more fitting for the imperatives of the industrial system, which gradually intensified. The university was given more autonomy, and its professors gained a civil service position in the 1970s. An academic area gradually emerged A. Chiadli (2008). Research has its position here, since promotions are firmly associated with it. In tandem with this, a few schools have also initiated technological research, while huge firms have initiated research and development divisions, thus declaring the necessity of technical research. Research is subdivided into two isolated areas: academic and technical. Moroccan scientific production is largely the output of universities. The university is structured into teaching units, which contain academic labs or research groups, but this structure is not usually official. They generally owe their presence to the devotion of a researcher. Budget resources are commonly scarce. To obtain a view of the priority given to research in developed states, A. Bouchra (2004) recommends examining R&D funding. The statistics mentioned by the researcher rank the USA in 1st place globally. In Morocco, until 2012, the funds reserved for scientific research amounted to just 0.8% of Moroccan GDP, which is yet a modest budget when putting beside the funds allocated for the

similar activity in other nations, notably France, which devotes 2.8% to scientific research. The researcher notes that the quantity of publications and the total number of researchers are very useful criteria for examining a nation's science strategy. Some researchers link the debate over the university's modern mission over the past five years with the initiation of regionalization plans that emerged in 2011 M. Hanouf (2014). A plan that has resulted in the designing of an innovative and creative model for coordinated and long-term growth, and the implementation of equity between the country's various provinces. The purpose was to democratize the function of the State and the links between it and local authorities. It positions the Moroccan university at the heart as a key economic and regional player. The characterization of this strategic role is grounded in the reports shared by the Organization for Economic Cooperation and Development OECD (2007). The adoption of this plan led to a revision of the university's responsibilities, specifically those linked to enhancing links with the socio-economic environment H. Lrhoul, et al. (2014). The report notes that its major contribution is to promote strong links with the firm by supporting knowledge advancement and technology diffusion. M. Hanouf (2014) highlights that this is an alliance that positions science and scientific research at the benefit of the region's issues. An aspect that is still rarely taken into account in today's context.

### **1.3.2. Conditions not conducive to scientific research in the kingdom**

Globalization would accelerate the economic fall of states whose scientific and technological capacity has remained limited. As noted by A. Bouchra (2004), it's not a matter of small or huge states, instead it's of scientifically and technologically developed and non-developed nations. In reply to the question of what impedes scientific research in the kingdom, this researcher links it specifically to the program of Arabization of teaching, which she judges to be a profound obstacle to the development of science. She clarifies that states that have achieved impressive levels of science and technology have not achieved so with their native language. The language issue is ongoing, as the reform in higher education has not succeeded. The concern is made all the more difficult by the reality that even the job sector is not highly Arabic speaking. The lack of a legal structure to promote the development of scientific research is an ongoing barrier M. Kleiche (2008); H. Boutaleb Joutei (2002). Other issues are presented or even addressed, e.g. the purpose of free education. Finally, with only 1 paper published per year for every 20 professors, the kingdom is a long way off from having realized its university research potential. As mentioned by F. Ndiaye (2000), forced by necessity, many scientists shifted to commercial jobs that allowed them to make a more comfortable life without counting

on their low salary. Teachers in Morocco do not earn satisfying wages, which diminishes their devotion to scientific research. As part of their statutory duties, universities are able to find incubators for creative firms, use licenses and promote the projects of their research, by means of an approach involving fee-for-service agreements. This framework is rigid, in North America, value-adding entities are supervised autonomously by the universities, which have legal status, empowering them to have great freedom in financial planning and administration. In Europe, and specifically in the Hexagon, they are directed by entities with varied legal forms. In summary, in order to enhance partnership with the socio-economic system, and to create beneficial and sustainable collaborations with giant and small and medium companies in the domains of continuing training, research and development and know-how, various approaches can be mapped out to host firms seeking to capitalize on the university's capabilities. University-environment liaison demands the design of a general framework for collaboration and synergy, with a medium- to long-term vision. While meaningful coordination efforts have been initiated before, their consequences persist incomplete and limited. It is essential to mention that the institutional framework managing the higher education structure since 1975 permits minimal chance for a more active and coordinated participation of the University in its territory.

## **2. Overview of scientific research in the kingdom of Morocco**

### **2.1 An examination of data on scientific research in Morocco (1996-2024) obtained from the SCOPUS database.**

Scientific publication is the key expression of research output. Its goal is to meet the requirements of solutions and improve the scientific and technological foundations. Most of our papers are produced in academic environments. According to the OECD report (2003), this is a major indicator of how scientists are appraised, hence the growing intensity of scientific activity, especially in European nations. According to the Scimago database, which is powered by Scopus database, the quality of scientific research is measured based on a number of criteria: The Bibliometric indices, the citable documents and non-citable documents, cited documents and uncited documents, external cites, international collaboration, external cites and self-cites, open access output, and the domains addressed by the researchers. These criteria will be analyzed below. One of the main drivers of scientific production is collaborative publishing. According to the OECD 2009 report, released in 2010, collaborative publication has increased significantly faster than individual authorship. In 2007, it represented 21.9% of scientific

articles, representing three times the proportion observed in 1985. The growing popularity of “joint” papers, both national and international, is linked to the importance of networking between scientists, helping them to broaden their sources of knowledge. It is also linked to the ease of exchanges and communications using modern information technologies, which enable various formulas for remote cooperation. Co-authorship is one of the most useful indicators of a nation's commitment to exchanging and discussing experiences with scientists from other nationalities. The OECD 2009 report OECD (2010), notes that the publication of scientific articles is not increasingly the result of a single person's work, but rather that of groups, not attached to a single establishment but to several institutions with more and more international horizons. The identical report notes that scientists from the largest European nations, both genders, produce more joint papers than those from Asia or the United States of America. When it comes to content, life sciences occupy more than 50% of scientific papers in a number of nations (OECD, 2003). The physical sciences represent the largest proportion of total scientific research output. The social sciences represent a rather small proportion in European nations. In the kingdom of Morocco, social science studies are relatively unstructured. The limited amount of research conducted is individual and not very apparent.

## 2.2. Presentation of results

### 2.2.1 Bibliometric indices

**Table1 : Bibliometric indices**

H index	Documents	Citations	Citations per document
286	140603	1680934	11.96

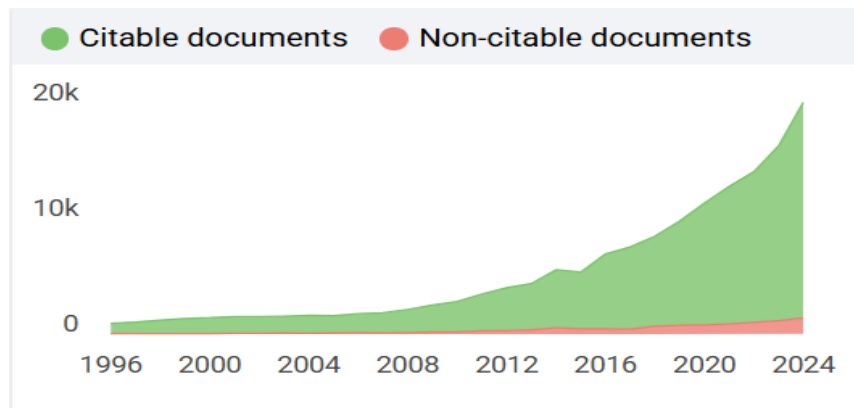
Source : <https://www.scimagojr.com/countrysearch.php?country=MA>

Discussion of Morocco's scientific production, based on bibliometric indicators, offers a significant view of the academic impact and visibility of research in the kingdom. The H-index of 286, calculated according to Moroccan scientific papers, demonstrates the increasing impact of Moroccan research on the world level. This index, which mixes productivity and the impact of publications, reflects not only the quantity of scientific publications, but also their power to receive a considerable number of citations. The number of papers (140603) reflects a strong research effort, spanning a wide range of scientific disciplines. Nevertheless, this number of publications should be viewed in conjunction with the total number of citations, which totals 1680934. This shows not only the continuous effort to publish, but also the influence of the work carried out by Moroccan scientists on the global scientific community. On average, each

paper is cited 11.96 times, which attests to the quality of the research performed. This record of scientific production and influence shows a supportive research climate, with a solid academic infrastructure and increasing international partnerships.

### 2.2.2 Evolution of the quality and impact of scientific publications: Analysis of citable vs non-citable documents, citations, and external references

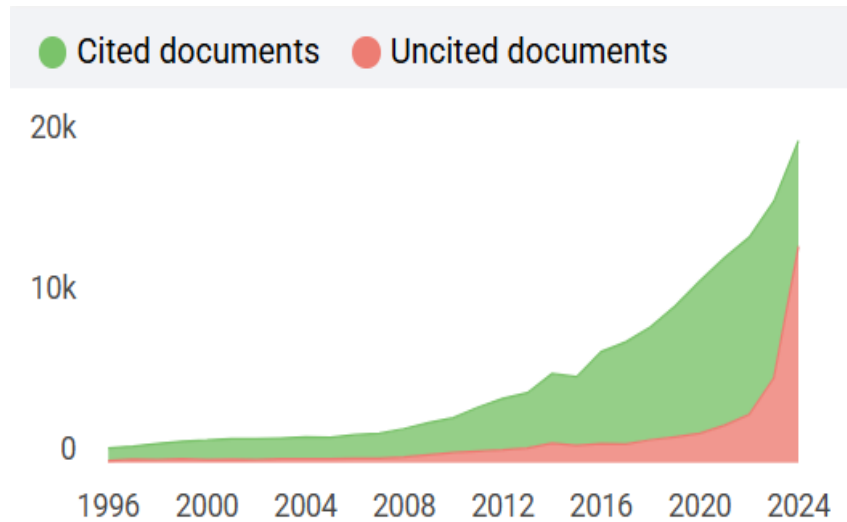
Figure No. 1: Citable and Non-Citable documents



Source : <https://www.scimagojr.com/countrysearch.php?country=MA>

According to the graph, there has been a significant increase in the quantity of citable papers, especially since the 2000s, with a noticeable increase after 2020. This development shows that there's been a boost in high-quality publication and research efforts. In contrast, the amount of non-citable papers has remained relatively low throughout the period, although there has been a slight noticeable increase over the years. The phase from 2010 to 2024 seems especially important, with a significant rise in citable papers, which can be explained by Morocco's growing participation in international research networks, improved accessibility to scientific databases, and national strategies to support high-impact papers. This analysis demonstrates a significant development in scientific research in the Kingdom of Morocco, especially in the number of papers that are cited. This indicates the country's growing focus on positioning itself as an influential and leading research community. Nevertheless, the low number of papers that are not cited highlights the need to keep enhancing the quality of scientific publications to maintain a significant and relevant position in the international scientific scene.

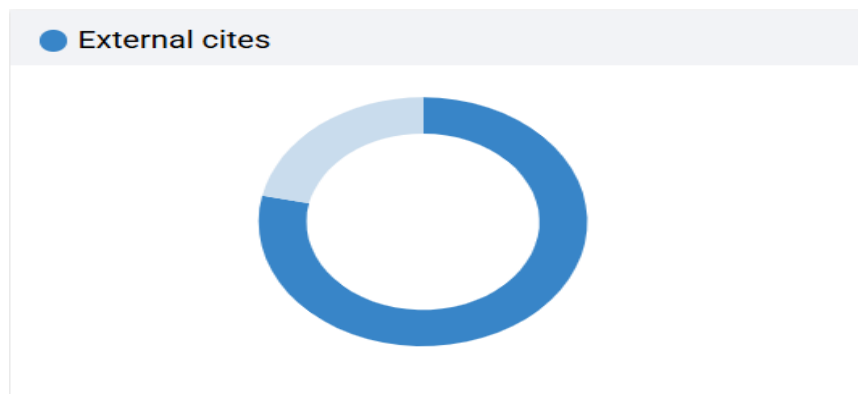
**Figure No.2: Cited documents and Uncited documents**



Source : <https://www.scimagojr.com/countrysearch.php?country=MA>

The graph indicates the progression of the quantity of cited and uncited scientific papers between 1996 and 2024. A significant trend is the notable rise in the number of papers cited, especially since 2015, indicating the rising impact of recent papers in the scientific world. This trend reflects a more effective integration of this research into the existing knowledge base, indicating that recent research plays a pivotal position in scientific advancements and impacts future investigations. Nevertheless, a concerning tendency is the simultaneous rise in the quantity of un-cited papers, particularly since 2020. Although the total amount of papers is growing, a growing portion of these papers aren't being cited in scientific papers. This phenomenon might be attributed to the saturation of some research areas, an excessive volume of papers, or less significant publications. As a result, despite the rise in the number of papers, a significant amount of research doesn't seem to be generating the desired influence within the scientific world.

Figure No. 3: External Cites

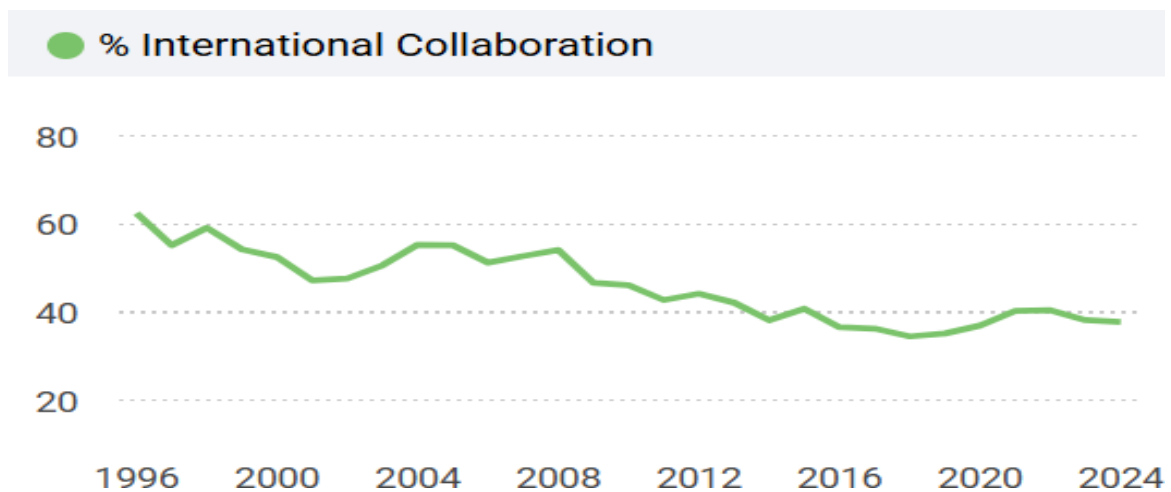


Source : <https://www.scimagojr.com/countrysearch.php?country=MA>

Regarding external citations, there has been a noticeable, albeit slight, increase over time. This trend suggests a growing receptiveness within the scientific community to studies originating from diverse geographical and disciplinary contexts. It may indicate that Moroccan researchers are increasingly relying on international studies rather than domestic research. Moreover, the progressive rise in external citations can be interpreted as a sign of the growing internationalization of research in this field.

### 2.2.3 Trends in International Collaboration and Citation Dynamics in Scientific Publications

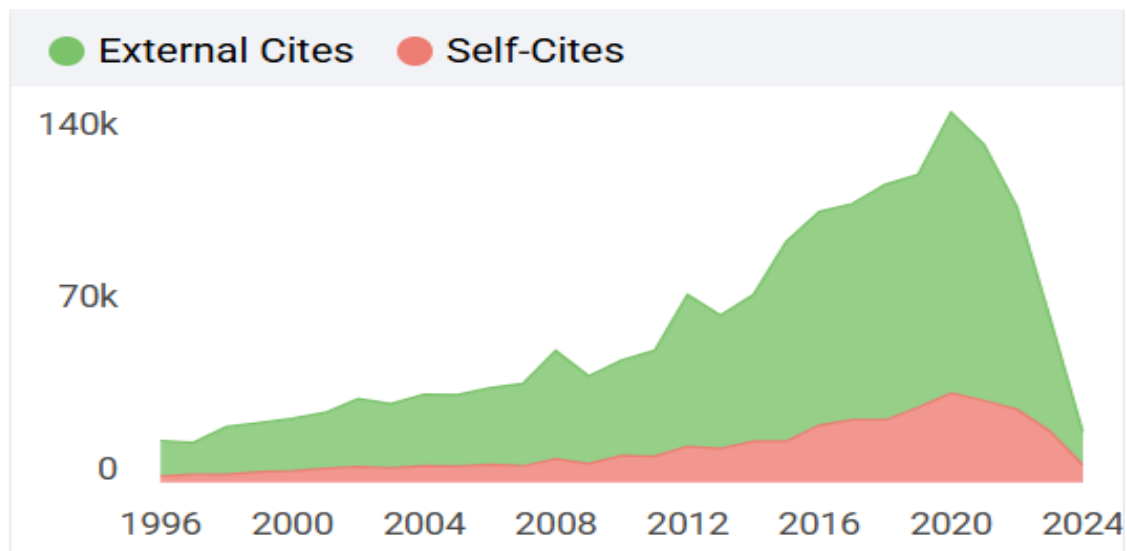
Figure No. 4: International collaboration



Source : <https://www.scimagojr.com/countrysearch.php?country=MA>

The graph illustrates a general downward trend in the proportion of international collaboration in scientific papers, a phenomenon that has been noticeable in the period since 1996. Despite fluctuations during some periods, the decline remains the predominant factor. A small rise in international collaboration happened in the 2000s, which was followed by a stabilization and then a progressive decrease from 2010 onwards. This development could be attributed to a number of conditions unique to the Moroccan context. At first, Morocco actively contributed to the globalization of scientific cooperation, backed by international financing strategies and cooperation plans with European and worldwide institutions. Nevertheless, since 2010, there has been a slight decrease in the proportion of research papers produced through international collaborations, which is likely attributable to two factors: The first one is the limited resources, Resources devoted to scientific research in the Kingdom have not increased sufficiently to match the needs. Budgetary limitations and economic difficulties may have resulted in decreased funding opportunities for international collaborations. The second one is the independence for national research; Morocco has been working hard to strengthen its own scientific research by helping local universities and national research institutions. This might reduce the desire to work with other countries, as some research teams might prefer to develop their own independent projects.

**Figure No. 5: External cites and self-Cites**

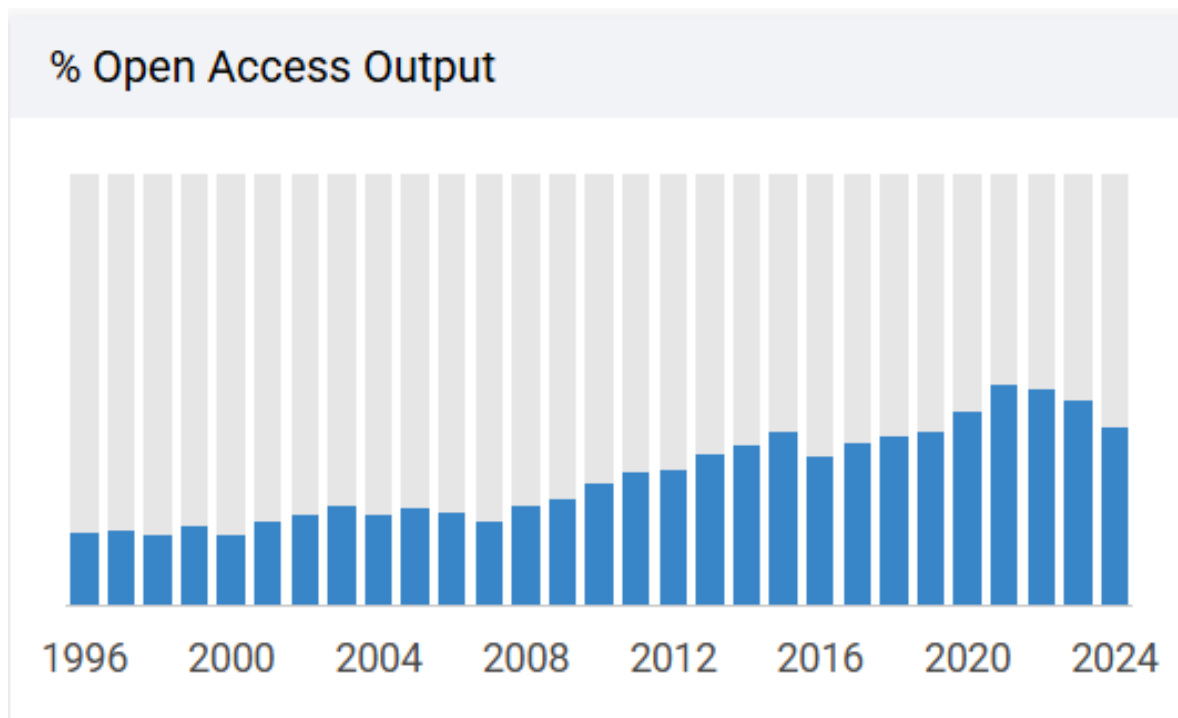


Source : <https://www.scimagojr.com/countrysearch.php?country=MA>

This graph shows a distinct distinction between external citations (in green) and self-citations (in red), with external citations predominating since 2010. The explosion in external citations, which has accelerated in the last few years, can be interpreted as the consequence of the greater visibility of scientific papers worldwide, encouraged by more widespread research communities, the expansion of open-access publishing systems, and the widespread adoption of open science. Conversely, self-citations, although present, show a decline, which could signify a reduction in scientists' self-sufficiency or an increased realization of the importance of objectivity and external approval in the scientific publication system. Although the general trend indicates a decrease in international collaboration in Moroccan scientific papers, the growth in external citations indicates that research performed in Morocco keeps having a critical role in the global scientific scene. This trend can be attributed to several reasons, such as the rise of open access, the growing visibility of Moroccan scientists, and the expansion of funding opportunities. This highlights the overall influence of the Kingdom's scientific efforts, despite the noticeable decrease in the amount of international collaborations.

**2.2.4 Growth of open access scientific production and its impact**

Figure No. 6: Open Access Output

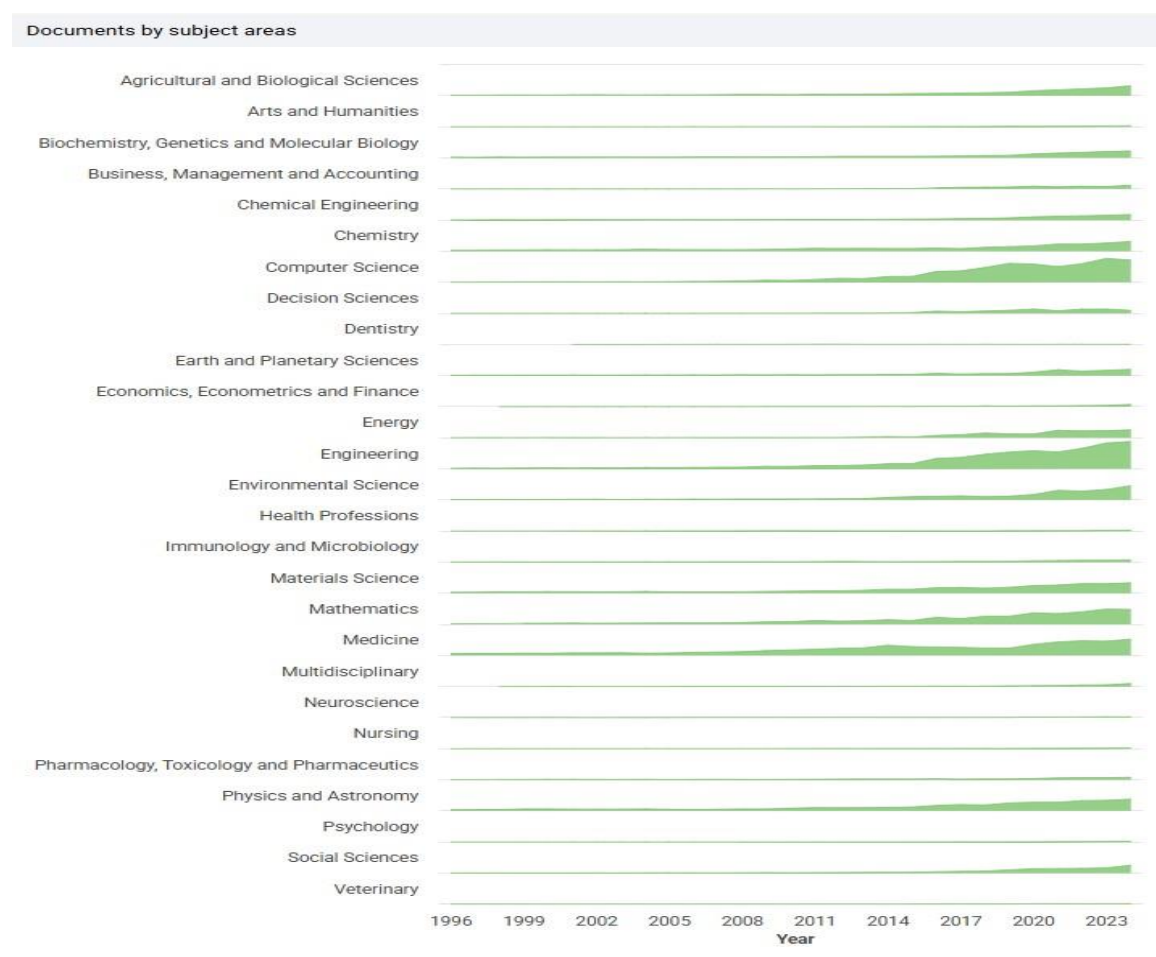


Source : <https://www.scimagojr.com/countrysearch.php?country=MA>

The graph indicates the evolution of the percentage of open access publications in Morocco between 1996 and 2024. A low percentage of open access papers is evident until 2008, followed by a gradual progression thereafter. This rise can be linked to public plans that encourage open access and the development of digital platforms. Since 2020, growth has intensified, showing a policy shift towards more transparency and improved access to scientific knowledge. In 2024, the proportion of open access articles achieved impressive levels, reflecting Morocco's dedication to the digital transformation of scientific research.

### 2.2.5 Main areas of research

**Figure No. 7: Main areas of research**



Source : <https://www.scimagojr.com/countrysearch.php?country=MA>

The graph illustrates the progression of scientific papers published by Moroccan scientists in different disciplines between 1996 and 2023. It is feasible to examine general trends that reflect the development of focus on certain research subjects over time. Fields such as

engineering, medicine, and environmental sciences saw remarkable growth during this phase, likely reflecting heightened interest in technical and medical matters, as well as an increased focus on environmental concerns in Morocco. On the other hand, disciplines such as social sciences, arts and humanities, and economics are characterized by more consistent publication rates or less pronounced growth, which could suggest weaker research performance in these disciplines. In addition, biological sciences and chemistry are also experiencing meaningful growth, which can be credited to the growth of research in biotechnology, public health, and natural resource management. Pharmacy and health sciences remain essential, but with less impressive growth. This indicates that Moroccan scientists strongly tend to focus on fields with considerable practical and economic impact. However, achieving a balance between diversification in scientific disciplines and specialization continues to be a major challenge in enhancing the international competitiveness of Moroccan scientific research. In this context, efforts to promote cross-disciplinary collaboration and support underrepresented fields could encourage balanced and continued development of scientific research in the kingdom.

### **3. Discussion: What ways can foster scientific research?**

On the basis of the foregoing, boosting the worth of research needs both a re-evaluation of the institutional structure and a suitable direction of content.

#### **3.1. Institutional framework:**

Since 1998, Morocco has accorded special prioritization to advancing scientific and technical research. Multiple research projects have been launched to connect the public scientific research field and the world of corporations. These connections would enhance the alliances between the university and the business field in the areas of R&D development. They would also support universities in boosting technology transfer by adjusting to the priorities of firms in their regional area. Law 01-00 on the reform of the higher education structure, legislated in 2000, emphasizes the Moroccan lawmaker's ambition to promote universities' cooperation with the state's economic prosperity. It initiates by outlining the functions of higher education that are linked to improvement: "The support for the kingdom's scientific, technical, professional, economic and cultural development, considering economic and social progress; the mastery and advancement of science, technology and expertise, through research and creativity; the preservation of Morocco's cultural heritage and the echo of its ancestral heritage". It also attaches major priority to the resources at his disposal. Therefore, the present reform of

the University requires re-evaluating its interaction with its economic, social and cultural context. A strategic role is consequently linked to the university: Participate more effectively in the state's progress, commit to global and national challenges and acquire expertise in the state's economic, social, technological and cultural evolution.

### 3.2 Content

In the kingdom, as in the other regions of Africa, many scholars have limited the aim of their investigation to criticism of development. While some examine the essence of “development”, others criticize it for its unfavorable effect on African communities. By framing “development” as the focus and purpose of the social sciences, African scholars have disconnected themselves from populations as epistemic subjects. During the colonial era, scholars were especially investigating broad research fields: the history of biomedicine, the destiny of ethnic groups and the nation-state. As a result of the end of the century, the human fields have started the “post” era: postmodernism, post-liberalism, post-nationalism and post-colonialism are all prospering on scholars' research plans. Africa was the origin of some of the world's first colleges of higher learning (Al Azhar in Cairo, Al Quarawin in Morocco, etc.) and the land of numerous famous thinkers, including Ibn Khaldun. Nevertheless, science as we recognize it was brought to Africa through interaction with the West, notably in the era of colonialism.

In the past decades, the institutional and demographic basis of research has experienced significant transformation. Since the colonial era, the progress of scientific knowledge in the kingdom has been globalized, given that it is a project to which foreign scientists participate, and which is also shaped by the practice of models created outside the kingdom. Given the challenges faced in the prior sections, linked above all to an environment that was far from perfect due to mediocre socio-economic and political circumstances (lack of resources, violations of academic autonomy, etc.), most investigators used theoretical frameworks developed in the West. Arabization has also been a critical evolution in the latest decade, at a time when academic research was largely performed in non-native languages, especially English and French. Consequently, new investigation has examined the extremely rich and lively intellectual traditions of Africa's past, with a re-examination of historical writings, to re-energize research into an era of “Enlightenment” witnessed by the continent's states before the protectorate Unesco (2012). During a long time, the founding of the state and of an identity of nationhood and growth have led to vital discussions in the domains of R&D. A majority of these investigations pay attention to borders and cross-border movements, national integration

processes, religion and culture, and so on. They also cover topics of rural and agricultural growth and industrialization projections. The emphasis progressively reoriented itself to concerns associated with structural adjustment, poverty, human rights and urbanization. In the early 1990s, the Kingdom initiated a wave of economic and political liberalization, which had an influence on the state's social and economic growth, capturing the curiosity of a huge community of academics. In reply to this point about content, U.G. Wurzel (2010) argues that the selection of topics is justified by the belief that research questions in economics are viewed as relevant in Europe and have not always been significant for African states. This deficit is primarily due to the disparities in the degree of socio-economic progress between the two zones, and therefore to the practical difficulties and priorities for scientific investigation. The researcher notes that other aspects of the region's circumstances - first and foremost the lack of accessible data, as well as the many constraints on investigations and other surveys - prevent researchers from addressing a wide array of topics in detail.

### **Conclusion:**

To conclude, what we can highlight in the context of this study is the disparity between scientific production and technological requirements in the private sector. Demand is still reliant on government backing policies and is compromised by the lack of tangible measures. In fact, the very obvious compartmentalization between R&D institutions and industry is a continuing problem, and the quasi absence of systems for transferring, spreading and promoting the fruits of science and technology are also serious limitations. There's a great deal of discussion about the importance of cultivating domestic scientific expertise, extending beyond engineering activities, and exploring alternative opportunities for developing countries to benefit from national and worldwide scientific research. One of the suggestions offered by some scientists is to engage a range of stakeholders in identifying research requirements and priorities. Some countries encourage business professionals to contribute to the development or funding of research issues. This is the policy in Finland, Germany and Italy (OECD, 2003). According to J. Bouoiyour (2003), this process should lead to a stronger relationship between universities, scientific research and the private business sector, with a special emphasis on national researchers living in foreign countries. As a further overall recommendation, we believe it's also vital for the advancement of science to be independent, without always depending on the imports of scientific and technical knowledge from advanced states. The findings of national science must be fully exploited, and universities must be integrated with

the large national industrial corporations. The state's primary responsibility is to encourage and boost these partnerships, in parallel with the improvement of basic education. It is also crucial that the government sets up procedures to allow laboratories and universities to collaborate with large multinational corporations. National support policies for scientific research come into the equation and decide whether scientists from developing nations are involved in projects undertaken by overseas investors, or whether they are excluded. It is important, consequently, that the authorities, through their science and technology strategies, seek to ensure that their scientific activities are widely publicized and acknowledged worldwide C. Forero-Pineda (2002). Every investigation has its shortcomings, and ours is no different. The first, and most visible, is to limit ourselves to papers appearing on SCOPUS database. The other limitation concerns the use of the number of publications, Unfortunately, we don't have access to this information, and it would be valuable to integrate it into further investigations of this topic.

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