



Bibliometric analysis of global research trends on UMI using Scopus database and VOS viewer from 1987–2024

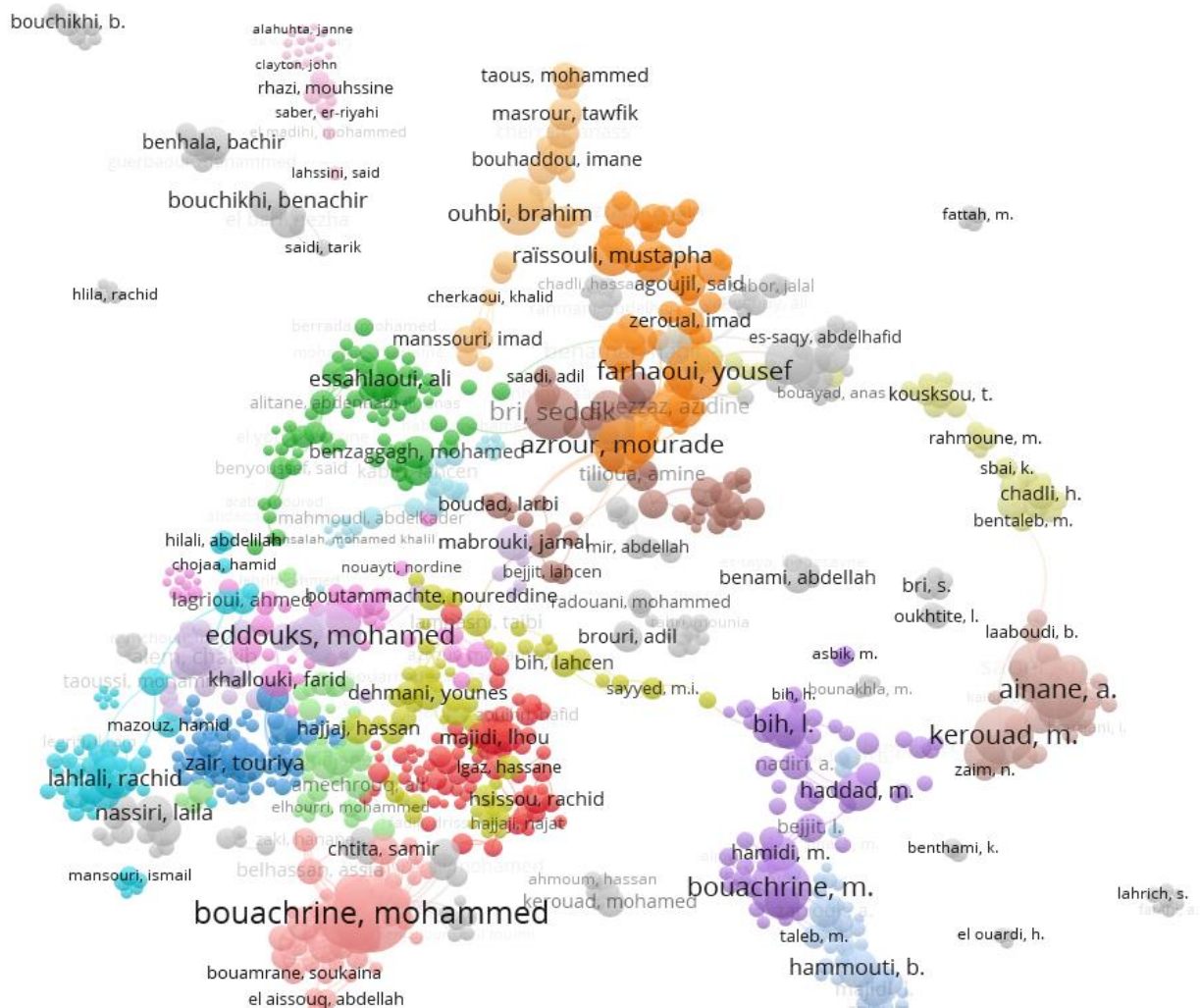
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Abstract: In this bibliometric study, we used the Scopus database to analyze the scientific production of the University of Moulay Ismail (UMI) published between 1987 and 2024. This objective was to investigate various aspects of the research output from UMI, namely publication trends, research interests, preferred journals, leading countries, regions, authors, articles, institutions, subject areas, and author keywords. This process of data collection consisted of querying the Scopus database, using keywords with links to UMI, and ensuring relevant publications over the stated period are included. The analysis of the obtained data was performed with VOSviewer, a tool to construct and visualize bibliometric networks. It provided a way to identify collaboration patterns, co-authorship networks, keyword co-occurrence, and citation analysis. Over 97% of publications are written in English.

Keywords: *bibliometric study; VOS viewer; University of Moulay Ismail; Authors; Collaborations*

1. Introduction

Bibliometric research uses statistical and mathematical methods (Luciano Barcellos-Paula et al, 2024). The analysis of the building of the indicators for scientific and technological information; within the scope of any given topic has been carried out in relation to the relevance of its application, as one of the two main sources of the argument of the research on investment resources in academic rankings, (Moura et al., 2017; Yang et al., 2023; Ghorbi et al., 2024). Bibliometric analysis has proven to be an essential method for assessing the development and influence of scientific knowledge across diverse research domains (Donthu et al., 2021). As scholarly output expands rapidly, bibliometric studies offer a holistic perspective on the emerging trends, leading contributors, and collaborative networks that shape the intellectual landscape of a particular discipline (Haghani et al., 2023). The analysis of bibliometric parameters, such as citations, co-authorships, and term co-occurrences, enables the identification of emerging themes in the scientific literature, dominant methodological approaches in the field, and research areas that require further attention. These kinds of analyses are fundamental revealing knowledge structure and trends in a particular field (Aichouch et al., 2025; Benavides-Sánchez et al., 2025; Hassan & Duarte, 2024; Lrhoul et al., 2023). By quantifying and analyzing scientific publications, these analyses help to visualize the impact, collaborative networks and emerging patterns in research (Zhao et al., 2021; Chou et al., 2024; Kan et al., 2020). The author's impact factor and the visibility that can be brought to the University is related to collaborative efforts (Limaymanta et al., 2022; Alamah et al., 2023). According to Lancho-Barrantes & Cantú-Ortiz, scientific production is the materialization of the resulting knowledge, in which several agents may participate through scientific collaboration (Lancho-Barrantes & Cantú-Ortiz, 2019). In other words, Research collaboration has become necessary due to the enormous pressure researchers and institutions face in meeting publication requirements (Glimour, 2023). Consequently, the number of internationally co-authored articles has increased considerably over the last decades due to the logistics of investigations and financial support. An intensification of scientific collaboration is observed at all levels of aggregation (Bemke-Świtilnik et al., 2020; Corrales-Reyes, 2017) and even at the level of emerging disciplines, where knowledge sharing should be more efficient (Heinze & Kuhlmann, 2008).

In this paper, we aim to examine global trends in the literature on leadership development at the University Moulay Ismail (UMI) through a bibliometric analysis of 9,565 articles published from its founding in 1989 to 2024, using the Scopus database. This analysis covers a period of 46 years. The

University Moulay Ismail of Meknes was officially established by Dahir number 21-86-144 on October 23, 1989. However, the schools of sciences, arts, and humanities have existed since 1982 as part of Sidi Mohamed Ben Abdellah University of Fez, and are considered the founding institutions of UMI (https://www.umi.ac.ma/?page_id=33). Our objectives include reviewing and analyzing the quantitative output of global publications and highlighting the collaborations between UMI and other national and international universities. We also examine the most cited publications and authors over the study period. This comprehensive search strategy aims to collect relevant literature on leadership development in higher education and university contexts, providing a solid data foundation for the subsequent bibliometric analysis.

2. Methodology

2.1 Sourcing and preparation of data

VOSviewer (“visualization of similarities”) was developed by the Center for Science and Technology Studies (CWTS) at Leiden University in The Netherlands to analyze and visualize patterns within data (Eck & Waltman, 2007). Thereafter, the VOS was performed into a program called VOSviewer for bibliometric analysis, hence has been widely adopted in bibliometric and citation studies for constructing and visualizing bibliometric networks, with journals, researchers, or individual publications as actors, based on co-citation, bibliographic coupling, or co-authorship relations Van Eck and Waltman (Van Eck & Waltman, (2010)). The VOS allows building co-occurrence networks of important terms extracted from a corpus of scientific literature using text-mining functionality. It can extract bibliographic networks from bibliographic data based on data files downloaded from WoS, Scopus, Dimension, PubMed, and RIS format. VOSviewer is a Java-based application that can be used to generate maps based on network data, visualize and examine these maps.

The data for this study were collected from the Scopus database, with free access to the analysis results provided by the Euromed University of Fes. The focus was on retrieving and analyzing the number of papers published and academic citations from research articles and studies specifically indexed by Scopus, categorized as journal articles. Additionally, the study examined the collaboration between Moulay Ismail University and other institutions, both within and outside Morocco. Data collection was strictly limited to articles published between 1987 and 2024. The articles were then saved in CSV format, allowing for visualization and analysis through bibliometric maps created using VOSviewer software. Data processing involved filtering specific terms for inclusion in the visualizations, which were generated in three types: network, density, and overlay.

3. Results and Discussion

This statistical analysis section illustrates the historical trend of articles published in the Scopus database considering the “Université Moulay Ismail”. The results mentioned in **Figure 1** demonstrate that the first article indexed in the Scopus database dates back to 1987, followed by zero articles in 1988 and 1989 to restart again by one paper in 1990 followed by an increase gradually with time, until reaching more than 1500 articles in 2024. It’s important to inform that the faculty of science of Meknes was affiliated with the University Sidi Mohammed Ben Abdellah (USMBA) at that time.

9565 articles have been produced and indexed in the Scopus database for 46 years investigated. The results show very slow growth in the number of articles produced until 2008, which shows a more increasing trend in 2012 and onward. We observe that major fields concerned by these papers are Engineering, Computer science, Mathematics and material Science ... (**Figure 2**). Moreover, articles

in this area are published in many languages such as English (9296 articles), French (317 articles), Ukrainian (10 articles), Spanish (8 articles), Arabic and German (4 articles) etc. The quasi-totality of published papers in English (> 97%) indicated that the authors prefer the international language of publication to reach more readers across the globe and citations. We also remark that only four papers are published in Arabic, indicating the lower indexed journals on Scopus in this Language. We hope that the decision makers will do more efforts and encouragements to see more indexed journals in the future.

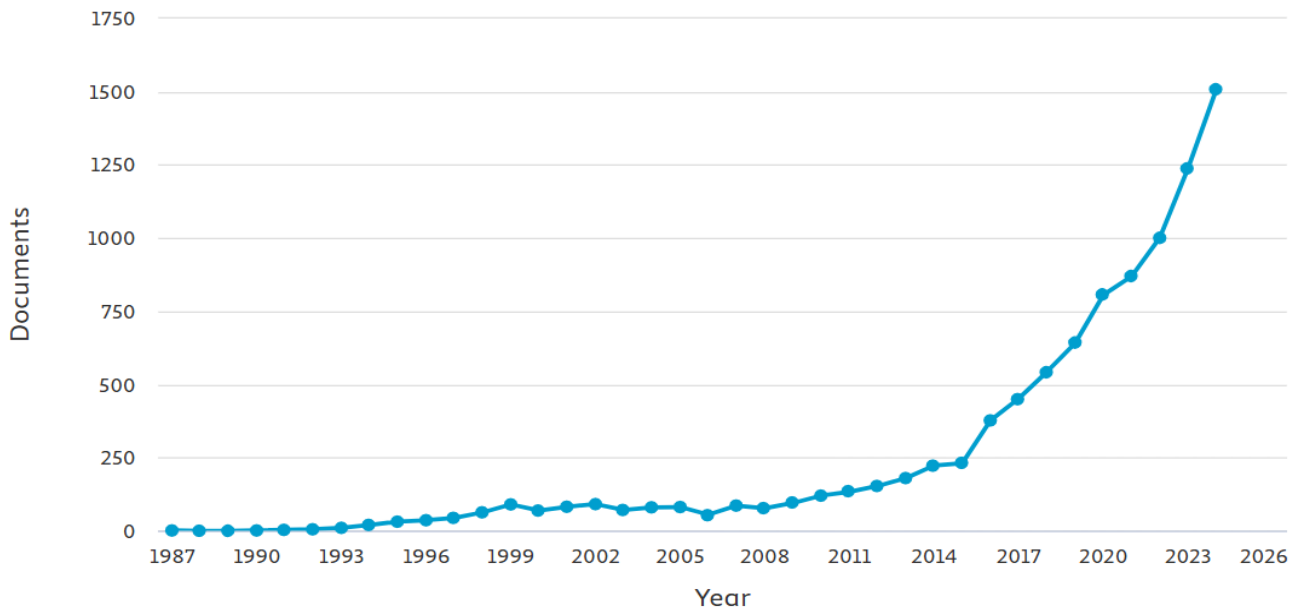


Figure 1. Evolution of the scientific production of UMI from 1987 to 2024

The distribution of papers according to affiliations indicated that most papers (9541) were co-authored with Moroccan authors, as shown in **Figure 3**, **Table 1**. The facility may explain this to meet colleagues in the National Meetings or personal contacts. Only 1591 papers have been published by partners from France's universities because of the poor benefit or researchers participation in the collaboration programs such as Volubilis, Toubkal, Erasmus, etc. It's interesting to see Saudi Arabia (KSA) as the first Arabic partner country (433 papers), this is due to the several international meetings in KSA, especially in Riyadh or Taibah Universities. Furthermore, the more visible roadmap in scientific research of KSA, allows Saudi researchers to be more flexible in cooperating more and more (**Figure 4**).

Subject trends

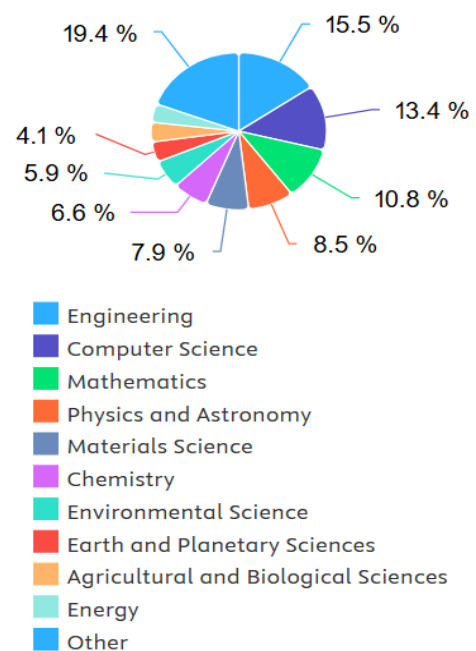


Figure 2. Fields of Interest in UMI

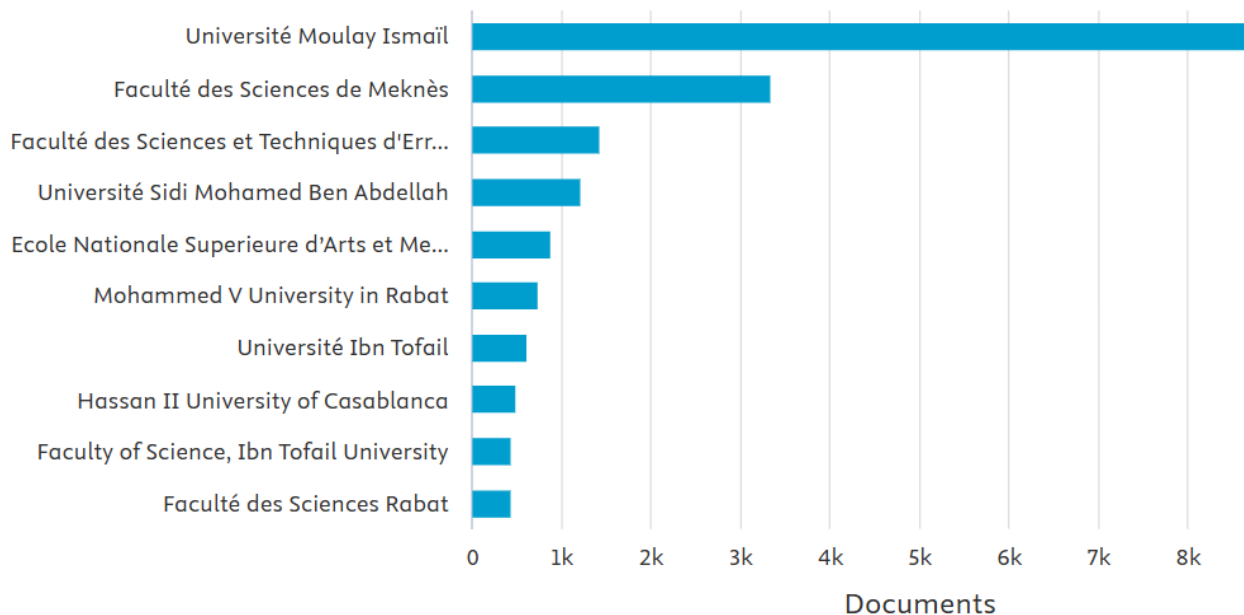


Figure 3. Scientific Collaboration of UMI with other national institutions

Table 1. Collaboration of UMI's authors nationally and internationally

Morocco	France	Saudi	Spain	Italy	Germany	India	US	Canada	Belg
9541	1591	433	191	250	241	199	179	160	150

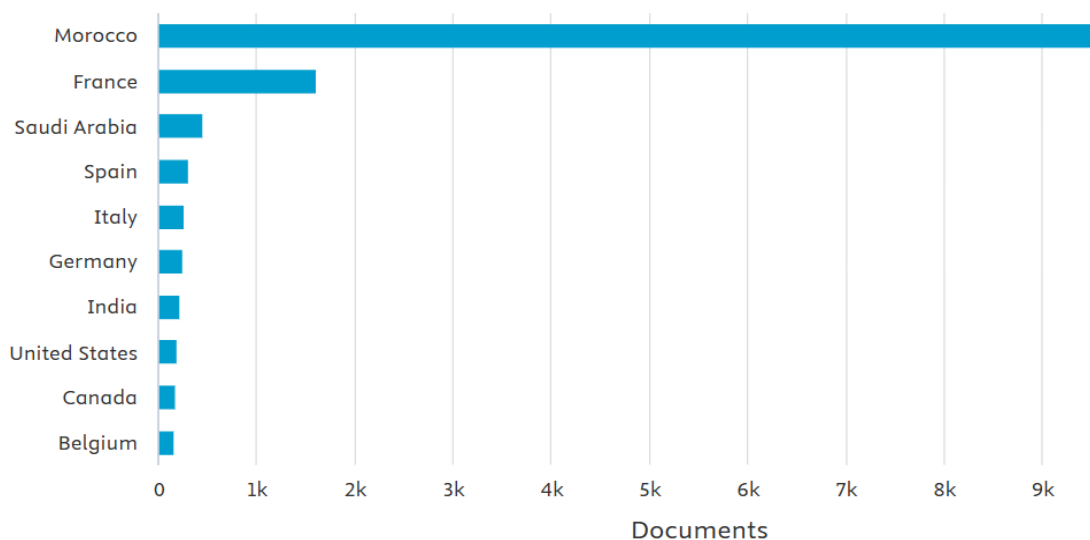


Figure 4. International cooperation with UMI

3.1. Author's profile on Scopus and VOSviewer

Our second research objective is to display contributions by leading authors, countries, and the most highly productive educational institutions. Scopus analysis gives the list of most contributors in each field or institution. **Figure 5** indicated that Bouachrine Mohammed is the most published author in UMI (370 documents), He collaborated with 490 coauthors to attend more than 6500 citations by

4500 documents. His collaborator Prof Lakhlifi comes in second place with 181 papers, followed by Eddouks (Faculty of Science & Technology of Errachidia) with a number of 180 articles.

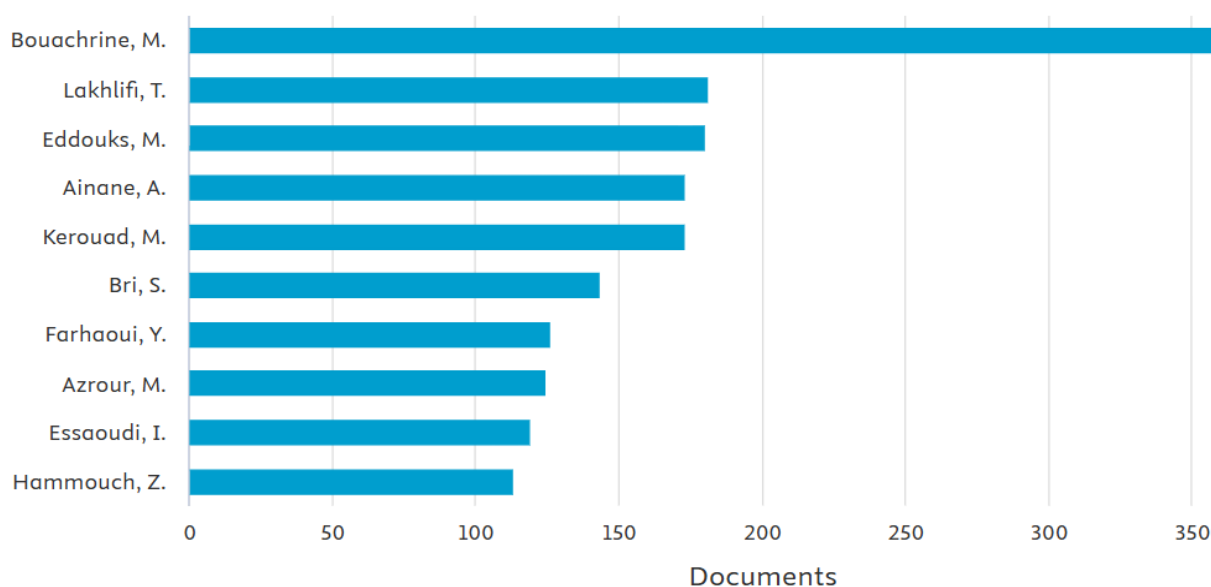


Figure 5. UMI's authors list of the most published authors according to Scopus data

It's more suitable to introduce the Ten most published authors to recognize for their efforts:



Prof. Dr. **Mohammed BOUACHRINE** collaborated with 495 coauthors to attend more than 7205 citations by 4500 documents. Prof Bouachrine published his first paper in 1996 and reached 47 papers in 2024. We noticed that Professor Mohammed Bouachrine is a professor researcher at the Faculty of Science, University of Moulay Ismail in Meknes, Morocco. His research focuses on drug design, molecular modeling, quantum chemical calculations, and the study of physicochemical and optoelectronic properties of organic materials.

He has published over 500 articles in peer-reviewed journals and authored 15 scientific books. The paper of Aanouz on “the Computational investigations on Moroccan Medicinal plants as inhibitors against SARS-CoV-2 main protease is the most cited (250 citations) (Aanouz et al., 2020). His work has significantly contributed to understanding various physicochemical, biological, and environmental phenomena. He is a Professor at Moulay Ismail University, Faculty of Sciences and Techniques, Morocco. <https://www.scopus.com/authid/detail.uri?authorId=8983993500>



Prof. Dr. **Tahar LAKHLIFI**, published 204 papers reaching more than 2750 citations by 1859 documents. The first two papers appeared in 1996 and reached 47 papers in 2024, with an impact factor of 27.

The most cited paper (366 citations) is published in 2015 in collaboration with the UMP team (Zarrouk et al., 2015) about the New 1H-pyrrole-2,5-dione derivatives as efficient organic inhibitors of carbon steel corrosion in hydrochloric acid medium: Electrochemical, XPS and DFT studies . <https://www.scopus.com/authid/detail.uri?authorId=58082496100>



Mohamed EDDOUKS is Professor at Moulay Ismail University, Faculty of Sciences and Techniques Errachidia, Morocco. He is a researcher in Physiology and Pharmacology with a Master Degree in Metabolic and Molecular Endocrinology from University of Paris 6, a specialized certificate in Endocrine Pharmacology from University of Paris 7 and PhD degrees in Physiology and Pharmacology from University of Liege, Belgium and Sidi Mohammed Ben Abdellah University, Fez, Morocco. After his post-doctoral fellowship at Department of Physiology, Faculty of Medicine of Montreal, Canada, he is working for the last 25 years on medicinal plants.

His research focuses on ethnobiological as well as pharmacological issues in the use of Moroccan medicinal plants for the treatment of diabetes mellitus, obesity and hypertension. His contribution to this field includes seven international books, 7 special issues in international journals and more than 200 indexed peer-reviewed articles and 20 book chapters of international repute. He served as Guest Editor and Member of Editorial Board of several international journals. He has been honored with the first Prize of Scientific Research in 2008 by the Moroccan Association of Research and Development and the first Prize of the Federation of Arab Scientific Councils in 2016. He has been the founding Dean of Polydisciplinary Faculty of Errachidia from 2008 to 2012. <https://www.scopus.com/authid/detail.uri?authorId=7003985262>



Prof. Dr. **Abdelmajid AINANE** is a full time Professor in the Department of physics, Faculty of Sciences at Moulay Ismail University, Meknes, Morocco, Head of the magnetism and systems modeling group (2MS). The Group is composed of 18 people. In his scientific career, he has supervised around 20 PhD students and he is one of the good researchers of the Moroccan University. Ainane's research covers a wide range of topics in nano-structured materials, condensed matter Physics and materials Science.

His current research is focused on four major areas: 2D Materials & Energy storage and Batteries, Perovskites Solar Cells, Magnetism and Nanomagnetism, Spintronics. Ainane is the author of more than 140 papers and a referee for several scientific journals. Ainane received the “NIKOLA TESLA” prize in 2015. Since November 2019, Ainane has Headed the Physics Department of Moulay Ismail University made up of 70 academics and 10 technicians/engineers. He published 180 indexed papers reaching an impact factor 27 and 2640 citations cited by 1791 documents. <https://www.scopus.com/authid/detail.uri?authorId=7003861350>



Prof. Dr. **Seddik BRI** is a full Professor in Electrical Engineering Department, responsible of Material and Instrumentations group in High School of Technology, Moulay Ismail University, Meknes -Morocco. His research interests are in communications systems with 420 articles and conferences, 14 Books and 20 chapters published. 3 International Patents (PCT) and 10 National Patents. Invited Professor at Polytechnic School and Institute of Electronics and Nanotechnology, Lille – France.

He is the Advisor of the International journal Microwave and Applications (IJMA) since 2012. Scientific Committee about 200 International Conferences and reviewer of the 40 International Journals. Holder of two research projects at Moulay Ismail University. Expert Evaluator with the CNRST from 2017-2020. 40 Masters and 30 PhD Student supervised. Reporter and Examiner in 120 PhD and HDRs and examiner 100 research projects. <https://www.scopus.com/authid/detail.uri?authorId=8572418800>



Prof. Dr. **Yousef FARHAOUI**, is a Professor at Moulay Ismail University, Faculty of sciences and Techniques, Morocco. Director of IMIA laboratory. Local Publishing and Research Coordinator, Cambridge International Academics in United Kingdom. He obtained his Ph.D. degree in Computer Security from Ibn Zohr University of Science. His research interests include learning, e-learning, computer security, big data analytics, and business intelligence.

Farhaoui has three books in computer science. He is a coordinator and member of the organizing committee and also a member of the scientific committee of several international congresses, and is a member of various international associations. He has authored 15 Books and many Book Chapters with Reputed Publishers such as Springer and IGI. He has served as a Reviewer for IEEE, IET, Springer, Inderscience and Elsevier Journals. He is also the Guest Editor of many Journals with Wiley, Springer, Inderscience, etc. He has been the General Chair, Session Chair, and Panelist in Several Conferences. He is a Senior Member of IEEE, IET, ACM and EAI Research Group. <https://www.scopus.com/authid/detail.uri?authorId=57193499468>

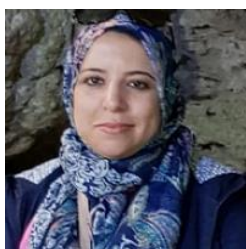


Prof. Dr. Mourade Azrour received his PhD from Faculty of sciences and Techniques, Moulay Ismail University of Meknes, Morocco. He has received his MS in computer and distributed systems from Faculty of Sciences, Ibn Zouhr University, Agadir, Morocco in 2014. Mourade currently works as computer sciences professor at the Department of Computer Science, Faculty of Sciences and Techniques, Moulay Ismail University of Meknès. His research interests include Authentication protocol, Computer Security, Internet of things, Smart systems, Machine learning and so ones. <https://www.scopus.com/authid/detail.uri?authorId=57193500437>

Mourade is member of the member of the scientific committee of numerous international conferences. He is also a reviewer of various scientific journals. He has published more than 137 scientific papers and book chapters. Mourade Has edited many scientific books for example: “IoT, Machine Learning and Data Analytics for Smart Healthcare”, “Blockchain and Machine Learning for IoT Security”, “IoT and Smart Devices for Sustainable Environment”, “Advanced Technology for Smart Environment and Energy”, and so ones. Finally, he has served as guest editor in journals “*EAI Endorsed Transactions on Internet of Things*”, “*Tsinghua Science and Technology*”, “*Applied Sciences MDPF*” and “*Sustainability MDPF*”

Prof. Dr. Ismail ESSAOUDI, is a Professor at Moulay Ismail University, Faculty of Sciences and Techniques, Morocco.

Coopering with 62 coauthors to achieve IF 23 and 1845 citations by 1200 documents. Total papers: 124
<https://www.scopus.com/authid/detail.uri?authorId=6505910555>



Prof. Dr. Zakia HAMMOUCH, is a Professor at Moulay Ismail University, Faculty of Sciences and Techniques, Morocco. Zakia Hammouch holds a diploma of advanced studies in Applied Mathematics and a PhD in Numerical Analysis and Fluid Mechanics from the University of Picardie Jules Verne Amiens France. She defended her university habilitation thesis at Moulay Ismail University, Morocco. She is currently Full Professor at the Ecole Normale Supérieure of Moulay Ismail Meknes University, Associate Professor at the Private University of Fez,

She is also Associate Researcher at the Applied Mathematics Division of Thu Dau Mot Binh Duong University, in Vietnam and Kyung Hee University Korea and consultant to the Department of Medical Research, China Medical University Hospital, Taichung Taiwan. She is a member of the European Association of Women in Mathematics (EWM), a permanent member of the Organization for Women in Science for the Developing World (OWSD) and a member representing Maghreb region in the African Mathematics Union (AMU), President of the African Commission of Mathematics and Artificial Intelligence. She has organized several international conferences in various countries (Morocco, Turkey, Cyprus, Pakistan). She was awarded the Oliviu Gherman award for her contribution to fractional calculus in 2020, the CNRST-Web of Sciences- Clarivate Research Excellence Prize in Mathematics in 2021 and the Scopus Award in Mathematics in 2022. She has published more than 147 articles and chapters in indexed journals and reputable works (Springer, Elsevier, Wiley, Worldscinet, etc.). She is a member of the editorial boards of several indexed international journals. <https://www.scopus.com/authid/detail.uri?authorId=12768922000>

N.B. the data published on the author’s biography were updated at the date of publication: March 20, 2025

VOS viewer indicated the best authors and their collaborators by coloured circles. Bouachrine existed in two colours (orange and grey) to show the separated profile of Bouachrine into Bouachrine Mohammed (Orange) and local collaborators such as Chtita, Hamidi, Ajana... and Bouachrine M. (grey) with national cooperation with Hammouti, Zarrouk... (Figure 6). Eddouks (Pink colour), Ainane Abdelmajid and Kerouad M. (173 articles, Blue colour), (173, Bri S. (143 documents, Grey), Farhaoui (126, Dark Pink), Azrour Mourade (124 docs, Pink), Essaoudi (119) and hammouch (113 articles).

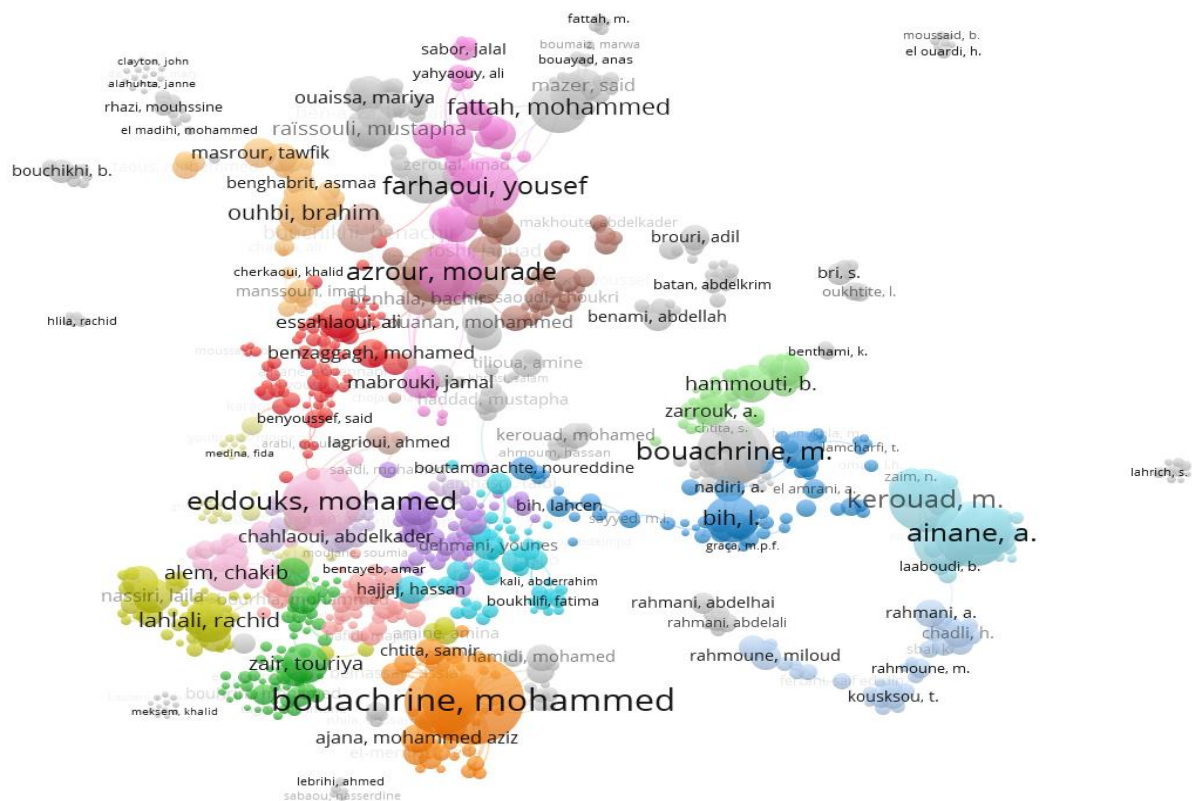


Figure 6. Network visualisation on VOS viewer of UMI authors and collaborators

3.2. Most cited papers

Scopus Analysis also indicated that the paper that exceeded 750 citations was published by Taleb Mohamed in 2012 (Shtessel et al., 2012). However, his profile is at only 21 papers. The second paper of Berradi et al. (2019) on textile surpassed 600 citations. Than of Eddouks et al., 2002 attained more than 520 citations (Eddouks et al., 2002). The fourth cited (470 citations) belongs to Zakia Hammouch published in “*Applied Mathematics and Computation*” Q1, Impact factor 3.5 (Singh et al., 2018). The fifth one cited 466 times on BACH: Grand challenge on breast cancer histology images, Medical Image Analysis, by Ismael Kone et coll. In Medical Image Analysis Q1, Impact factor 10.7 (Aresta et al., 2019)

3.3. Adscientificindex tool

Adscientific (Alper-Doger Scientific Index) can also be interesting to see rankings for Countries, Universities, and Authors. Only 433 scientists with profiles on Scholar Google appear on adscientificindex.com. Zakia Hammouch, Mohammed Bouachrine, Mohamed Eddouks, etc., are the higher H-index (Figure 7). Adscientific covers 24,484 institutions and 2,534,485 scientists across 221

countries in 13 major academic fields and 197 disciplines (www.adscientificindex.com). Some authors who did not appear, must subscribe to be added.

Total 434 scientist , Updates every 2 days List without CERN, Statistical Data etc. Sort by last 6 years H Index

* Total H Index Rankings

Rankings

100,849

30

1

Ranking Based On Selection: 1

Zakia Hammouch

Université Moulay Ismail Meknès Meknès, Morocco

H-Index Metrics

Total	Last 6 Years	Last 6 Years / Total
46	44	0.957

Engineering & Technology / Mechanical Engineering

Computational methods

Fractional differential equations

Soliton theory Fluids Mechanics Thermal

🔒 Get Full Access to Premium Data

* Total H Index Rankings

Rankings

101,557

32

2

Ranking Based On Selection: 2

Mohammed Bouachrine

Université Moulay Ismail Meknès Meknès, Morocco

H-Index Metrics

Total	Last 6 Years	Last 6 Years / Total
46	37	0.804

Natural Sciences / Chemical Sciences

Organic Materials and Optoelectronic

Drug Design Molecular Modeling

🔒 Get Full Access to Premium Data

* Total H Index Rankings

Rankings

114,481

37

3

Ranking Based On Selection: 3

Mohamed Eddouks

Université Moulay Ismail Meknès Meknès, Morocco

H-Index Metrics

Total	Last 6 Years	Last 6 Years / Total
44	30	0.682

Medical and Health Sciences / Health Sciences

Medical and Health Sciences/Pharmacology

🔒 Get Full Access to Premium Data

* Total H Index Rankings

Rankings

148,929

52

4

Ranking Based On Selection: 4

Benachir Bouchikhi

Université Moulay Ismail Meknès Meknès, Morocco

H-Index Metrics

Total	Last 6 Years	Last 6 Years / Total
39	30	0.769

Engineering & Technology / Electrical & Electronic Engineering

Electronic Engineering Sensor systems

Food safety

Volatile organic compounds analysis for disease diagnosis

Environmental mo

🔒 Get Full Access to Premium Data

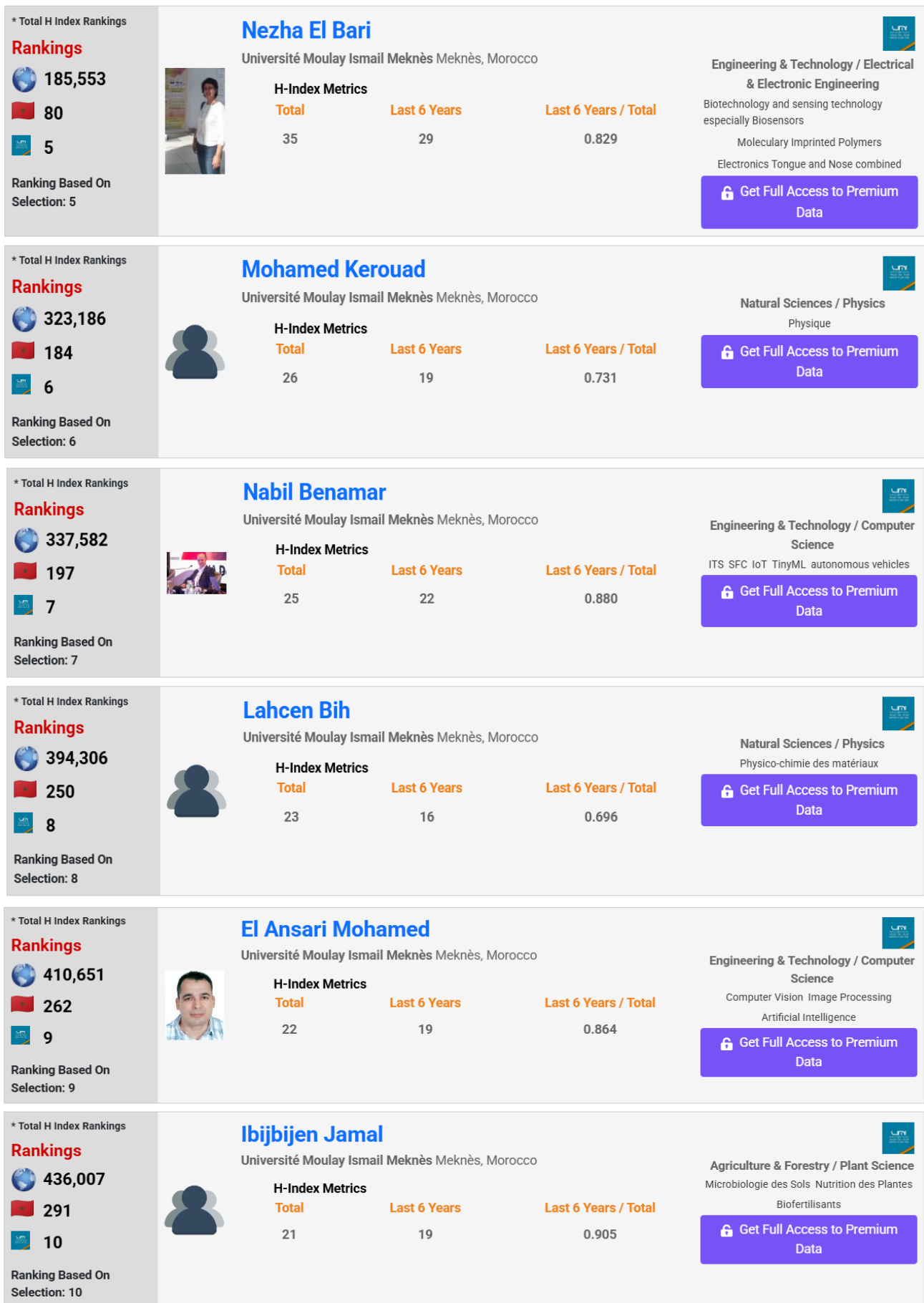


Figure 7. Author ranking of UMI by the adscientificindex

Conclusion

This bibliometric study provides a detailed analysis on the evolution and impact of the scientific production of the University Moulay Ismail from 1987 to 2024. The findings offer key insights into their researchers' growth, development, and dynamics. Firstly, the steady increase in publications over the last decade reflects a significant and growing interest of the teachers/researchers in UMI in contributing to science and forming young researchers in various fields. Secondly, the presence of databases such as Scholar Google, Scopus, Web of Science, and several international rankings, such as Academic Index or Stanford University, has encouraged more and more highly ranked professors to put in more effort to get articles and citations.

Acknowledgement, Authors thanks Scopus for the different services to serve the Science

Disclosure statement: *Conflict of Interest:* The authors declare that there are no conflicts of interest.

Compliance with Ethical Standards: This article does not contain any studies involving human or animal subjects.

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