The Relationship Between the Scientific Activities in Research Laboratories with Webometrics Ranking of Algerian Universities: An Empirical Investigation

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Abstract

Algeria has paid attention to the higher education and scientific research sector through the five-year scientific research and technological development programs (1998-2002, 2008-2012, and 2014-2019). The study aims to evaluate the scientific research activities in Algerian universities within the framework of scientific research programs, to study the relationship of scientific activities by researchers in Algerian research laboratories with Webometrics ranking of Algerian universities. It is eluted what are the scientific activities of Algerian researchers which have the most impact on the ranking of Algerian universities in the Webometrics ranking. We adopted the experimental, exploratory approach by collecting, exploring, and analyzing the correlation between of data from the Algerian university rankings according to the number of researchers in the research laboratories, the number of citations, the number of patents, published papers, and the ranking of each Algerian university in Webometrics ranking, by Spearman's correlation coefficient to test the strength and signification of the correlation between these rankings. The results showed development in the various components of scientific, material, human and financial research, but it is not enough. Also, despite many research laboratories, researchers at these laboratories, and the improvement in the number of internationally published research in each Algerian university, this did not contribute to improving its global Webometrics ranking due to the weakness of the relationship with activities of researchers in Algerian research laboratories. The result showed that the Algerian university is not interested in its virtual presence on the web, which negatively affected its Webometrics ranking. The researchers conclude that to improve the ranks of Algerian universities in various aspects, they must improve their global ranking according to the number of citations. Accordingly, to improve the ranking, international visibility of Algerian universities, decision-makers must adopt indicators of "research quality" (number of citations), "research production" (publications) in financing and accrediting research laboratories.

Introduction

Scientific research is a major issue in the 21st century, especially about technological challenges and globalization that will constitute the field of confrontation between industrialized countries and developing countries, which may push institutions that do not keep pace with growth back down to late ranks. Accordingly, scientific research is the most important function of the university in addition to teaching and

community service (Mezhouda, 2019). The transformation to a knowledge economy is based on leadership and innovation in scientific research in universities and research and studies centers and linking them to governmental and industrial policies through the knowledge (Henry, 2008), scientific and research integration between the university represented in scientific research activities through its various structures, the state is represented in its policies, and the industry is represented in various the actors, in the framework of what is known as the Triple Helix (Gibbons et al., 2010), this is from a local side, and from an international side, through the quality of scientific research, which is considered according to international standards a true indicator as a determinant of the cognitive progress of countries, which has become an urgent necessity to achieve sustainable development in the university knowledge society through the quantity and quality of its outputs, where the universities are interested and international research centers publish the results of their scientific research (in indexed and specialized scientific journals or books and conferences) in refereed publishing vessels such as the prestigious scientific journals database of the Institute for Scientific Information ISI (Aguillo, Granadino, Ortega, & Prieto, 2006) which adopts solid scientific standards, by increasing the number of papers published in the highly scientific and technical journals, the increase in scientific productivity and the clear scientific impact of an author and a scientific journal or research institution or country is known as the H index (Bouyssou & Marchant, 2010), thus increasing the ranking of higher education and scientific research systems in countries in various international classifications (Cloete, Bunting, & Van Schalkwyk, 2018), and accordingly, these will not be achieved national and international goals, except by providing the financial capabilities that are measured through the volume of spending on scientific research as a percentage of the gross domestic product, and human potential measured by the number of researchers and the number of technicians working in scientific research / one million people; here, the role and importance of scientific laboratories in providing the incubator environment for the activities of these researchers, and the material potential represented in the various structures incubating the scientific research, and the legal represented in the various laws and procedures regulating the scientific research system.

Problem Statement

Scientific research in Algeria has gone through many stages during its development since the seventies of the last century to date, which has enabled it to acquire significant capacities and experiences in the field of scientific research, where the scientific research laboratories in Algeria are considered one of the most important scientific research entities due to the human, material and financial capacities at their disposal which make them contribute to the task of collecting and transferring knowledge, particularly in with regard to the professional field, and in addition to their efforts in the collection of scientific and technological information related to the research objectives, the treatment, evaluation and facilitation of the process examined, participate in training through research, the promotion and publishing the results of scientific research, but despite all these gains, the Algerian system of higher education and scientific research ranks behind, according to the Scimagojr (The SCImago Journal & Country Rank), where in 2019 it ranked fifth in Africa, and fourth in Arab countries, with 74802 scientific articles published in SCOPUS, with an H-index of 178, and a total number of citations of scientific articles published by Algerian researchers is estimated at 569227, and the presence of 32 universities among the 5000 best in the world in 2021 according to Webmetrics ranking (Webometrics, 2020).

On the other hand, considering that researchers are at the heart of research processes in Algerian scientific laboratories, and at the source of the production and transfer of knowledge of the required quality to local and international actors, through the high quality of international scientific publications that they published them in a database for research literature and high-quality internet sources (e.g., Scopus, ISI). So, the number of full-time researchers for scientific research in scientific research laboratories is considered as an essential indicator of the increase in scientific knowledge, the increase in scientific publishing and the virtual presence on the Web network of the researcher and the university to which they belong (Benouar, 2013). From the above, the following problem is reflected, is there a correlation between the scientific activities of researchers in the scientific laboratories of Algerian universities with the Webometrics ranking of these universities? What are the scientific activities of Algerian researchers that have the most impact on the ranking of their universities in Webometrics rankings?

In this exploratory, experimental research, we have dealt with the problem of the impact and correlation of the scientific activities of researchers in the scientific laboratories of Algerian universities with the Webometrics ranking for these universities. We have also discussed the scientific activities of researchers Algerians that have the most impact on the ranking of Algerian universities in the Webometrics ranking.

These questions are the subject of national, regional, and international debates between stakeholders (academics, students, Funders, and many other stakeholders). Currently, in Algeria, these stakeholders are questioning the scientific performance of activities Algerian researchers and universities in the various world academic rankings, in particular the number of publications, the scientific impact of these publications, the number of citations, the number of patents, the visibility, and the presence online academic on global digital platforms (presence, visibility) (Govender & Nel, 2021). These stakeholders confirm that answering these questions would lead to solutions to improve the ranking of Algerian universities in Webometrics ranking. Therefore, we adopted the experimental, exploratory approach by collecting, exploring and analyzing the correlation of data from the rankings of Algerian universities according to the number of researchers in the research laboratories of Algerian universities, and the number of citations, and the number of patents, and the number of papers published, and the ranking of each Algerian university in the Webometrics, and for this purpose, we used Spearman's correlation coefficient to test the strength and signification of the correlation between the different rankings of Algerian universities.

The expectation of carrying out this exploratory research was to inspire new research on Algerian universities' current performance evaluation processes on a global scale. The expectation of carrying out this exploratory research was to inspire new research on Algerian universities' current performance evaluation processes on a global scale. Considering the low scientific productivity of Algerian researchers the low ranking of Algerian universities in the Webometrics ranking (Khedim, 2015), another expected result is the absence of any correlation between the ranking of Algerian universities according to the number of researchers in scientific laboratories with other rankings and expected that there is a correlation between the ranking of Algerian universities according to the scientific impact of Algerian researchers with different rankings, especially the citations. The document is organized as follows: The second section gives an overview of the characteristics of Algeria's research and technological development system in terms of evolution and results obtained. The third section presents the methodology and research methods used by defining the study variables and the data adopted in the analysis. The fourth section presents the study results by testing the correlation between the selected study variables and discussing these results. Finally, Finally, the concluding section gives an outlook and major results in the fifth section.

Literature Review

The scientific research system in Algeria has gone through many stages since independence, coinciding with every reform and change in the general policy of higher education and scientific research in Algeria, which coincided with the latter's socio-economic changes of the country, as the Algerian research model in particular is of the French model (Mezhouda, 2019). The year 1998 can be considered as the beginning of a new stage in the perception of the system of scientific research and technological development in Algeria, especially the issuance of law N 98-11 that includes the directive law and the five-year program for scientific research and technological development 1998-2002 without forgetting the results obtained before this period, and accordingly the most important changes and components that touched in this system is as follows:

1. Scientific Research from 1998-2008. The efforts to restructure and develop the research sector in Algeria are culminated in the promulgation of Law N 98-11, which covers the directive statute and the five-year scientific research and technical development program 1998-2002. It is considered among the solutions that Algeria tried to put in place to advance scientific research. Its preparation began in 1996, but it was only released in 1998, and it did not go into effect until the year 2000. Moreover, the Algerian authorities regard this law which dedicates scientific research and technical development, to be a national priority because it reflects the state's perspective of science and technology as two critical aspects for the country's economic, social, and cultural development.

Six principles for this law are (Assembly, 2008):

➢ First principle: Dedicating scientific research and technological development, which is a national priority.
➢ The second principle: Determining the economic and social objectives to be targeted by the research.
➢ Third principle: Establishing the institutional and regulatory framework empowered to define and implement the national policy for scientific research and technological development.
➢ Fourth principle: The gradual mobilization of financial resources to reach a percentage by the end of the five-year period 1% of GDP.
➢ Fifth Principle: Developing and valuing highly qualified human resources, through the increased involvement of university professors in research activities.

➢ Sixth Principle: Supporting links between universities and research centres on the one hand, and the economic sector in general and the industrial sector on the other hand.

To materialize these six objectives, the national research system that this law came with is based on the following main elements:

1.1. Programming. Economic and social goals were programmed during the five years 1998-2002 in 30 national research programs. These programs cover many fields, from history to biotechnology, space science, agriculture, and nutrition. During this period, 27 national research programs were implemented (90% of the program implementation rate), and it was approved 5244 citizenship Research Project with the National Committee for the evaluation of University Research Programs for 15 research bodies affiliated with the various ministerial departments, which means that scientific research is not centered in the university's periphery, but instead extends to its external surroundings (DGRSDT, 2018).

1.2. Organization. Eight joint sectoral committees have been installed, charged with promoting research activities, evaluating them, and providing means for their implementation. Forming 21 sectoral committees in the various ministerial departments, charged with promoting, coordinating, and evaluating research activities at the level of each ministerial department concerned with this topic. Law has allowed 98-11 creating three intermediary bodies in the form of research agencies, namely (Regis, 2019):

➢ The National Agency for the Development of Research in Health, under the joint supervision of the Ministry of Health and Higher Education, monitors and finances health programs.
➢ The National Agency for University Research Development is responsible for all research carried out by universities' research laboratories.
➢ The National Agency for the Evaluation of Scientific Research Results and Technological Development, which is considered the most important agency, as it links scientific research − whatever the sector that produces it − and the economic sector to transfer and evaluate research results.

1.3. HR. Recruiting 15500 research professors and permanent researchers, i.e. one researcher for every 2250 Algerians, or 443 researchers for every million people in 2008 (DGRSDT, 2018), compared to 2300 researchers for every million in Tunisia, and 4300 researchers for every million in France, while the international standard is 2000 researchers per million people, and therefore suffering Algeria from a deficit of 54,500 researchers, distributed as follows (Bougaada, 2016):

➢ 13,500 university professors conduct research activities within research laboratories, equivalent to 40% of the teaching staff in 2008.
➢ 2000 permanent researchers are mainly active in applied research.

1.4. Facilities and Equipment. Research has been supported by major facilities and equipment by:

➢ The Economic Recovery Support Program, where it was completed 04 major research centres, ALSAT2 program completed, high-traffic internet, and a platform for distance education completed.
➢ Through the National Fund for Scientific Research and Technological Development, incubation centres have been established 4550 research laboratories, to make room for pedagogical places on the one hand, and to protect equipment for laboratories, two headquarters to host research units, as well as the ALSAT 1 program.

1.5. International Cooperation. Agreements in the field of research have been concluded with several countries, and these agreements contributed to the achievement 217 research projects.

1.6. Funding. The financial envelope dedicated to financing scientific research has reached during the period between 1999-2005 Approximately 34.2 billion DZDs, of which 17.6 billion DZD were allocated as management credits and 14.2 billion DZD as equipment credits. That is, there is an approximation 93% as consumption of the program (DGRSDT, 2018).

2. Scientific Research after 2008. To consolidate the gains achieved in the five-year program 1998-2002, and to address deficiencies and shortcomings, a five-year law was prepared for the period 2008-2012 called the law amending and supplementing Law 98-11 that includes the directive law and the five-year program for scientific research and technological development 1998-2002. The amendments to this amended and supplemented law focused on seven 07 key points are:

➢ Establishing a time horizon for basic research goals extends over 10 years, this means that the programming of scientific research will be five-year, but since the goals are related to the economic

conditions of the country, they are within a horizon of 10 years. For example, with regard to renewable energies, and accordingly, this economic and political goal is translated at the level of scientific research with research programs that correspond to this political and economic will, and therefore the dimension and the goal is for 10 years, the programming is five years (05 years) and the evaluation is annual and the funding is every three years (03 years).

➢ Activating the National Council for Scientific and Technical Research and renewing its formation, so that it consists of all relevant ministries under the supervision of the Prime Minister.

➢ Creating the National Council for the Evaluation of Scientific Research and Technological Development, as a tool to evaluate research activities and support the National Council for Scientific and Technical Research.

➢ Laying down the legal foundations that allow the installation of the National Authority "the General Directorate of Research and Technological Development", activating its role, organizing its functioning, and granting it the independence of management.

➢ Creation of objective agencies for research in all fields, similar to the National Agency for the Development of Research in Health that was established previously, as experience has shown that these agencies have facilitated matters related to the management, follow-up, programming, evaluation, and financing of research activities.

➢ Creating research teams to take care of projects that require the cooperation of many bodies to be completed, for example creating working groups that include researchers from pharmacy and researchers from universities working on the same project.

➢ Creating common interests aimed at the optimal use of competencies and equipment, by combining all human and material efforts that would serve a specific research project without forgetting or excluding any party that would benefit and/or benefit, and thus reach practical and satisfactory results.

As for measures related to financing, a ceiling has been set 100 billion DZD to fund the programmed operations and to reach 60,000 researchers in the horizon of 2020 (Benjelloun, 2020). These funds are distributed by 73% to finance the research area and national programs, and 27% for investment. In addition to taking other measures and measures that would facilitate the process, such as exempting scientific equipment from taxes, enacting laws for research professors and permanent researchers, constructing basic facilities and providing major equipment for research.

3. Evaluation Indicators of Scientific Research in Algeria after 1998. Done during the period 1996-2017; 57,222 research papers were published in international scientific journals, the number of citations reached 353,325, and the scientific impact index of the published research reached H index 137, which 1.04 international research per laboratory researcher, 8242 interventions at international forums, and 237 patents registered. And therefore, despite the partial and insufficient nature of these publications, they highlight the dynamism recorded in this field, especially with the help of the facilities granted in the transportation of professors outside the country to participate in forums and contact with professors of the global level (Meyer & Benguerna, 2019). This dynamic was characterized by only the basic sciences, as according to statistics and indicators Published by the Thomson Reuters Foundation (Thomson Reuters) Technical sciences in Algeria were divided according to the index of specialization into three groups: the first group includes branches whose specialization index is less than 1, which are the branches of immunology 0.03 and neuroscience with an index of 0.09, then the branches of oncology with an index of 0.09, as Algeria was considered to have twice its specialization in these branches, the second group includes the sciences whose specialization index is limited between 1 and 2, as Algeria is considered to be of medium specialization, and includes mathematics and statistics with an index of 1.87, chemistry with an index of 1.41, automated information with an index of 1.25, ecology with an index of 1.12 and science of food and nutrition with an index of 1.06.

The third group includes the sciences whose specialization index is greater than 2, where Algeria is considered to have a strong specialization. It includes mechanical engineering and fluid mechanics with an index of 2.74, chemical engineering with an index of 2.61, applied physics with an index of 2.58, materials and minerals with an index of 2.35, general and nuclear physics with an index of 2.32, optics and electronics and reference with an index of 2.16. As for technological innovation and economic valuation, a selection was made 469 research products and services out of 890 projects that were offered in 2005 by institutions of higher education and scientific research, as well as by research bodies of other sectors. 75 projects were registered that could be transferred to a patent, but the costs related to the international registration of a patent. The problem of financing this type of operation always arises.

Among the technological achievements, there is the launch of the first Algerian satellite "ALSAT 1" in 2002; the second satellite "ALSAT 2" in 2010, and the third satellite "ALSAT B2" in 2017. The first was manufactured with pure Algerian expertise and was developed to be high-precision and strengthened with advanced imaging and sensor technologies in exploiting them (Mesrs, 2008). There is a decrease in the quantity and quality of applied research and an increase in the amount of basic research. This decline in applied research is due, according to specialists, to the recent restructuring of Algerian universities and their interest in teaching more than scientific research. In addition, applied research must be accompanied by solid economic institutions and a strong economic sector, and in Algeria, this is not available. Despite this, studies confirm that it is fundamental research that feeds applied research, for example, in the USA, it is the government that finances fundamental analysis, and the economic sector that finances applied research, and in Algeria, it is the government funding basic research, and a very low percentage of applied research, with an almost total absence of funding by the economic sector. Reaching (1396) a research laboratory within higher education institutions at the end of 2018 (DGRSDT, 2020a), which includes more than 54446 researchers among researchers professors, doctoral students, and researchers from other sectors, meaning there are about 39 researchers per laboratory on average (Rouen, 2019), and Figure1 shows the development of the number of research laboratories according to the years of the year 2000 to the year 2018, where we notice that the years 2000 and 2012 were distinguished by a great pace in establishing research laboratories, while the years 2016 and 2017 were characterized by a very low pace in establishing research laboratories, as the year 2000 marked the beginning of Law N 98-11, which included the directive law and the five-year program for research scientific and technological development 1998-2002, while 2012 is the year of the end of the implementation of the five-year program of the five-year law for the period 2008-2012.
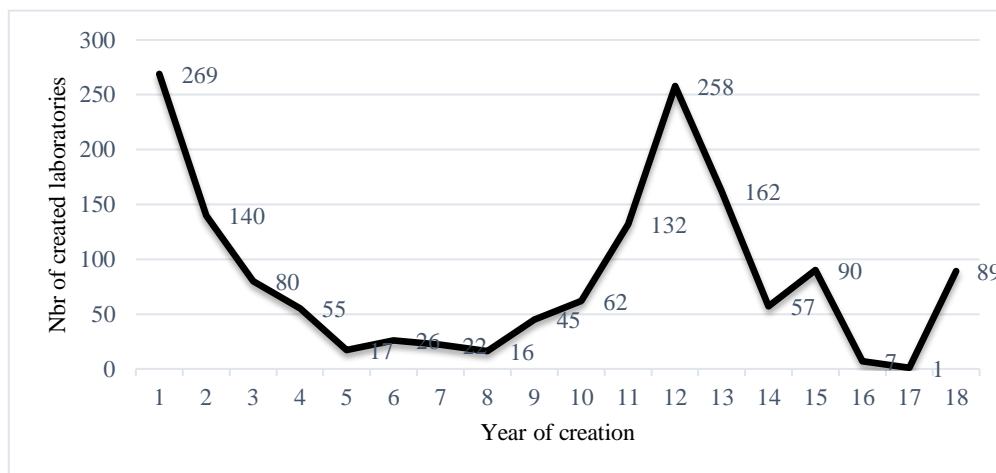

Figure 1. Number of Research Laboratories Created Between Years 2000 and 2018

Source: Authors' estimation

The number of research professors increased, as it reached the end 2013 about 27548 research professors and doctoral students enrolled under completed research laboratories (about 57% of the teaching staff), and therefore we note that this number is very close to the programmed number estimated at 28079 research professors, that is, the percentage of achieving this goal has reached 98%, and about 2315 permanent researchers, and this number is somewhat far from the programmed number, which is estimated at 4,500 permanent researchers, meaning that the percentage of achieving this goal amounted to 51.44%, and therefore the number of researchers becomes about 29,863 after it was programmed 32579, Which 786 researchers per million people, after it was 443 researchers per million inhabitants, that is, an increase of 77.42% in the five-year period, and despite this remarkable increase, it remains below the global level, which is estimated at 2000 researchers per million inhabitants, and if we maintain the same pace, that is, a development rate of 77.42 % every 05 years, then by the year 2025 we will have approximately 2475 researchers per million people, that is, we must have about 104,000 research professors and permanent researchers and doctoral students by 2025, and 52,983 in 2019, and we actually have at the end of 2018 according to Ministry statistics Higher education has 54,568 researchers among research professors, doctoral students, and researchers from other sectors, which is slightly more than expected.

A year ago, 2010, 5200 proposals were received as projects included in the National Programs for Research (PNR); after studying the criteria for administrative admission, 4093 projects were selected for higher education institutions that are going for the scientific evaluation process, through which 2732 projects were

finally selected (Amdaoud, 2017), all of which are attached to the research laboratories (on average two projects per laboratory), and framed by 12 research centers belonging to the Ministry of Higher Education and 11 centers belonging to other sectors, four centers of the Atomic Energy Governorate, and 02 centers belonging to the Algerian Space Agency.

Regarding the identification of valued projects of a common sectoral nature, project holders were asked to prepare a descriptive report on the work performed and an explanation of the nature of the socio-economic evaluation of their research work. 2200 detailed reports were submitted. However, some researchers in basic sciences considered that their work is theoretical and does not lead to an economic evaluation. Consequently, the scientific committees of the leading institutions have chosen more than 1,100 projects as listed in the National Research Programs (PNR) that are considered excellent and capable of being valued. The formation of a national committee of experts by the General Directorate of Scientific Research and Technological Development highlights the listed works in a common sectoral perspective, which can thus be valued from the social and economic side. Whereas the National Specialized Committee selected 312 projects that could be valued of a common sectoral nature, i.e., an evaluation of 11% of the projects, which is a very weak percentage indicating the weakness of the relationship between the university and its particular economic environment on the one hand, and the weakness of the relationship between the university and government policies pursued in other sectors.

Table 1. Distribution of Projects Valued at Socio-Economic Impacts According to the Field of Research

Number of Projects	Domain or Field of Search	Number of Projects	Domain or Field of Search
26	Agriculture, water ressources	34	Humanities and history
23	Creating the environment, territory and major risks	30	Basic sciences
48	Law, Economy and Society	44	Technology and industry
34	Education, culture and communication	19	Raw materials and energy
23	Housing, construction, transportation and public works	18	Health and Life Sciences

Source: Authors' estimation

We note through the table that the field of raw materials and energy and health and life sciences are the two fields in which there is the fewest number of appraised social and economic projects. While the most significant number of appraised projects were in the field of law, economy and society, and technology and industry. Average of two projects per informant, we conclude that there are only 156 research laboratories out of 1402 produced quantifiable projects (about 11% of the research laboratories).

In evaluating research results, the number of patents registered in the name of Algerian resident researchers from 174 at the end of 2014 to 331 patents at the end of 2020 (Aissaoui, 2020). In 2020 (DGRSDT, 2020b), the increase in the number of patents registered in the name of higher education institutions was the driving force behind the overall increase in the number of patents for national researchers, as the contribution of higher education institutions reached about 47.73%, while Research and Development Centers affiliated to the Ministry of Higher Education contributed 40.78%, and R&D Centers not affiliated with the Ministry of Higher Education and Scientific Research contributed 09.37%, while the Research Agencies of the Ministry of Higher Education contributed 2.11%, as technical fields contributed to the highest share of Number of patents for national researchers in the form of renewable energies, physics, minerals and mechanics, health and pharmaceuticals, agriculture and irrigation, electricity and electronics, communication technologies these are the same fields that have contributed to a large number of research published in reputable international journals, and to a large number of national research projects of a social and economic nature (see Table 1).

The size of the financial envelope that was spent on all scientific research and technological development projects under the title of the National Fund for Scientific Research and Technological Development between 2008 and 2014 amounted to 69.77 billion DZD, but this disbursed money suffered from mismanagement. Professor Mohamed Bahloul (President of the Human Resources Institute in Oran) says that scientific research does not suffer from a lack of financial resources but from the bureaucratic management of the administration that takes more than 60% of the budget for scientific research. The rest is spent on formative research and not exploratory study. For this reason, the results of scientific research are still weak, and "the failure to conduct scientific research following international standards in research centers".

Methodology and Research Methods

1. **An Overview of the Ranking of Algerian Universities in the Webometrics Ranking.** The context of higher education and scientific research is going through a new phase and rapid changes. Every university has to change its view of higher education, adopt a new idea based on pedagogical creativity governance, adopt and strengthen modern information and communication technology, and adopt methods that help it develop its educational and research services. It enables them to improve their global ranking and develop their outputs, especially those related to publications, using all available and possible means of communication to create strong competitiveness. Accordingly, the Webometrics ranking for universities came to provide a quantitative analysis of the openness index (the volume and impact of the information) for the university (Kurbatov, 2017), and the visibility index (the number of external links) on the Web for universities (Kunosić, Čeke, & Zerem, 2019), which Björneborn defined as "*The study of the quantitative aspects of the construction and use of information resources, structures and technologies on the Web drawing on bibliometric and informetric approaches*" (Björneborn, 2004). Accordingly, the Algerian higher education and scientific research system until the end of 2019, according to Scimagojr (The SCImago Journal & Country Rank), ranked 5th in Africa after South Africa, Egypt, Nigeria, Tunisia. It ranked fourth in the Arab world after Egypt, Saudi Arabia, Tunisia. Moreover, 74,802 scientific articles published by Algerian researchers in SCOPUS, with an H index, were estimated at 178, and the total number of citations of Algerian researchers was estimated at 569,227 citations (Scimagojr, 2020). Algeria acquires 0.26% for knowledge-based technology products globally and 0.02% for knowledge production in the humanities.

The Webometrics ranking of July 2020 showed the position of Algerian universities in this ranking. This ranking showed 34 Algerian universities among the top 100 universities in North Africa. It also showed that the University of Constantine and the University of Science and Technology Houari Boumediene scored good results in terms of the Research Excellence Index (Excellence: the number of papers published out of 10% of what was cited in 26 data areas for the five years 2015-2020). As it was noted that in 2019 it was among 103 Algerian university institutions included in the classification, we find that 33 Algerian universities registered their attendance among the best 5,000 universities in the world, while there were 15 universities among the best 5000 in years 2015 (Webometrics, 2020). And therefore, despite this development, Algerian universities are backward and delayed internationally, despite the sums spent annually due to the lack of interest in their hypothetical presence on the internet. The evidence for this is that there is no Algerian university among the best 5000 in the world in terms of sub-ranking "the visibility" reflecting the impact of the institution's web content and the lack of publication in indexed international journals that consider in such classifications, especially the backwardness of social sciences in this field. And with this pace at which Algerian universities operate, it is not possible achieving the ministry's goal of reaching three universities among the best 500 universities in the world in the horizon of 2020, namely the University of Tlemcen, the University of Constantine, and the University of Science and Technology Houari Boumediene (Hafid & Mokhtar, 2014), and it is what happened that the best ranking was given to the University of Constantine in the rank 1928 globally.

2. **Methodology for Determining Study Variables and Data.** According to the statistics of the Algerian Ministry of Higher Education concerning the number of research laboratories in each Algerian university institution and the number of researchers belonging to these laboratories, it was found that there are 1395 laboratories, of which 36% are in social sciences, and 54421 researchers are active in these laboratories of which 64% are researchers at universities and the rest in research centers. Among all the Algerian higher education institutions, there are about 74 university institutions including those containing at least one laboratory, and some of them contain at most 94 laboratories (Annaba University) (DGRSDT, 2018), while on average there are about 39 researchers per laboratory. And considering the human element is the focus of the research process and the source of knowledge in terms of its production and transfer by quality required for the scientific public, whether locally or internationally, through international scientific publication in global databases similar to the rule of Scopus and ISI, and thus distinguish universities globally by improving their global Webometrics ranking (Torres-Samuel et al., 2018), it is considered the number of researchers devoted to scientific research in scientific research laboratories is an important indicator of increasing scientific knowledge, increasing scientific publishing, and the virtual presence on the web network of the researcher and the scientific institution to which he belongs.

Accordingly, based on the above, we adopted the following methodology to determine the study variables, where we have ranked the Algerian university institutions that contain research laboratories (73 university institutions) on the basis of the number of researchers/per laboratory (first place for the university that

includes the largest number of researchers/per laboratory, and so on), and we have also selected three global rankings for the concerned university institutions according to the global Webometrics ranking July 2020 version, which is the global Webometrics ranking, and the sub-ranking "Transparency" (Openness) which ranks the university according to the number of citations of the main authors according to the university they belong to, and the sub-ranking "Excellence'" which ranks the university according to the number of published papers out of 10% of those cited, we also arranged the Algerian university institutions according to the number of patents from the most number to the least, and we also arranged the Algerian university institutions according to the number of patents for each laboratory in each university institution, considering or assuming that patents are produced in the laboratory, and we have done this ranking to find out the productivity of the laboratories for patents. The following table presents the data of the variables ranked according to the methodology used.

Table 2. Ranking of Universities According to the Various Approved Rankings

University	Rank by Researcher /Lab	Global Webometric Ranking	Rank by Citation	Rank Nbr patents /lab	Rank by Nbr Papers	Rank by Nbr brevets
Univ of Constantine 1	26	1	1	23	6	23
Univ of USTHB	4	2	2	3	1	10
Univ of Oran 1	48	3	31	9	7	18
Univ of MSila	57	4	11	25	16	25
Univ of Tlemcen	12	5	6	13	8	20
Univ of Sidi BelAbbès	16	6	7	5	2	7
Univ of Béjaïa	7	7	4	11	4	16
Univ of Biskra	10	8	3	4	11	4
Univ of Ouargla	35	9	17	8	25	11
Univ of Annaba	41	10	12	24	3	24
Univ of USTOMB	24	11	10	12	10	17
Univ of Mostaganem	38	12	5	26	27	26
Univ of Boumerdès	27	13	8	2	12	3
Univ of Jijel	66	14	19	10	9	8
Univ of Guelma	37	15	9	27	19	27
Univ of Tébessa	64	16	20	28	13	28
Univ of Chlef	36	17	13	29	23	29
Univ of Sétif 1	25	18	70	6	5	6
Univ of Laghouat	33	19	14	7	21	5
Univ of Batna 1	58	20	66	22	15	22
Univ of Mascara	30	21	15	30	18	30
Univ of Oum El Bouaghi	40	22	18	31	28	31
Univ of Saida	54	23	39	32	24	32
Univ of Tizi Ouzou	18	24	64	21	20	21
Univ of Blida 1	43	25	67	1	14	2
Univ of Médéa	53	26	26	15	29	9
Univ of Bouira	59	27	22	33	31	33
Univ of El Oued	52	28	21	34	36	34
Univ of Constantine2	19	29	29	35	34	35
Univ Souk Ahras	62	30	34	36	30	36
Univ Alger 1	61	31	33	37	42	37
Univ of Djelfa	44	32	30	38	39	38
National Polytechnic School of Algiers	14	33	23	19	17	15
Univ of Bordj Bou Arréridj	67	34	35	39	32	39
Univ of Skikda	39	35	72	40	26	40
Univ of Tiaret	34	36	73	41	22	41
Univ of Béchar	11	37	32	20	40	19
Univ of Khenchela	31	38	27	17	38	13
Univ of Relizane	68	39	40	42	35	42
ESI ex-INI	3	40	25	43	37	43
Univ of El Tarf	50	41	43	44	41	44
Univ of Khemis Miliana	65	42	69	45	43	45
Univ of Adrar	6	43	28	16	55	12
Univ of Mila	73	44	44	46	47	46
Univ of Blida 2	45	45	24	47	54	47
Univ of Oran 2	29	46	38	48	58	48

Table 2 (cont.). Ranking of Universities According to the Various Approved Rankings

ENP Oran	51	47	47	18	63	14
National Higher School of agronomy	17	48	41	49	59	49
Univ of Ghardaia	60	49	37	50	57	50
Univ of Batna 2	23	50	16	51	53	51
Univ of Constantine3	32	51	36	52	56	52
Univ of Tamanghasset	28	52	52	53	45	53
Univ of Alger 2	47	53	48	54	64	54
Univ of Sétif 2	46	54	71	55	65	55
Univ of Alger 3	2	55	65	56	66	56
Univ of Témouchent	42	56	45	57	61	57
National Veterinary School of Algiers	8	57	61	58	33	58
Higher Normal School of Letters and Human Sciences of Constantine	69	58	58	59	46	59
Higher School of Computer Science of Sidi Bel Abbes	13	59	42	60	60	60
high school of commerce Algiers	5	60	63	61	50	61
Univ of Tissimsilt	71	61	46	62	62	62
National Higher School for Hydraulics of Blida	21	62	50	63	44	63
School of Higher Commercial Studies	1	63	54	64	67	64
Univ of Naama	55	64	55	65	68	65
Univ of Tipaza	70	65	53	66	69	66
Univ El Bayadh	72	66	51	67	70	67
Polytechnic School of Architecture and Urbanism	9	67	49	68	49	68
Higher normal school Kouba	49	68	56	69	51	69
National School of Statistics and Applied Economics	56	69	59	70	71	70
National Higher School of Marine Sciences and Coastal Management	15	70	60	14	48	1
National School of Built and Ground Works Engineering	20	71	62	71	72	71
ENS Bouzareah	22	72	57	72	52	72
Univ of Sciences Islamiques Constantine	63	73	68	73	73	73

Source: DGRSDT, 2018, 2020a, 2020b; Webometrics, 2020

Through the results, we notice that there is a difference in the ranking of the relevant university institutions according to each ranking, and to find out whether there is a correlation between the various rankings of the Algerian universities, we calculate the Spearman's correlation coefficient, because it is the most appropriate to measure the strength of the relationship between the ranks.

Results

1. The Relationship of the Number of Researchers in Each Laboratory and the Global Rankings of Algerian Universities. The results of Spearman's correlation coefficient for the different ranks of all Algerian universities as follows:

Table 3. The Results of the Spearman's Correlation Coefficient Between the Different Ranks of All Algerian Universities

		Rank by Researcher / Lab	Global Webometric Rank	Rank by Citation	Rank by Nbr Papers	Rank by Nbr patents /lab	Rank by Nbr patents
Rank by	Correl coef	1,000	0,059	0,151	0,147	0,176	0,169
Researcher	Sig.		0,619	0,202	0,214	0,136	0,153
/Lab	N	73	73	73	73	73	73
Global	Correl coef	0,059	1,000	,711**	,906**	,857**	,809**
Webometric	Sig.	0,619		0,000	0,000	0,000	0,000
Ranking	N	73	73	73	73	73	73
Rank	Correl coef	0,151	,711**	1,000	,560**	,575**	,545**
by	Sig.	0,202	0,000		0,000	0,000	0,000
Citations	N	73	73	73	73	73	73
Rank by	Correl coef	0,147	,906**	,560**	1,000	,816**	,776**
Nbr	Sig.	0,214	0,000	0,000		0,000	0,000
Papers	N	73	73	73	73	73	73

Table 3 (cont.). The Results of the Spearman's Correlation Coefficient Between the Different Ranks of All Algerian Universities

Rank by	Correl coef	0,176	,857**	,575**	,816**	1,000	,992**
Nbr of	Sig.	0,136	0,000	0,000	0,000		0,000
patents /lab	N	73	73	73	73	73	73
Rankby	Correl coef	0,169	,809**	,545**	,776**	,992**	1,000
Nbr	Sig.	0,153	0,000	0,000	0,000	0,000	
patents	N	73	73	73	73	73	73

Source: Authors' estimation

Through the results of the correlations, we observe and conclude the following:

Result 1: The presence of weak and insignificant correlations between the ranking of universities according to the number of researchers/laboratory and various other ranks.

Result 2: The presence of strong and significant correlations between the ranking of universities according to the global Webometrics ranking and the sub-ranked according to the number of citations, the sub-ranked according to the number of published papers, the ranking of universities according to the number of patents, and the ranking of universities according to the number of patents for each laboratory.

Result 3: The presence of medium and significant correlations between the ranking of Algerian universities according to the number of citations and the ranking of Algerian universities according to the number of published papers, and the ranking according to the number of patents, and according to the number of patents/laboratory and therefore we conclude here that the number of papers published by Algerian universities, in general, are not cited entirely, or that ranking half of the Algerian universities according to the number of citations does not correspond to their ranking according to the number of papers published in international journals.

Accordingly, by correlating the ranks of all Algerian universities according to the number of researchers/per laboratory and various other ranks, the large number of the 54421 Algerian researchers active in the 1395 scientific laboratories has nothing to do with the global Webometrics ranking of their universities. They do not contribute to global scientific production. However, 50% of them have a PhD (DGRSDT, 2020a), due to the lack of their scientific activity nationally through publishing in national journals and unclassified forums, in addition to establishing various research programs that are not economically and socially feasible, not even creative scientific activities or projects beneficial to society, not even patents. It is what prompted the permanent sectoral committee for scientific research and technological development, which is charged with the promotion of scientific research and technological development activities in its evaluation of scientific laboratories to its classification into three categories. The first is the red list or the negative list (39 laboratories), which includes laboratories that do not respect the conditions and have not provided a statement on their researchers' activity status. Second, the orange list (410 laboratories) has submitted a report on the level of its researchers, but it does not match the criteria set by the committee. Third, the green list (941 laboratories) submitted a statement on the status of its researchers following the requirements set by the committee.

Hafeez Uragh, Director General of Scientific Research and Technological Development at the Ministry of Higher Education and Scientific Research revealed that 68% of the reports on the achievements and results of scientific laboratories are positive, especially those related to the exact sciences, as he only recorded, for example, 5% of negative reports about research laboratories in chemistry, 16% for the sciences of nature and life, and 13% for physics laboratories, while the whole problem is in the human sciences research laboratories in which the Ministry registered 54% of the percentage of negative reports (DGRSDT, 2018), which will make the Ministry cut off funding from it (20 billion dinars annually as a budget for scientific research from 2017 to 2022) in view of its inability to provide an added value to knowledge, scientific research and the national economy despite the great time that her been given to it to adapt and move to the field of scientific and knowledge production, which is also what made the Ministry decide to close of 72 research laboratories in 22 higher education institutions in 2018 due to their negative outcome and their depletion of money without providing any practical return. There were laboratories in grand universities such as the University of Algiers (09 laboratories), the University of Oran, the University of Tlemcen, the University of Constantine1, and the Oran University of Science and Technology (Mesrs, 2018). Therefore, it can be said that our laboratories derive their value from their number and not from the quality and quality of their scientific and knowledge productions.

2. The Correlation Relationship Between the Rankings of Algerian Universities Producing Patents only. As it is known, not all higher education institutions have patents, and by referring to the statistics of the Algerian Ministry of Higher Education and Scientific Research, we noticed that there are only 24 higher education institutions have at least one patent, only half of which have at most two invention patents, and 20% of them have at least nine patents for invention, and there are well-established universities such as the University of Oran 2 and University of Algeria1 and University of Setif and others that have not produced a single patent, and therefore we have by studying the correlation relationship between the different ranks approved in this study only for 24 Higher Education Institutions that have patents, and we note here that this ranking aims to know whether the general results will change, mainly the first result of the ranks relationship in the general ranking mentioned above, and accordingly the results of the ranking are as follows.

Table 4. The Results of the Spearman's Correlation Coefficient Between the Different Ranks of the Algerian Universities Producing Patents only

		Rank by Researcher/ Lab	Global Webometric Rank	Rank by Citation	Rank by Nbr Papers	Rank by Nbr patents /lab	Rank by Nbr patents
Rank by	Correl coef	1,000	0,140	0,384	0,139	0,114	0,027
Researcher	Sig.		0,514	0,064	0,517	0,596	0,900
/Lab	N	24	24	24	24	24	24
Global	Correl coef	0,140	1,000	,716**	,849**	0,320	-0,220
Webometric	Sig.	0,514		0,000	0,000	0,127	0,302
Rank	N	24	24	24	24	24	24
Rank	Correl coef	0,384	,716**	1,000	,531**	0,199	-0,080
by	Sig.	0,064	0,000		0,008	0,351	0,710
Citations	N	24	24	24	24	24	24
Rank by	Correl coef	0,139	,849**	,531**	1,000	0,304	-0,150
Nbr	Sig.	0,517	0,000	0,008		0,148	0,485
Papers	N	24	24	24	24	24	24
Rank by	Correl coef	0,114	0,320	0,199	0,304	1,000	,773**
Nbr of	Sig.	0,596	0,127	0,351	0,148		0,000
patents/lab	N	24	24	24	24	24	24
Rank by	Correl coef	0,027	-0,220	-0,080	-0,150	,773**	1,000
Nbr	Sig.	0,900	0,302	0,710	0,485	0,000	
patents	N	24	24	24	24	24	24

Source: Authors' estimation

Through the results of the correlations, we observe and conclude the following:

Result 1: The existence of weak and non-significant correlations between the ranking of universities producing patents according to the number of researchers/per laboratory and various other ranks, except for the presence of an average and significant correlation between the Algerian universities' ranking of patents according to the number of researchers/per laboratory and their global ranking according to the number of citations, and from here and by reference to the result one previously from the general relationship of the ranks of all Algerian universities, we conclude that by introducing the patent variable that there is only a correlation between researchers in the laboratories of Algerian universities that produce patents and the number of citations for researchers belonging to these universities.

Result 2: The presence of strong and significant correlations between the ranking of universities according to the global Webometrics ranking and sub-ranking by number of citations and sub-ranking by number of papers published, as these sub-rankings are part of the global Webometrics ranking.

Result 3: The results showed that the ranking of the Algerian universities producing patents according to the number of patents for invention or according to the number of patents for each laboratory that there are weak and insignificant correlations with the ranking of Algerian universities according to the number of citations and the ranking of Algerian universities according to the number of published papers and the global Webometrics ranking, because these are latest rankings do not take into account the patenting factor in their ranking of universities.

3. The Correlation Relationship Between the Rankings of the Most Cited Algerian Universities. Quite remarkably, it is known that the number of citations is an indicator of the good quality of the published research and its content, and from this standpoint, we have studied the relationship of correlation between the different ranks approved in this study only the 20 most cited universities, and accordingly, the results of the ranking were as follows:

Table 5. The Results of the Spearman's Correlation Coefficient Between the Different Ranks of the Most Cited Universities

		Rank by Researcher /Lab	Global Webometric Rank	Rank by Citation	Rank by Nbr Papers	Rank by Nbr patents/lab	Rank by Nbr patents
Rank by	Correl coef	1,000	0,398	,672**	0,397	,445*	0,371
Researcher	Sig.		0,082	0,001	0,083	0,049	0,107
/Lab	N	20	20	20	20	20	20
Global	Correl coef	0,398	1,000	,726**	,719**	,561*	,484*
Webometric	Sig.	0,082		0,000	0,000	0,010	0,031
Rank	N	20	20	20	20	20	20
Rank	Correl coef	,672**	,726**	1,000	,535*	,462*	0,395
by	Sig.	0,001	0,000		0,015	0,040	0,084
Citations	N	20	20	20	20	20	20
Rank	Correl coef	0,397	,719**	,535*	1,000	,577**	,529*
by Nbr	Sig.	0,083	0,000	0,015		0,008	0,016
Papers	N	20	20	20	20	20	20
Rank by	Correl coef	,445*	,561*	,462*	,577**	1,000	,980**
Nbr of	Sig.	0,049	0,010	0,040	0,008		0,000
patents/lab	N	20	20	20	20	20	20
Rank	Correl coef	0,371	,484*	0,395	,529*	,980**	1,000
by Nbr	Sig.	0,107	0,031	0,084	0,016	0,000	
patents	N	1,000	0,398	,672**	0,397	,445*	0,371

Source: Authors' estimation

Through the results of the correlations, we observe and conclude the following:

Result 1: The existence of weak and insignificant correlations between the ranking of universities according to the number of researchers/each laboratory and the various other ranks, except for the presence of a strong and significant correlation between the ranking of Algerian universities according to the number of researchers/each laboratory and their ranking according to the number of citations, and the existence of an average and significant correlation between the ranking of Algerian universities according to the number of researchers/each laboratory and ranking them according to the number of patents/each laboratory, and with reference to the result 1 previously from the general relationship of the ranks of all universities, we conclude that by introducing the variable "number of citations" there is a correlation relationship between researchers in the laboratories of Algerian universities that are most cited for their research in the world with the number of citations for researchers belonging to these universities, and with the number of patents for each laboratory in these universities.

Result 2: The results showed that the Algerian universities' ranking of the most cited according to the number of patents/each laboratory have correlations medium and strong, and they are significant with the rest of the ranks of other Algerian universities.

Result 3: In general, we notice that introducing the standard of the most-cited universities has improved the strength and morale of the correlation relationship between the various ranks compared to the two previous cases. Therefore, we conclude that to improve the ranks of Algerian universities in various aspects, they must pay attention to enhancing their global ranking according to the number of citations and according to the papers published in prestigious international journals in terms of quality and content. It will increase and improve the productivity of the laboratories and the researchers affiliated with them, all of this assuming that laboratories are the main pillar of any research activity, whether producing patents or publishing research papers and, in general, the production of implicit or explicit knowledge. In other words, universities that have more cited articles, are cited more per article (Raan, 2008).

Discussion and Conclusions

Research laboratories are incubators of creativity because thinking there is supposed to be collective and integrative between the different sciences as they form and accumulate knowledge experiences. Research laboratories in Western universities produce important strategic ideas on which countries rely on issues of concern to the country and provide recommendations to decision-makers according to visions. During the last twenty years or so, the higher education and scientific research system in Algeria have changed Significantly; it has moved to an allocation of resources with an appraisal culture based on some measure of performance on the assumption that society will reap the benefit of scientific development. This change is grounded in the belief that there are "universal" measures of scientific "excellence" that academics,

policymakers, and stakeholders can reliably use to assess the outputs of researchers, research laboratories, and universities. In parallel, globally, a set of bibliometric indicators has been created closely related to well-known academic classifications such as the Webometrics ranking. Despite this change in the Algerian research and development system, it has faced significant criticism due to the poor performance measures of researchers, research laboratories and universities, which negatively affected the ranking of Algerian universities in the Webometrics ranking. This study concluded essential results about the correlation of the scientific results of researchers in the research laboratories of Algerian universities with the Webometrics ranking of these universities, which can be summarized in the following:

First result: Despite the efforts made and the Algerian decision-makers' human, material, and financial resources, they did not yield the expected results due to the lack of a clear implementation and evaluation strategy and public accountability. Previous studies in this regard point to the successful pattern of countries' policies to establish research universities, inspired by the American research university based on international "excellence" (Taylor & Cantwell, 2015), with policymakers assessing their position in global rankings (Hazelkorn, 2009). Here, the Algerian R&D system has failed, and a study of Hazelkorn's (Hazelkorn, 2009) shows how ratings influence national policy, shape institutional decision-making and behavior, improve performance, and increase public accountability. The rankings in excellence universities provide evidence or rationale for making a significant change, accelerating reform, or pursuing a particular agenda, while in many universities where quality assurance mechanisms are relatively new or relatively weak, rankings have taken on the function of quality assurance (Hazelkorn, 2009).

Second result: Most researchers and research laboratories in Algerian universities did not contribute to ranking their universities in the webometrics ranking. Due to the low productivity of Algerian researchers, particularly in social sciences, most of the scientific publications (papers, patent applications, etc.) published by researchers are in technical sciences. Half of the research laboratories in Algeria do not produce knowledge. The students push the universities to expand their staff to manage educational activities and, in turn, reduce their team's scientific production. Previous studies show that the low salaries cause the low productivity of Algerian researchers, the migration of researchers, that they are looking for international scientific excellence, high salaries. A comparative study between US and European universities (Lepori, Geuna, & Mira, 2019) showed that the researchers are the main resource of universities and showed that the strongest scientific production (publications, citations) impact occurs by providing more resources for each researcher. Therefore, the dominance of US universities in rankings according to the number of publications and citations is concerned at the international ranking (Webometrics ranking).

Third result: Weak indicators of R&D in the research laboratories of Algerian universities. This study showed that the research laboratories of Algerian universities are still below the international level because of the absence of a scientific methodology to build, maintain and enhance the intellectual capacities of researchers in these laboratories, the absence of training programs, and the exchange of experiences, the lack of interaction and relationship with the external environment (society, economic institutions), and the lack of production of knowledge related to economic and social development. This knowledge can provide qualitative and practical solutions according to a global vision and achieve the concept of a knowledge economy in terms of creativity and production and mastering the slogan "Think globally and implement locally". A study on the URAP-TR ranking system of Turkish universities (Alaşehir, Çakır, Acartürk, Baykal, & Akbulut, 2014) showed that this national ranking can help Turkish university administrations to identify areas that still need improvement and to develop strategies to address their shortcomings, such as research laboratories, programs, and the capacities of researchers, and thus improve competitiveness at the national and international levels.

Fourth result: To improve the ranking of Algerian universities in Webometrics ranking, they must ensure to improve their world ranking according to the number of citations. This result is important for decision-makers to improve the ranking of Algerian universities international visibility by adopting the 'research quality' (number of citations) 'research production' (publications) indicators in funding and accrediting research laboratories. In parallel, academic rankings were closely correlated with more advanced bibliometric data (Alaşehir et al., 2014), such as the number of publications in the list of most cited papers or the h-index. Therefore, such metrics that work well in the context of global rankings are less useful in a developing country such as Algeria, which has newly founded universities. In contrast, such metrics are more useful in the context of a developed country such as the United States, Britain, and Japan, which have leading universities characterized by research production and quality (Raan, 2008). However, for most universities, expanding research output is much easier than improving research quality (Li, Yi, Guo, & Qi, 2012).

Limitation

This research, however, is subject to several limitations. The most important is the lack of experts in higher education in Algeria, the low feasibility of national scientific research programs on the economic and social level, and the lack of national studies that detail the subject. We were confronted with the limits of excluding certain Algerian universities from this study because there are no research laboratories in these universities despite their ranking in the Webometrics ranking ahead of some universities included in this study but did not affect the overall objective of this study. We encountered difficulties collecting data relating to research laboratories due to the absence of an easily accessible national database. However, an updated approach has been proposed to assess the performance of Algerian universities by linking their performance to Webometrics rankings. The research results have been good and essential for Stakeholders in Algeria given the results obtained in foreign studies who confirmed the same results in this research (Guseva, Kalashnik, Kaminskii, & Kireev, 2022; Raan, 2008), especially the effect of citations and the number of papers Published on improving the performance of universities in international rankings (Raan, 2008). Finally, other assessments of R&D systems in Algerian universities can be carried out, for example realizing a survey to know and study the factors influencing the decline in the scientific productivity of Algerian researchers in research laboratories and realizing an econometric study to study the factors influencing the technical inefficiency of R&D systems in Algerian universities, by utilization inputs (human, material and financial) and utilization outputs of the R&D system.

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