

THE VISIBILITY OF MEXICAN KNOWLEDGE: THE PARTICIPATION OF MEXICAN SCIENTIFIC PUBLICATIONS IN THE INTERNATIONAL CONTEXT

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Resumen

Este trabajo estudia la visibilidad internacional del conocimiento producido en México y que se difunde a través de revistas y artículos publicados por científicos mexicanos. Analiza cinco bancos de información. El análisis reporta un fenómeno de concentración de revistas y de la información científica en general que influye en la visibilidad de las publicaciones; también observa la influencia de las instituciones y una serie de elementos como el idioma, el campo científico y mecanismos de evaluación, que conforman barreras a la visibilidad. Ante ello, ha surgido el movimiento de *Open Access* que promueve el libre acceso al conocimiento.

Palabras clave:

- Visibilidad del conocimiento
- Difusión científica
- Producción científica
- Revistas científicas
- Bancos de información

Abstract

This study examines the international visibility of the scientific knowledge produced in Mexico and disseminated through journal and scientific articles published by Mexican scientists. It analyzes five information banks. The analysis found a phenomenon of concentration of publications and scientific information in general that affects the visibility of scientific knowledge. Also, it shows the influence of institutions and elements such as language, scientific fields, and evaluation mechanisms which constitute barriers to visibility. In this scenario, an Open Access movement has emerged to promote free access to scientific knowledge.

Key words:

- Knowledge visibility
- Scientific dissemination
- Scientific journals
- Scientific production
- Information banks

Introduction

This paper is aimed at analyzing the visibility achieved by Mexican scientific knowledge through two mechanisms: the participation of Mexican journals in scientific databanks, and the publication of scientific papers by Mexican researchers. The visibility of a scientific paper is understood as the possibility of putting knowledge before the potential user in order to facilitate its consultation. This is achieved through the dissemination of the work, which means to make the published work visible (Ochoa, 2004).

Available literature on the visibility of publications assumes that the simple entry of scientific journals to the most prestigious databases is a way for them to be consulted by all users in the world without any barriers, however, these scientific information banks, with their objectives and rules of use, present entry restrictions for both the publication and the use of the materials, therefore the patterns of science diffusion through journals and papers may not be presumed as being under the perfect umbrella of fair competition.

Field data were accessed from four information banks: SCOPUS, ISI (Institute for Scientific Information), Redalyc (Network of Scientific Journals from Latin America, the Caribbean, Spain and Portugal) and Latindex (Regional Information On Line System of Scientific Journals from Latin America, the Caribbean, Spain and Portugal).

The paper proceeds as follows: first with an analysis on the importance of knowledge visibility achieved through the publication of scientific journals; then it reviews the contents of the four databanks, which include Mexican journals; plus an analysis of the publication of papers by Mexican researchers in journals recognized by the Institute for Scientific Information (ISI); followed by an analysis and summary of the information presented, which leads to establishing some conclusions.

The visibility of knowledge through publication in journals and scientific articles

Ochoa (2004) notes that the dissemination of knowledge is a phase in the scientific work that takes place when the intellectual production reaches the user, i.e. going beyond the work of publishing; this requires making the published work visible; i.e. making it accessible to the potential user to facilitate consultation. Without visibility there is no use for knowledge which is ultimately the very reason for its production.

The visibility influences the citation index. This makes researchers, and the public at large, aware of the existence of a paper, when the work is not visible it is impossible for it to be considered, and therefore, evaluated. The visibility, accessibility and availability necessarily influence the behavior of consumption or use of an article in a given context (Cañedo, 1999: 31)

Visibility can take on two forms: through paid subscriptions or journals purchased directly by consumers, be they individuals or institutions, this is called direct visibility. Indirect visibility is achieved through databanks, directories, journal catalogs and virtual libraries.

Rogel (2009) summarizes a number of factors that justify why today's science is published in scientific journals, more than in books and other forms that are called gray literature, fugitive literature or semi-published literature. Among the reasons for preferring to publish in a journal are:

Through this medium, investigations are in progress and subject to discussion by different groups of scientists; journal articles undergo a peer review process by scholars who are responsible for assessing the scientific quality of publications; a journal appears periodically so it makes it possible to generate positioning indicators within an academic community; because of international standards in place, both academic and format, for the publishing of journals and the writing of papers, it is possible to make comparisons in this context, and for this purpose there are several databases that assess and record publications thereby increasing their visibility.

It is also possible to develop research performance indicators for each country as well as to compare journals regardless of their area of knowledge or size. The main indicators are the Impact Factor, the Immediacy Index and the Life-span Index. The Impact Factor is obtained from a ratio of the number of citations of articles in the two years following its publication divided by the number of articles published in the journal, the immediacy factor is the number of citations in the following year after publication divided by the number of articles published, and the Life-span Factor refers to the time in which the magazine receives 50% of its citations.

Mexican scientific journals and participation in databanks

Vessuri (Ríos and Herrero, 2005) notes that Latin American publications are in a vicious cycle: national publications have no international prestige and circulation because regional scientists publish their best results abroad, but Latin American researchers also publish abroad because their results in national journals do not reach the international scientific community.

In the case of Mexico, the dissemination of science takes place mainly through national journals that have low representation in international databases, and through books that have regional and national reach. As one researcher (Rogel, 2009) puts it, this literature includes very diverse documents, of which the main characteristic is that they remain outside the common production circuits and, especially, outside of distribution; consequently, they lack quality assurance, are difficult to find and, therefore, access is restricted, limited or even impossible to acquire. She qualifies this literature as “unconventional”, “semi-published” or “runaway”.

In order to organize scientific publishing a set of scientific databanks and directories of journals have been established to support the work of researchers in information searching tasks. Here are four of these groups.

SCOPUS

Scopus is an Elsevier group company based in Amsterdam, Netherlands. It has information on more than 16,000 journals, of which 1,213 are Open Access, the other 15,000 or so are restricted. So in total Scopus handles 16,213 journals.

Within this scientific databank the great dominance some publishing houses show can be fully appreciated, leading to a phenomenon of knowledge concentration, since the distribution of publications by the 5,105 registered publishing groups shows that 7,825 journals, equivalent to 48.3%, are managed by ten publishers, and the top four operate 40% of publications. On the other hand, there are 2,853 publishers that only support one journal, together they make up 18% of total publications.

In the case of Mexico, after performing an exhaustive search for publishers, it was found that the most visible institution in this database is the Universidad Nacional Autónoma de México (UNAM), with eight journals. Noteworthy is the presence of the Universidad Autónoma de Baja California, which is the only university that appears after UNAM. It must be pointed out that there is the presence of several journals published by institutes and public research centers, such as the National Public Health Institute, el Colegio de México, el Colegio de Postgraduados de Chapingo, the National Institute of Nutrition and others. On the other hand, it is important to note that various associations of researchers in different fields of science are represented, which is of great value to Mexican science. Most Mexican journals registered in Scopus are enrolled in the Directory of Open Access Journals (DOAJ). Approximately 37 active Mexican journals take part in this bank of scientific information.

Institute for Scientific Information (ISI)

An agency founded by Eugene Garfield in 1960, who in 1955 presented some ideas in the journal *Science*, arguing the need for a method to compare journals despite their differences in size and scientific discipline, the reason for which he created the Impact Factor. Later the agency was acquired by Thomson Scientific and Healthcare, in 1992, later known as Thomson ISI in 2003 and is now part of the Thomson Reuters conglomerate.

This company, comes from other economic sectors and it already had information as one of its activities. With the acquisition of ISI in 1992, it became the world's leader in providing scientific information to universities, businesses and government. In that year it also acquired Micromedex, a company dedicated to providing information in the field of health, toxicology

and the environment. In 1995, it bought Petersons' a company dedicated to providing scientific information to universities. It has also acquired major publishers such as West Publishing in 1996, and Aranzadi S.A., a Spanish company in 1999. In 2003, it formed Reuters Knowledge, designed to provide information services for industry, and in 2004 it acquired Information Holdings Inc., a provider of IP services and a wide array of information and legal advice in the field of science and technology. ScholarOne acquired in 2006, offers virtual authorship assessment and online publishing of scientific papers for two million users. Through this the conglomerate becomes a giant in the management of activities related to the production, dissemination and management of scientific knowledge.

Looking at Mexico's participation according to the number of scientific journals recognized by this conglomerate there are 38 publications of which eighteen are considered regional for Latin America and the twenty others have global coverage. UNAM stands out with twelve journals. Twenty-six of these publications are recognized in Science Citation Index Expanded, ten in the Social Sciences Citation Index, and two in the Arts and Humanities Citation Index.

Although the company claims to handle information on about 16,000 journals, only 10,000 of them are considered scientific publications, so in this area Mexico holds about 0.4% of world scientific journals.

Network of Scientific Journals from Latin America and the Caribbean, Spain and Portugal (Redalyc)

This is a newly established project, its activities started in October 2002 and it is an initiative of the faculty of the Universidad Autónoma del Estado de México, by 2009 it was comprised of 550 journals with 121,169 papers. Under the motto "If science can't be seen, it doesn't exist" it has already achieved several successes, the first, to be formed into a prestigious organization in the field of scientific information; gaining recognition on the part of researchers to be used as a means of consultation; and receiving the distinction as the best e-science and technology site in Latin America and the Caribbean, through the UNESCO's World Summit Award. Redalyc functions as a virtual library providing a valuable space by positioning itself as an Open Access project, in order to counterbalance the aforementioned international corporations.

16 countries have taken part in this project, Mexico has provided the largest contribution of 153 journals, corresponding to 27.9%, followed by Colombia with 91 journals, representing 16.6%, then Spain with 83 journals and 15.1%, Brazil with 62 journals, 11.3%, Chile with 45 titles, 8.2%, and Venezuela with 41 journals and 7.5%. These five countries account for 86.6% of the total publications. Another ten nations contribute the remaining 13.4%.

Publications are grouped in two areas of knowledge, natural and social sciences. The participation of the latter is much higher than the former, by about 73%, that is to say 400 journals are listed in the area of social sciences. This area includes 23 disciplines, which are dominated by educational journals with 11%, followed by psychology with 10%, the multidisciplinary, 9.8%, sociology, 7.8% and economics, 6.6%. These five areas account for 45.2% of all social sciences.

Natural sciences include sixteen disciplines dominated by biology journals with 22.2%, followed by engineering with 18.1%, Agriscience with 16.8%, and Medicine with 14.1%, in total these disciplines make up 71.2% of the natural sciences. Important disciplines such as mathematics are represented by only two journals.

Regional Information Online System for Scholarly Journals from Latin America, the Caribbean, Spain and Portugal (Latindex)

Latindex is a product of the cooperation of a network of institutions that work collaboratively to gather and disseminate bibliographic information about scientific publications produced in the region (<http://www.latindex.unam.mx/latindex/busquedas1/latin.html>).

From the beginning (Aguirre *et al.*, 2006: 104), “Latindex had the aim of providing free access to the information generated by the system, and to promote free and open access to publications listed in its databases. We were concerned about the trends observed in recent years that restricted access to knowledge, and which fortunately seem to be on track to be overcome. The truth is that scientific knowledge should be a public good and, as such, access to it should be increasingly extended. Thus, the current open access to publications movement is revolutionizing and dramatically changing the environment of publishing and the dissemination of scientific journals in general, involving people from different fields of science, editors, scholars, researchers, information professionals, commercial publishers, computer specialists and all of those who contribute to the world of scientific publishing.”

Latindex operates through two information systems, the Directory, which is a list of publications that by December 2009 had reached 18,141 publications from 33 countries with information on the themes of specialization, the editing agency, publisher, address, distribution procedures and the databases that each journal is registered with. Mexico was represented by 2,225 journals, 12.25% of total publications. Brazil, Spain and Argentina, with 21.8%, 17.27% and 16.24%, respectively, were ahead of Mexico. This considering the journals in print.

The electronic format Directory, on that same date itemized 12,788 journals of which Mexico participated with 1,690 publications corresponding to 13.21% of the total. At that time only Haiti had no publications in this for-

mat, while just Brazil and Spain had 21.8% and 19.74%, respectively, which placed them above Mexico.

An important element to highlight about the Directory is that no academic assessment is needed for the integration of the journals, once providing the above mentioned information.

The second system is the Catalog, which is a bank of journals that are selected under certain quality criteria, for which assessment is required. The in print Catalog includes 5,082 journals, Spain has the largest share with almost 30%, followed by Brazil with 21.07% and Mexico with 564 journals, representing 11.09%. These three countries represent over 60% of the scientific literature in this area.

The electronic format Catalog is comprised of 4,713 journals of which Spain is represented with 30%, Brazil with 22.21% and Mexico with 11.5%.

Going back to the Directory, according to the areas of knowledge, the distribution is as follows: 2,905 arts and humanities journals, 1,321 from agricultural sciences, engineering sciences, 1,439, natural sciences, 2,808, medical sciences, 4,058, social sciences, 10,246, and 710 multidisciplinary journals. The most important disciplines are: the arts, humanities and literature with 636 publications, philosophy with 518 and linguistics with 460, the rest are distributed in fifteen disciplines. In agricultural sciences, agronomy dominates with 761 publications and the rest is divided in six disciplines. In engineering sciences, technology and architecture with 321 and 212 journals respectively, with 23 more disciplines completing the picture. In natural sciences the landscape is dominated with 412 biology publications, and 248 in ecology, this area is integrated by 26 disciplines. 34 disciplines comprise the area of medical science where the greatest number of publications are in medicine, 1,666 journals, and dentistry and public health with 279 each. The largest area are the social science disciplines comprising of 69 disciplines where education stands out with 1,111 publications, economy with 912, history, 850, psychology, 628 and sociology, 514. In the Latindex space, by disciplines, according to the number of publications, medicine dominates, followed by education and thirdly, economics.

An academic evaluation is required for a journal to be included in the catalog, considering 36 quality criteria set by the catalog.

The publication of scientific papers

The low participation of Mexican scientific journals in the international context does not mean that Mexican scientists do not publish in the so called “mainstream” journals. In terms of the publication of articles in scientific journals there are two categories: a) scientists that publish in internationally recognized journals that are included in the main databases of scientific diffusion, b) scientists who maintain a tendency to publish nationally, regionally or even institutionally, which are the majority.

The participation of Mexican researchers in the publication of scientific papers worldwide, although of a modest dimension, has been gradually growing. This can be seen in table one.

This growth has been observed on a permanent basis, with the exception of 2006 when it was negative, which can be noted in table one columns two and three. In regard to Mexico's share in global knowledge the rate has been growing, as shown by the data in column four, because in 1997 the share was 0.53% compared to 0.77% in 2004 where it remained until 2007, except for the 2006 drop. The last column shows the Impact Factor growth taking into consideration five-year periods, which means that papers by Mexican researchers are having an increasing number of citations.

Table 1
Behavior of Mexican researchers' paper production and its participation in the international context

Year	Papers	Annual Growth Rate	Share percentage	Impact Factor
1997	3,587	8.0%	0.53%	1.96
1998	4,057	14.26%	0.57%	2.01
1999	4,531	12.06%	0.63%	2.19
2000	4,633	2.0%	0.64%	2.22
2001	4,999	7.9%	0.67%	2.35
2002	5,213	4.2%	0.70%	2.47
2003	5,859	12.8%	0.72%	2.59
2004	5,887	0.57%	0.77%	2.68
2005	6,794	15.5%	0.77%	2.79
2006	6,604	-2.7%	0.75%	2.88
2007	6,991	5.8%	0.77%	3.16

Source: CONACYT, 2008. Data from the Institute for Scientific Information 2008.

The disciplines that have a global participation rate above the national average of 0.77%, are astrophysics, 2.0%, agriculture, 1.6%, plants and animals, 1.6%, ecology, 1.4%, microbiology, 1.1%, physics, 1.0%, geosciences, 1.0%, pharmacology, 0.9%, materials, 0.9% and math, 0.8%, within the average are biology, chemistry and immunology with 0.77% each. Below average are law, 0.06%, education, 0.2%, economics and computing with 0.3%. A special case is that of medicine, which occupies the center of the worldwide scientific production, where Mexico participated only with 0.4%.

In the national context, the discipline with more weight is physics with 17.6% of the articles, followed by chemistry with 12.0%, plants and animals, 12.4%, medicine, 11.5%, engineering, 7%, biology, 6.9%, ecology, 5.5%, agriculture, 5.1%, materials, 4.5% and geosciences, 3.8% (CONACYT, 2008: 85).

These percentages differ with respect to the global production of scientific papers, since most are focused in the area of medicine with 23.7% of articles published between 1998 and 2007; followed by chemistry with 14%, physics, 12.53%, engineering, 8.3%, biology, 7.3%, plants and animals, 6% and materials, 3.9%. Finally, education and law with 0.3% and 0.2% respectively.

Space of analysis

The four organizations providing recognition, discussed above, that group scientific journals and work as databanks, can be divided into two models: the first is restricted to users as it involves costs for the use of the scientific information they manage, and the second corresponds to what is called the Open Access movement, which has comprised the DOAJ (Directory of Open Access Journals).

The first is possible to explain from a market logic, as in the case of SCOPUS, the concentration of production in publishing houses is strong given that the two largest companies, Elsevier and Springer directly control almost 24% of the scientific journal production, on the other hand, there are 2,853 publishers that are only in charge of one journal each. This is a phenomenon of economic concentration which makes the distribution and sale of scientific journals a function of an oligopolistic market that sets the prices. It also influences the definition of editorial policies regarding the definition of publishing rules, features that journals should have and the norms articles must follow for them to be integrated in the journals, so they can be recognized by the indexes.

This concentration has followed two lines, the first is of mergers through agreements. These mergers have attracted the attention of the Department of Justice in the United States, since October 1997 when the merger of Wolters Kluwer with Reed Elsevier was publicly announced (The New York Times, October 14, 1997), a review of this type of process began in order to assess whether the antitrust law was broken. This in spite of the fact that previous mergers have resulted in the prices of books and journals to soar considerably, in concrete, referring to the successful merger between Elsevier and Pergamon.

The price-formation mechanism for books and journals has received little attention from economic theory, although it is a market that has been growing and becoming more concentrated, the attention paid to the knowledge economy has been rather focused on the study of research productivity (McCabe, 2000). One of the main reasons for this neglect is based on the idea of knowledge as a free access good. However, as seen in the data presented about the large companies, this concept of free access to knowledge is in serious jeopardy.

The companies are marketing knowledge that to a high degree was generated through public funds. We are facing a phenomenon that might be called “double payment”, universities and institutions fund the research pro-

jects for researchers to carry them out and publish the results, this research is later purchased by the universities themselves when contracting databank services and buying scientific journals.

Another mechanism that favors economic concentration in the management of scientific information is that used by Thomson Reuters, which entered the knowledge market using economic resources from other sectors. Since the acquisition of ISI, in 1992, it became the foremost supplier of codified knowledge for business, government and academia. Through the acquisition of several companies, in 2008, it was able to generate revenues in the scientific caption of US\$646 million that reached 5.5% of total corporate profits and 6.5% of profits using only 3.7% of the means of production of the company.

Open Access constitutes a second model, which in Latin America is represented by Redalyc and Latindex. This movement stems from the rationale that knowledge is a public good and should be disseminated at no cost to society. This trend has emerged at the expense, both in Latin America and globally, of groups of researchers that seek more equitable progress in the production and use of knowledge.

Rogel (2009) notes that through this process a greater democratization in the publication of results of scientific research is achieved; the interaction between the academic communities intensifies and increases its quality; locally produced knowledge spreads more easily, increasing its rate of dissemination; the impact level of research increases as does the number of citations, but mostly, it is assumed that scientific and technical information is a fundamental public good that should be readily available for everyone's benefit.

The current system of scientific publishing, mainly, goes against this principle because commercial publishers impose economic and technological barriers to widespread access to the results of scientific production, mainly resulting from research financed by public funds from governments and other institutions.

Finally, the Open Access movement seeks to increase the visibility, accessibility, quality and impact of journals produced in developing countries.

An obvious question at this point is, which path should Mexican journals take between these two models. A review of the status of two journals, both belonging to the same field of knowledge, *Investigación Económica* (Economic Research), published by the Faculty of Economics at UNAM and *El Trimestre Económico* (Economic Trimester), published by the Fondo de Cultura Económica, where both journals have an impact factor of less than 0.24, implying low citations.

In spite of this *Investigación Económica* decided, on top of joining ISI, to also join Redalyc, which follows an open access policy format, in this version, the January 2007 to January 2010 issues, received a total of 33,618 visitors. A visit and a quotation are different, but what the participation in virtual libraries significantly increases is the visibility of journals. *Investigación Económica* therefore has a higher degree of visibility than *El Trimestre Económico*.

The policy to follow for Mexican journals and publishing institutions, is to increase their presence in virtual libraries such as Redalyc, without abandoning the indexes that are considered high-quality.

The creation of the largest virtual library in Mexico was recently approved (La Jornada, 10/12/2009), which initiated activities in 2011 and is expected to have at least 12,000 electronic journals. This is an excellent initiative, but we must not forget that projects already exist, such as Redalyc and Latindex.

Furthermore, to ensure that Mexico does not just become a consumer of knowledge, it is important to not disregard a worldwide movement involving some of the most prestigious universities, which is building knowledge repositories in a free format, a movement that by January 2010 already had 666 repositories, 400 of which were ranked by size and visibility. Yet, no Mexican university has been involved in this process. It is okay for CONACYT to invest \$35 million pesos in purchasing journals, but not to fall behind in the open access movement. To access all the information about the repositories go to: http://repositories.webometrics.info/directory_rep_es.asp

The institutional strength is another factor to consider in the visibility of journals and articles. The involvement of the journal in a larger number of indices and databanks offers greater strength and therefore greater visibility for the journal.

Another aspect of the institutional strength is that offered by the institutions to both journals and researchers. Higher education institutions in Mexico should define a policy for the dissemination of knowledge.

In the area of Latin America and the Caribbean, Mexican scientific journals enjoy relatively good visibility, this is demonstrated with an exercise that is presented below. Redalyc implements a monitoring of the use of journals by the number of online queries performed for each of them. In carrying out an analysis of the visibility of Mexican journals in this space, we selected the 100 most visible journals and found that 47 are Mexican, which means that Mexican publications have good visibility in the area of Latin America, Spain, Portugal and the Caribbean. Typically, this indicator would be around 30%, according to the number of publications with which Mexico participates in Redalyc.

Another element that may be highlighted about papers published by Mexican researchers in mainstream journals is that they are still dominated by the area of physics, while in the international context medical areas are the highest represented.

Just as in the case of the concentration and strength of institutions, there are other elements which hinder free access to the publication and use of knowledge, among them are the following:

One of the barriers is language. The creator of the Impact Factor is aware that this is an indicator that favors English-language publications, but not only in that sense is language a barrier, it is also one for researchers from developing countries with a language other than English who want to publish in mainstream journals. The barrier extends to a large number of potential users who are not able to use this language.

Another barrier is the reduced participation of Mexican researchers in the evaluation committees of both journals and papers, that does not favor Mexican publications.

Mainstream publications lean toward the medical areas, that although have many practitioners in Mexico, do not represent the strongest areas for the country in international publications.

Assessment processes for journal papers are long and require constant feedback and some researchers in Mexico are not willing to undergo such processes. Evaluative exercises are not fully accepted by some researchers.

Conclusions

The visibility of Mexican scientific knowledge through the scientific journals included in the two main banks of scientific information is limited, since in both cases the participation of our country does not reach 40 journals, 38 registered in the ISI and 37 in SCOPUS. Generally speaking there are 56 journals, as 19 of them are included in both banks.

Mexican journals should strengthen efforts for improving their quality since the Latindex Directory registers 2,225 scientific publications, but the catalog, which entails an evaluation exercise records only 564 journals. This means that a large group of Mexican journals do not have external evaluation among their policies.

Individual participation of Mexican researchers is stronger than in the case of journals, as it has already reached 0.77% of the world's scientific output.

One way to increase visibility and avoid these barriers is through participation in Open Access, which must be considered and promoted by higher education institutions as a focus of attention by the agencies in charge of implementing public policies in Mexico.

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