

# Measuring the visibility of the universities' scientific production using scientometric methods

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*Abstract:* Paper presents scientometry as a science and a fundamental instrument for determining the international value of an university as well as for the statistical evaluation of scientific research results. The impact of the research measurable through scientometric indicators is analyzed. Promoting the scientific production of universities through institutional digital repositories deals with the concept of scientific production of the university and the development of scientific research in information society. These concepts are approached through the prism of marketing methods and techniques. The digital repository is analyzed as a PRODUCT, destined for promoting, archieving and preserving scientific production.

*Key words:* educational marketing, marketing strategies, marketing researches, open access, institutional repositories, academic assessment, citations analysis, scientometry, scientific research, scientific production.

## 1. Development of scientometry as a science

The terms bibliometry and scientometry were introduced almost simultaneously by Pritchard, Nalimov and Mulchenko in 1969. While Pritchard [ 15 ], explained the term bibliometry as „the application of mathematics and statistical methods to books, articles and other means of communication” Nalimov and Mulchenko have defined scientometry as „the application of those quantitative methods which deal with the analysis of science viewed as an information process”. Instead, infometry has replaced bibliometry. The term infometry was assumed by VINITI, , and is the representative of subclass of information sciences which deals with mathematical-statistical analyses of communication processes.in science. By contrast with the original definition of bibliometry .In contrast with the original definition of bibliometry, infometry also deals with electronic media along with topics as statistical analysis of the scientific text and hypertext systems, library circulation, information measurements in electronic libraries, models for information production and management as well as quantitative aspects of information storage. In

his review, «Biblio-, sciento-, infor-metrics???

What are we talking about», [ 2 ], presented the origins and the context of these terms of science, literature and information in general. The description given by Glänzel and Schoepflin in 1994: defines the scopes of bibliometric research areas as much wider than the usual ones and therefore integrate all currently existing orientations such as applications to science policy, library science and information retrieval,[ 8 ]. According to their approach, bibliometry and infometry include «all quantitative aspects and models of scientific communication storage, dissemination and retrieval of scientific information». Gloria Carizzo-Sainero considers bibliometry «the ensemble of methodological knowledge that will serve the application of quantitative techniques in order to evaluate the processes of production, communication and use of scientific information». This provides a clear orientation towards research evaluation that has become the most important application of bibliometric research [ 3 ].

The origins of ststistical studies on scientific bibliographies can be traced back to the twenties of the last century, respectively

1923. In 1926, Alfred J. Lotka published a study about the distribution frequency of the scientific productivity. At almost the same time in 1927, Gross, P.L.K. și Gross, E.M. published their citation-based studies in order to support the decision of which periodicals in the field of chemistry should be purchased by small colleges [ 9 ]. In particular, they examined 3633 citations of the 1926 volume of the Journal of the American Chemical Society. This study is considered a first citation analysis in the sense of present-day bibliometrics. Eight years after Lotka's article appeared, Bradford (1934) published his study on the apparition frequency of articles in journals. [ 17 ].

These early attempts remained unnoticed until the early 1960's. This phenomenon is caused by two aspects. These periodicals appeared when traditional information retrieval methods were still sufficient and the financing systems for scientific researches did not need sophisticated statistical methods. The situation changed dramatically when Derek John de Solla Price published his books entitled „Science since Babylon” (Price, Science since Babylon, 1961) and «Little Science – Big Science» [ 14 ]. Thanks to his contribution, questions dealing with quantitative aspects of research became the target of scientists' and research managers interests. He was also one of the main propagators of using the Science Citation Index (SCI) database of the Institute for Scientific Information (ISI) as an instrument in qualitative science analysis. He analyzed the system of science communication and presented the first systematic approach on the structure of modern science applied to science as a whole. At the same time he laid the foundation of modern research evaluation techniques. «Little Science – Big Science» had a significant impact and serious consequences. The need for evaluating scientific productivity and effectiveness became imperative and his idea could be received whereas globalisation of science communication, the growth of knowledge and the published results increasing specialisation as well as growing importance of interdisciplinarity of scientific research reached a level where scientific information retrieval began to fail and funding systems based on personal knowledge and evaluations by peer reviews became more and more difficult. The amazing rise of bibliometrics since the late 1960s is reflected by remarkable

academic activities is connected to advanced information technology, with the development in the field of computer science and technology and especially with the availability of bibliographic database serving as a basis for researches in bibliometrics. Especially the ISI database should be mentioned in this context. The SCI and much more recently, Web of Science have become the basic sources generally accepted for bibliometric analysis. However in the 1970s, when data collection was frequently a manual operation, the field of bibliometrics was characterized by enthusiastic researchers much as a hobby only to later intergrate interdisciplinary approaches as well as mathematical and physical models on one hand, and sociological and psychological methods on the other. Later on, at the beginning of the 1980s bibliometry evolved into a distinct scientific discipline with a specific research profile and many subfields and substructures of the corresponding scientific communication. Significant actions were taken in order to institutionalize this field. In 1978, appeared *Scientometrics* as the first journal specializes in scientometric topics. The publication of several books on bibliometry, [ 6 ], [ 4 ]. The fact that bibliometric methods are already applied to the field of bibliometry indicates the rapid development of this discipline. In the 90s bibliometry became the standard instrument for science policy and research management. All significant compilations of scientific indicators are based on publishing and citation statistics as well as on other bibliometric techniques. At present, bibliometric research aims at the following target groups which clearly determine the topics and subfields of „contemporary bibliometry”.

## 2. Scientometry

When it was first used, the term bibliometry was defined as “the application of mathematical and statistical methods to books and other means of communication, dealing especially with library and research center management, while scientometry refers to „those quantitative methods that are used in science analysis regarded as an information process”. Although bibliometric and scientometric methods are similar, we must emphasize that scientometry analyzes the quantitative aspects of generation, propagation and use of scientific information,

in order to contribute to understanding the mechanism of scientific research.[1]

## 2.1 Outstanding historical moments in the development of bibliometry, scientometry

1926: LOTKA'S LAW (Lotka A., 1926). [ 12 ]

Describes the frequency of author publications in different fields, it shows that the number of authors having  $n$  contributions is  $1/n^a$  of those making only one contribution where  $a$  nearly always equals two. Thus the number of authors publishing a certain number of articles is a fixed number to the number of authors publishing a single article. As the number of published articles increases, the authors producing several publications become less frequent. There are  $1/4$  authors publishing 2 articles over a period of time when they are single authors,  $1/9$  publishing three articles,  $1/16$  publishing more than 4 articles.

This law covers several disciplines with these distributions, but constant  $a$  may differ depending on the specific field. (Wikipedia, 2009)

The general formula is:

$$X^n Y = C$$

where  $X$  is the number of publications chosen over a certain period  $Y$  is the relative frequency of the authors with  $X$  publications,  $n$  and  $C$  are constants depending on different fields ( $n \approx 2$ ).

1934: BRADFORD'S LAW [ 17 ]

Bradford estimated in 1934 that «if the scientific periodicals are arranged in order of decreasing productivity on a given subject, they may be divided into a nucleus of periodicals that are particularly devoted to that subject and several groups or zones containing the same number of articles as the nucleus. In a different formulation, if the journals in a field are sorted into three groups then the number in each group will be proportional to 1:  $n^2$ .

Zipf's law is also known as the „rank-frequency” law. It was initially formulated to describe the relationship between the frequency of occurrence of a word in a given text and the rank occupied by that word in the decreasing order of its frequency of occurrence. In its general form Zipf's law is a power-type law of the form:  $q(n) = \alpha n^{-\beta}$ ,

where  $q(n)$  is the frequency of occurrence,  $n$  is the rank,  $\alpha, \beta$  = the filter parameters. The law is used for the quantitative description of the dependence of the impact factor on the rank of the scientific journal. [11]

## 2.2 Measurement indicators of scientific activity

The first „International conference on science and technology indicators” was organized by the OECD in Paris, in 1980.[ 13 ] It proposed several definitions and classification principles for the competent authorities of the member states. Thereby, science and technology indicators are series of data, specially created, for answering a specific problem regarding the state of existence or development of science and technology, internal structure, relationship with the external world and the degree they reached in achieving certain objectives.[ 5].

These indicators can be grouped as follows:

- Indicators regarding creation and innovation activities;
- Indicators regarding the impact of science and technology on economy;
- Science indicators.

The last group, science indicators may be divided, in turn, as follows into:

- number of publications
- number of citations
- peer reviews

We will not give details on every indicator of the very many that already exist and continue to appear but instead we will signal the most important and significant ones and can be assigned to the analyzed country to compare it with countries of similar size, population number, gross domestic product, etc

Thus, we mention:

- number of publications (that exist in the ISI database therefore are considered relevant in a given field);
- distribution of publications by fields;
- number of uncited papers (although ISI-quoted, they could be considered an uninteresting topic, which makes an adequate assessment difficult);
- number of very frequently cited papers as they appear in the ISI database.
- number of patents etc. [ 10 ]

### 3. IMPLEMENTING A DIGITAL INSTITUTIONAL REPOSITORY AT TRANSILVANIA UNIVERSITY OF BRAȘOV

The members of the academic community at *Transilvania* University are concerned with the development of scientific research and participate in all national and European competitions to access research funds. The number of won projects is great which, in turn, results in an impressive scientific production. This academic environment is very adequate for a successful implementation of a digital repository.[ 16 ]

#### 3.1 THE MISSION AND OBJECTIVES OF THE DIGITAL REPOSITORY

- The digital repository is a product of information technology offered by the university to its members for managing and disseminating digital materials created by the university's community.
- This product is essentially an organizational commitment regarding the management of the university scientific materials for organizing, accessing, sharing but also long-term preservation.
- This product will ensure collection and sharing of all scientific documents created by the university staff members. The main objective of the digital repository is to increase the impact of the university's scientific production through the institutional digital repository and thereby enhance its visibility worldwide and EU-wide in order to increase Romania's

contribution to the scientific and technological progress.[ 7 ]

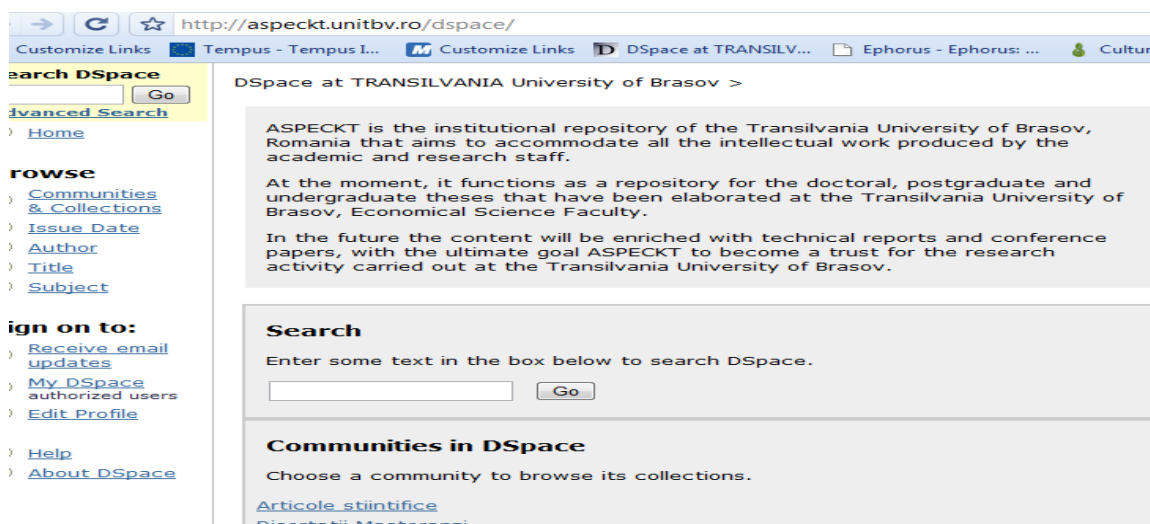
#### 3.2 LAUNCHING THE DIGITAL REPOSITORY

The launched product is the PILOT DIGITAL REPOSITORY at *Transilvania* University of Brașov – ASPECKT-DSpace. What is ASPECKT-DSpace:

[http://aspeckt.unitbv.ro/dspace/;](http://aspeckt.unitbv.ro/dspace/)

- The created online service archives research materials published by the staff members of *Transilvania* University;
- These documents can be accessed online from anywhere, by anyone;
- By archiving the researches in this repository, scientific products will enjoy wide-scale accessibility increasing visibility and impact;
- Repositories similar with ASPECKT-DSpace are being developed worldwide;
- The documents uploaded into DSpace are indexed in Google Scholar;
- The repository represents an instrument which provides access to the university's researches ensuring their worldwide large-scale availability;
- It is not a publishing system nor is it supported for journals but hosts already published materials;
- It is intended to promote scientific research literature and free access to information

The communities of the repository were defined, that is the types of materials that will be stored, namely: Scientific papers, master dissertations, student reports, diploma projects, doctoral student research, doctoral dissertations,(Fig.1)



**Fig. 1** – Screen image of the webpage of digital repository ASPECKT-Dspace

During the first stage, the master dissertations of the master research students in Marketing will be uploaded. Therefore, the authors are the master graduates 2009. Based on this example, other types of materials in the same database will be made accessible by

using the same criterion of searching by authors, addressing a specific target group: student reports, diploma projects, research reports. Similarly, the search can be conducted by paper title.

[DSpace at TRANSILVANIA University of Brasov >](http://dspace.unitbv.ro/)

**Browsing by Title**

Jump to: [0](#) [9](#) [A](#) [B](#) [C](#) [D](#) [E](#) [F](#) [G](#) [H](#) [I](#) [J](#) [K](#) [L](#) [M](#) [N](#) [O](#) [P](#) [Q](#) [R](#) [S](#) [T](#) [U](#) [V](#) [W](#) [X](#) [Y](#) [Z](#)  
 or enter first few letters:

Sort by:  In order:  Results/Page  Authors/Record:

Showing results 1 to 14 of 14

Issue Date	Title	Author(s)
Feb-2009	<a href="#">ACTIVITATE DE CERCETARE STIINTIFICA: MIXUL DE MARKETING IN DOMENIUL SOFTWARE - IT STUDIUL DE CAZ: MICROSOFT VERSUS SUN MICROSYSTEMS</a>	<a href="#">BOITOR, Axenia Bianca</a>
Jul-2009	<a href="#">Activitatea de cercetare stiintifica II: Strategii ale mix-ului de marketing Studiu de caz: S.C. ALTEX ROMANIA S.R.L.</a>	<a href="#">Boitor, Axenia Bianca</a>
Jun-2009	<a href="#">ANALIZA DE MARKETING LA NIVELUL FIRMEI PLUS DISCOUNT ROMANIA</a>	<a href="#">Badea, Anamaria Irina</a>
Jun-2009	<a href="#">ANALIZA MEDIULUI INTERNATIONAL DE MARKETING AL COMPANIEI JAGUAR STRATEGII ALE MIXULUI DE MARKETING</a>	<a href="#">TIEREAN, SILVIU-HORIA</a>
Feb-2009	<a href="#">ANALIZA MIXULUI DE MARKETING BANCA COMERCIALA CARPATICA – BRD – GROUPE SOCIETE GENERALE</a>	<a href="#">ANTOCI, Otilia</a>
Feb-2009	<a href="#">ANALIZA STARTEGIILOR DE PIATA: COMPLEX BRAȘOV VS OCEAN FTSH</a>	<a href="#">TIEREAN, Silviu</a>

**Fig. 2** – Structure repository after uploading master dissertations search by title

The format used for uploading is .pdf since it offers multiple advantages among which the most important is the small amount of occupied computer memory and the very accessible procedures of secure copying and printing the access being decided by the authors. Once installed DSpace can be easily used.

**3. CONCLUSIONS**

We live an era full of the unpredictable, new models for promoting scientific development are created, but equally major drawbacks are expected with academic institutions not yet involved in projects for promoting their own research. The fact that nowadays reality changes at a very high role

and the need for information of different academic communities is constantly increasing and diversifying involves among other the following:

- The use of sources on the Internet (search engines) which are more easily accessible than traditional library repositories;
- The creation of repositories within the research institutions, thereby adding to the visibility of researcher's work and creating a central national repository, as well.
- The financial resources, considering the costs involved by designing an operational system, its implementation and the development team.

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