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Analysis of the usage of the scientific serials and determination of its hardcore at the Department of Physics Library, Faculty of Exact Sciences, National University of La Plata. A case of study : Dissertation defended at the National University of Mar del Plata March 27, 2009.

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Abstract.
The bibliometric analysis of the scientific serials collection of the Department of Physics Library of the Faculty of Exact Sciences of the National University of La Plata, Argentina [http://biblio.fisica.unlp.edu.ar] had allowed the evaluation of its use at a scientific centre, with important international groups of scientists. This analysis also had allowed, the accuracy of this collection according with the needs of information of the users, and, the hardcore that could obtained the data in order to decide the collection development. To instrument it, we had implement a technique that can study the relationship between the bibliographic references or cites –at footnote or at the end of every paper. It also had analized its usage onto two aspects: the bibliographic reference like an index of the information use, and the bibliographic cite to know the impact that the bibliographic production had had at the scientist community. It also had analized, the influence that had –from its origin- the web site of the Electronic Library of Science and Technology, that belongs to the Science, Technology and Productive Innovation Ministry, Argentina [http://www.biblioteca.mincyt.gov.ar] on the searching and recuperation of the information in situ.

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Resumen.

El análisis bibliométrico de la colección de publicaciones periódicas de la Biblioteca del Departamento de Física de la Facultad de Ciencias Exactas de la Universidad Nacional de La Plata [http://biblio.fisica.unlp.edu.ar] permitió evaluar su uso, en un centro de investigación con grupos de científicos muy consolidados y de prestigio en el ámbito internacional; posibilitó estimar la adecuación de dicha colección respecto de las necesidades de los investigadores y determinar cuál sería el núcleo básico de publicaciones periódicas más apropiado, para así obtener los datos necesarios al determinar una política de desarrollo de la colección. Para instrumentarlo, se empleó una técnica que permite estudiar las relaciones entre las referencias o citas bibliográficas -consignadas a pie de página o al final de cada trabajo de investigación-, y se analizó su uso según dos aspectos: la referencia bibliográfica del documento como indicador del consumo de información, y, la cita bibliográfica para conocer la repercusión que su producción bibliográfica ha tenido en la comunidad científica. Se analizó también la influencia que ha ejercido -desde su surgimiento- el Portal de la Biblioteca Electrónica de Ciencia y Técnica, dependiente del Ministerio de Ciencia, Tecnología e Innovación Productiva, [http://www.biblioteca.mincyt.gov.ar] en la búsqueda y recuperación de información por parte de los investigadores, y, en qué medida su uso ha determinado una disminución en la consulta de publicaciones periódicas in situ.

KeyWord. Bibliometric – Bibliographic references analysis – Information use – Impact Factor – Middle Age - University Libraries – Academic Libraries – Research Libraries - Department of Physics Library – History of Physics.

Palabras clave. Bibliometría - Análisis de referencias bibliográficas - Uso de la información – Factor de Impacto – Vida Media - Bibliotecas universitarias - Bibliotecas de investigación - Biblioteca del Departamento de Física - Historia de la Física.

Introduction.

Since 1995, as a continuos, we had realized at the Biblioteca del Departamento de Física evaluations of the scientific serials collection that covers the information needs of the users. Up till them, we only had realized evaluations in times of low budgets with the objective of justify the requeriment and the inversion of the budgets funds to buy serials -from the National Council of Scientific and Technique Researches (CONICET, Argentina) and the Commission of Scientific Researches of the Provincia de Buenos Aires (CIC-PBA). The need of evaluate the serials collection arises because, the subscriptions costs increases excessivily in comparison with the assigment of the budgets funds. This problem yet affects, the academic libraries in the area of Exact Sciences, and the research centres on science and technology -which serials collections are more expensive. At the Departamento de Física, it had built -from more than 100 years ago-, an important hardcore of printed serials that had been maintained, till principles of this century, with funds of every research laboratory.

The Senior College of Physics Sciences was found by ordinance from Feb. 12, 1909, and, it was integrated by the Faculty of Physics Sciences, Mathematics and Astronomy, to contribute to the teaching and the scientific research..."[3] This collection, till the middle of the 20th century, was one of the most important in Argentina and the whole of Latin America... A lot of academic and research centres on Physics in Argentina were found and development by scientists graduate at the Universidad Nacional de La Plata...

"...Even though, the budget adversities to maintain the serials collection, it would be always present. These had been worst towards the decade of the 1990s..."[4] From 2003, the percent of the budget that was assigned to acquire the scientifc serials in printed format -from the *CONICET* to the Institute of Physics La Plata (IFLP-CONICET) was assigned to each Research Laboratory- was issufficient. During the period 2000-2001, the budget deficit at the scientific sector was unsubstainable. In general, the collections there would be not maintained by the universities and scientific research centres, and there was no available the necessary information to make decisions.

This circumstance had determined at 2002, the decision of the Science, Technology and Productive Innovation Secretary, of the Presidence of the Argentine Republic (SECTIP), to create the *Electronic Library* (BECYT) from the one the CONICET's scientists, and the scientists from the public universities, could download the serials papers on differents formats. This web site, makes able the Internet acces to the full-text serials papers from national of international scientific publications about several knowledgment areas, such us makes able, the acces to databases of bibliographic cites or references, abstracts, and other bibliographic information -that are very important for the Science and Technology information system. This portal, is available to scientists, profesors and teacher auxiliars, scholarships, administrative, technical and library support staff, graduate and postgraduate students, and national public and private university authorities -all over the Argentine scientific centres.

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[3] For further information, see the Letter of Prof. Dr. in Physics Emile Bóse (Carta de Emile Bóse) which had sent to Joaquín V. González, from Oct. 20, 1909. Available at URL: http://biblio.fisica.unlp.edu.ar.

[4] Translation of the note of the asesor of this paper Prof. Doctor in Physics A. G. Bibiloni based upon his studies about the history of the Physics Department, Exact Sciencies Faculty, National University of La Plata.

The usage of this web site, there will be restricted to the organizations that they are licensed and authorized by the Science, Technology and Productive Innovation Secretary (SECTIP). The access would be able from any PC terminal that it is connected to Internet shared by the participants organizations. The portal is in a continuous development, through different activities of design and optimization -whitin the framework of the protocol of undestanding between the SECTIP and the Coordination of the Improvement of the Personal of Higher Level (CAPES).[5]

At the Departamento de Física, from the FOMEC Project (Fund to the Improvement of the Teaching Quality) funded by the International Bank for Reconstruction and Development (IBRD) –before, BIRF-, towards the middle of the 1990s, we had realized studies of evaluation of the bibliographic collection, under several standards –the opinion and expert trail of the users, the location of the scientific serials out there the Library, etc. -that had given results that had made possible determine the hardcore. Through the results of the evaluations that a Commission integrated by Profesors and Members of the Departamento de Física Staff, between 1995 and 2002, we had distributed by e-mail, lists of the titles of the serials to use more frequently. The scientists had indicated the ones which had more interest to them, and, they had completed this list with others that had been necessary to the future course of evolution of their researches.

In order that -from 2002, we had prepared a hardcore of scientific serials, that were selected by the researchers of the Department, and it was submmitted to the SECTIP, on January of 2003.[6]

In the same manner -on 1995, we had designed a database that had contained the papers that the scientists of the Departamento de Física had produced in the area of Theoretical Physics. These papers were published at arXiv.org[7] (Los Alamos National Laboratory), before it will be published in international scientific serials. From this database in CDS-ISIS, it would be probable to make an evaluation study through the recount of the bibliographic cites or references of these papers.

[5] For further information, see, http://www.biblioteca.mincyt.gov.ar/

[6] For further information, see, *Hardcore of scientific journals of the Phyiscs Departament Library*, 2002.

[7] Also see, http://arXiv.org

However, this database which was designed in 1995 with the Open Source Software from the CDS-ISIS of the Family UNESCO MicroIsis -under Ms-DOS- had put on evidence, one of the most important disavantages of this evaluation method: the automatization of the bibliographic references, in order to analize the information data that was so restricted (i. e., abridged titles of the serials which were referenced, without the place of publication; the abreviations of the titles on different forms, and only in a few cases we had the international standard serial ISSN).

From the appearance of the BECTIP, we had made several annual data harvesting of the user's needs, which information was centralized from the UNLP. In some cases, there were be some difficulties to obtain some data from the users. They probably had supposed that, if they would provide this data, perhaps that could determine the cancelation of the subscription of some of these titles, adquired by the SECTIP. We have take into account that, the users of this Library belong –in one of its categories- to the segment correspondent to the scientists and academic teachers of the area of physics, chemistry and others, of this Department and other departments of the Exacts Sciences Faculty, and centres of the National University of La Plata, and other organizations.

Formulation of the problem.

"The serials collection of the Biblioteca del Departamento de Física, it would be pertinent about the information needs of the researches? ¿which was the hardcore of scientific serials?".

Objectives.

General Objective.

- Evaluation of the usage of the serials collection.

Specific Objective.

- Verification of the supposition that, the collection it would be really pertinent with the information needs of the users.

It would be part of this objective:

- *Consume Información Index*[8], through the calculus of the *Middle Age* o *Semiperiod* of the bibliographic references or cites[9], to determine the validity of the obsolescense of the bibliographic resources, that we had analized by the Index of Price[10];
- Definition of the hardcore of scientific journals more adequate -through the stablishment of the best collection, that would be garantize the coverage of at least a 80% of the researchers needs. From the definition of this collection of scientific journals of more frequent usage, we had obtained the necessary data to make decision about collections development.
- Analysis of the influence that it had made the performing of the Science and Technology of *SECTIP* on the information retrieval, and, how it had been determined a decrease on the reading of the scientific journals in situ.
- Determination of the visibility of the scientific works that the users can read at Departamento de Física, and its productivity.

Hypothesis.

"The scientific journals that are most well-read and which are more taken in the Biblioteca del Departamento de Física by the scientists -in several cases- are the same that are most used, and more read by these authors –in order to published and broadcast the results of their scientific works- or, only have agree with those titles of the journals in which they have founded their researches. This would be taken in account, at the moment of the definition of the hardcore of scientific journals."

[8] J. M. López-Piñero y M. L. Terrada, "Los indicadores bibliométricos y la evaluación de la actividad médico científica (III). Los indicadores de producción, circulación, dispersión, consumo de la información y repercusión", Barcelona: Medicina Clínica,, 1992, 98 (4):142-148.

[9] R. E. Burton y R. W. Kleber, "The half-life of some scientific and technical literature", American Documentation, 1960, 11(1): 18-22.

[10] López-Piñero, J. M. y Terrada M. L., íbidem.

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Theoretical Frame.

1. Previous considerations about the analysis of the bibliographic references like a methodology in order to be use on information studies.

1.1. Foundations of the choice of this methodology.

The importance and the condition of being useful about the studies of the informaton usage -in university and research libraries- is evident. However, it is difficult to generalize which it would be the most approppiated method that it would be used in each case. But it is essential to have the capability of decide in each situation, which method or methods would be more convenient. This it would be applicable, if we could recognize the strongholds and weaknesses of hole available options, although it would be facilitated, if we have knew their methodological details.

If we consider that, the results of all scientific research it would be kept on documents (articles, communications, reviews, etc.) and we take part, in major or minor meassurement, of a defined corpus of scientific literature about an area of knowledge that they had researched. This referenced or cited document it would be relationed with the other documents –by similitude, contraposition, or expressed mention of concepts, ideas, data or arguments, which they were be previously published. When a document it is mentioned on a list of bibliographic references or cites, we have supposed that it could be existed between the thinking of the author and the writer, any relation -as well as- it could be existed any relation between the referenced document and the article which is being writing. In the same way, from the point of view about the studies of the information usage and the studies of information users, to reference a document it would be supposed that the author whom had realized this bibliographic reference or cite, in any way, had used this referenced or cited document.

The *analysis of bibliographic references or cites* –from now on, in same times we only could call "*analysis of references*"- it would be considered like one of the most appropiate methodologies. The express mention of these relationships, it would be marked by the usage of the bibliographic references or

cites- at footnote or at last of every referenced paper. Through bibliometry we had done the analysis of these references, that it is mentioned on the bibliographic references or cites studies.

1.2. Bibliographic References and Bibliographic Cites.

Previously to avance with this study, we could make the difference between the concepts of bibliographic reference and the bibliographic cite. According with *Price*, a bibliographic reference is the acknowledgment that an author had received by another author -which work in some way that, it had been useful- in order to contribute with his own work. A bibliographic cite is the acknowledgment that a document has done to another one. [11]

> "This differentation [between a reference and a cite] use to be confuse, because at the final, it would be only the same concept: a bibliographic reference. The difference, [perhaps], would be at the leadership of the author: on the reference, the author is the leadership, while on the cite his leadership does not exist. The author makes the references, while he had received the cites"[12]
>
> "A reference is a part of a scientific document, and, it uses to have a date previous of the date of publication... On the cite is backwards. At the grouping of the references of a paper (co-citation), we can see the perception of the author over the production of the scientific community, while on the grouping of the cites -that an author had received (bibliographic coupling joint)- we can see the perception of the scientific community over the author's production..."[13]

[11] D. J. de Solla Price, "Citation measures of hard science, soft science, technology, and nonscience", en C. E. Nelson y D. K. Pollock (eds.) Communication among scientists and engineers, Lexington, MA: Heath, 1970, pp. 3-22.

[12] Translation of the Note of the Director of the Trabajo de diploma Prof. César O. Archuby, oct. 2008.

[13] Archuby, C. O., oct. 2008, íbidem.

The objective -of the study of the bibliographic cites, as well as, the study of the bibliographic, it would be the determination of the scientific information use (scientific information consume) –by an author, a group of authors, etc.-, and it would be to show the repercussion or the impact that its scientific production had had on many scientific communities. [14]

1.3. Bibliographic References and Scientific Research.

An informational environment, would impact with significance on the research processes, and would determine its phases and could include a joint of information resources with which the author can be related in accordance with its objectives. The reading of the scientific literature would made possible that the researchers, 1) can determine new problems without resolving, 2) establish the relations between different variables (hypothesis), 3) acces to the methods that are employed with more frequent in other similar studies, as well as, it can permit compare critically the results of similar works.[15]

A comprehensive, representative and updated revision, that it would be done from well formulated searching strategies, on pertinent databases, with objetived criteria –to be able the valoration and the selection of the scientific papers that they would used on the written of another new, would guarantee the quality of its results.

The frequency of the usage of a serial title, can show a razonable measure of its usefullness, therefore, we could considere the use of a scientific work from the bibliographic references that other authors had made of this.[16] If we recognize that the authors use previous bibliographic resources –to prepare or write another one, about an specific theme –the act of include bibliographic references or cites, it could be considered, in theory, an expression of the importance that could atribute to the referenced bibliographic resources.

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[14] López-Piñero J. M. y Terrada, M. L., Barcelona, Clínica, 1992, op. cit. pag. 6.

[15] R. Cañedo Andalia, “Los análisis de citas en la evaluación de los trabajos científicos y las publicaciones seriadas”, Acimed, 1999, 7(1): 30-39.

[16] E. Sanz Casado y C. Martín Moreno, “Técnicas bibliométricas aplicadas a los estudios de usuarios”, Revista General de Información y Documentación, Madrid, Servicio de Publicaciones, Universidad Complutense, 1997, 7(2).

As much as, the frequency with which the scientists reference a bibliographic resource it would be major, the acknowledgment of the scientific community of the influence or impact of their researches would be major.[17] In brief, the act of refer documents -of record the bibliographic *references* or *cites* of other work- is function of a lot of variables, and it could be cause for several reasons.

There are several points of view which are related with the fact that the *analysis of references* do have or not valid, the usage of the information for the users of the libraries. According with Urbano Salido, ..."some authors only think that it would be able the *analysis of bibliographic references* onto the data of the documents that the authors had produced. These authors are the same users of that library. We believe that this analysis would kept the correlation with the direct measure of the real use of the information resources at these libraries. They advocate the direct measure of the usage of the information resources in situ, through the statistics of loan, and also have defend the expert judgement of users and librarians..."[18]

In fact, and because the papers of the users of the Biblioteca del Departamento de Física –by their major availability online and in situ, in this study we had been prefered review and analize the bibliographic references or cites than the authors have had done. That have alowed to obtain a detailed data, that it would be so difficult to obtain by another methodologies. Even though, the analysis of the bibliographic references or cites -like an area of bibliometrics- it would be seem to be held by multiple controversies and restrictions, we have to consider that method like the most adequated to the evaluation and planning of the information policies, and the scientific production.

The conclusions about the credibility of the application of the bibliographic references or cites analysis have emerged from the review of the studies that other researchers had done at the area of the evaluaction of academic libraries. These would be confirm that, this method do have validity to the evaluation of others collections of information centres.

[17] E. Garfield, Which medical journals have the greatest impact?, Ann. Intern. Med., 1986, 105 (2): 313-20.

[18] C. Urbano Salido, "El análisis de citas en trabajos de investigadores como método para el estudio del uso de información en bibliotecas", Anales de Documentación, 2001, (4): 243-266.

The methodology of the study of the relationships between the bibliographic references or cites, and, the usage of the scientific information, it also had been resolved onto two aspects, like *López-Piñero* y *Terrada* [19] had written:

- the bibliographic references or cites like an indicator of the information use or usage by the scientific authors;
- the bibliographic references or cites to know the impact that the bibliographic production of these authors had had at the scientist community.

It also had existed an inernational method which can be used to the scientific evaluation. This is called Impact Factor or Index of Impact of the scientific journals, which best example are the publications of the ISI (Institute for Scientific Information).[20] Some of the strongholds of this method, are that: it do not interfered on the behavior of the community that it has been studied; it would permit a high level of details on the information that is obtained; it is hardly comparable with another methods. An annual study of the usage of the scientific serials also could allow the evaluation of the productivity of a community of scientists from the databases of the Science Citation Index (SCI) and its relationship with another Impact Factor from the *Journal Citation Reports (JCR).*

These kind of procedures, it would be to be the favorite among the most consolidated researchers groups and scientific journals, in comparison with the "new" scientific groups and the publicationes that are recently have edited. From this methodology we could study the use of the information of papers about physics and other areas of the science, and could obtain several bibliometric indexes -like the indexes of growth, productivity and information transference, the factor of aging, and the Impact Factor of scientific information.

[19] López-Piñero, J. M. y Terrada, B M. L., Barcelona: Clínica, 1992, op. cit. pag. 6.

[20] See, http://scientific.thomson.com

1.4. Impact Factor and other variables like scientifc indexes.

Since always, at the sector of the scientific research, the quality and quantity of publications had had interest for several causes. From more than 10 years, at the academic and universitary libraries we have employed with more frequency words that we use to have in the area of bibliometrics.

Among several variables, the most important to represent the bibliographic references or cites of a research work are: visibility, acess, availibilty, circulation, scientific reputation and scientific status.

These variables are consequence of the action of other indexes, that would represented the bibliographic references or cites of scientific journals or the impact that a scientific instituction have.[21] For example, the visibiliy: is the coverage by large general or specialized databases; its presence on the biggest information repositories on large libraries –including digital repositories- with hign number of visitors; and, the number of copies of the published version. The visibility and the accesibility of a scientific work, are decisive and determinat factors on the process of make bibliographic references or cites. If a work is not visible, or eiher not accessible or available, it could not be considered, evaluated or used to make another one.

The chance to have open access to the free full-text of a scientific work, is an important variable. In this study, this was determined by the free access of the Portal of Science and Technology, by the researchers of the UNLP and the CONICET. Actually, this variable is beneficed by an strong tendence to the open access on the area of the scientific journals, that it had been put in front the tradicitional model of edition in the area of science and technology.

At this moment, both models co-exist. This situation had determinated big changes in the area of fhe scientific edition, which includes several aspects:

- an increased of the aid of the financial agencies to the open access model of edition, to the institutional contributions and archives;
- availability of a major quantity of open acces papers;

[21] Cañedo Andalia, R., 1999, op. cit., pag. 6.

- several alternative chances to the tradicitional model of subscription;
- the creation of new open access journals.

1.5. Visibility of scientific journals.

The publication of scientific journals it become to be an strong industry that it had been enlarged in the development countries. Its evolution, use to tender to the cumpliment to certain quality standards, which are defined for the *Institute of Scientific Information (ISI)*, the *Internacional Standard Organization (ISO)*, and the General Information Programme *(PGI)* of UNESCO and other international organizations.[22], [23], [24]

In this study, we had analized the level of visibility that the scientific journals -where the researchers of the Departamento de Fisica of the Universidad Nacional de La Plata have published- had reached. It had been based on descriptive data that had demonstrated the presence of these publications on the international indexes and databases –on the web or in the susbscriptions that had existed at the Library, or in the ones than they could access. We had emphasized, as like the international cooperation can afford a major visibility of the scientific journals. This conclusion, before the study was only a measure of the application of several methods like its appearance on indexes and the Impact Factor.

The publishing industry of Latin America was considered like “poor” in comparison with the industry of some countries of Europe, the United States or Canada. Accordingly, the visibility of the local scientific production have depended on the mundial publishing industry, and like its bibliographic product will locate on international indexes that has contained this production.

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[22] See, *Institute of Scientific Information (ISI)*, http://isiwebofknowledge.com

[23] See, Internacional Standard Organization (ISO), http://www.iso.org/iso/home.htm

[24] See, Intergovernmental Council for the General Information Programme (PGI) Unesco, http://www.unesco.org/webworld/pgi/index.html

These indexes will provide in the countries of Europe and the United States –where the information is harvested and processed. We had to added to this, the appearance of the electronic journal, that had made an hito on the history of the science. It had made possible to strenghtening of the titles that exist, and a major celerity on the creation of new products. However, in some countries on development, the situation is different for several causes: the low budget, and the difficults that some researchers of Latin America have to publish in the journals of the major prestige in the world.

Countries of Latin American and the Caribbean, with Spain and Portugal, have create information systems that can facilitate that serials of the region can be included in indexes that can enter to the hardcore of the international scientific community. These complementary systems had been developed becaurse the existence of cooperative activities between several institutions and countries that are interest on decrease the gap of information between the named “poor” countries and the rest of the world. Among this endeavors will have: *LATINDEX* [25], *SciELO* [26], *REDALyC* [27] and others of open access (O*pen A*ccess*, OA*).

The analysis of the inclusion of Argentina in the information system *LATINDEX* had demonstrated results. Its situation, is an example for other latinamerican countries and for other regions even more disadvantaged, to obtain the necessary visibility that the science use to have on this context. So the scientific journals will be included in these international indexes. This is the case of the scientific journal *Anales de la Asociación Física Argentina*, which has cumpliment the items included in the international standards of peer-review process.

Another factor that had influenced the scientific production, is the difficult that certain scientific journals have to be included in these international directories and indexes, perhaps they do not knew all the details of the standards and the criteria that are applied in the interantional systems of refeeres. This situation do not exist at the Departamento de Física, either in the area of the physics sciences and others.

[25] *LATINDEX*, open access, http://www.latindex.org
[26] *SciELO,* open access, see, http://www.scielo.org
[27] *REDALYC*, see http://redalyc.uaemex.mx

1.6. The concept of the International visibility of the science.

The international visibility of the science was verified through the presence of scientific papers on sites –i.e., finite and virtual resources- which have distributed the results of an institutional research.[28]

Some authors, have only considered that this visibility would be by the works of certain authors, and which are published on journals that are analized by international databases –i.e., the *Science Citation Index.*[29]

At this study, the method of the Impact Factor, had allowed to know the frequency which the information that was contained in this serials is used by the scientists. They used it in their scientific researchrs, and they would transform it in a new knowledge.[30]

The analysis had began from the titles which are referenced in the journals where the scientists of the Departamento de Física have published. These scientific journals have a major visibility, if we had considered that in the databases of *SCI* will find the most important serials of the world. We also had considered the criteria that determine that the visibility of a journal is able to be measured by two manners, direct and indirect difussion.

The direct difusión, it will be relacioned with the journals subscription, the donations or the exchange. The serial has obtained visibility –also at the libraries. This kind of visibility will be mesaured from the presence of this journal on the libraries catalogues –individual or collective, printed or online-, from the loans that a journal had obtained in these libraries –in the case of this study-, from its transactions –outside of the library-, or by the number of subscriptors –data that was controled by the editor.

The indirect visibility, has been defined like a result of the difussion on directories, indexes and databases of scientific journals, which useful is determined by its location and selection –according to several areas of knowledge.

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[28] Adriana Beatriz Rocca, Módulos de autoaprendizaje en bibliotecología : Descripción documental. La Plata: DB Bureau de Publicidad, ©1994-2009.

[29] See, http://isiwebofknowledge.com

[30] Sanz Casado, E. y Martín Moreno, C. Madrid: Servicio de Publicaciones, Universidad Complutense, op. cit. pag. 10.

The directories only have included the minimun data wich is necessary to locate a title of a serial, or to know the journals that could exist in a certain area of knowledge (i.e., *EBSCO Serials*, *Directory of Open Access Journals (DOAJ)*, *LATINDEX Directory*).[31], [32], [33] Each one has included the journal that are more pertinent, according to criteria on the policy of selection for bibliographic materials of each organization –geographic area, language or matter. Some directories had been development by companies -that are marketing the compiled information, and other directories of *open access* (*OA*).

The indexes and the databases, had realized a detailed work of each issue or fasciculo of each journal, which are selected with criterias of quality, usage and matter. They had indexed the articles of each number, through the criteria that the organization or company whom had made the work of the data harvesting and analysis. These are specialized tools that could alow to locate authors, titles, abstracts or dates of publication. They can include certain information, are referencial or full-text, and can add value to the analysis –because, they had included indexes of references or cites, tables of contents, collective catalogues or other sub-products. Examples od the indexes or databases are the following: *Current Contents®/Physical*, *Chemical & Earth Sciences*, *INSPEC*, *MathSci* (Mathematics, Probability and Statistics 1940-present)-*OVID, NASA Astrophysic Data System* (Astronomy, Astrophysical, Physics, Geophysics), *Science Citation Index!®*, *SciSearch®*, *SCOPUS–Elsevier.* [34], [35], [36], [37], [38], [39], [40]

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[31] *EBSCO Serials*, restrictive access, http://ejournals.ebsco.com/Login.asp?Librarian=1

[32] *Directory of Open Access Journals (DOAJ),* open access, http://www.doaj.org

[33] *Directorio LATINDEX,* open access http://www.latindex.org

[34] Restrictive access, http://scientific.thomson.com

[35] Restrictive access, http://www2.theiet.org/inspec/index.cfm

[36] Open access (from any PC of the UNLP or CONICET, and to the Portal BECTIP), http://www.biblioteca.mincyt.gov.ar/

[37] Open access, see, http://ads.on.br

[38] Restrictive access, http://www.thomsonscientific.com/cgi-bin/jrnlst/jloptions.cgi?PC=K

[39] Restrictive access, http://www.thomsonscientific.com/cgi-bin/jrnlst/jloptions.cgi?PC=D

[40] Restrictive access (from any PC of the UNLP or CONICET, and to the Portal BECTIP), http://www.biblioteca.mincyt.gov.ar/

Methodology.

1. Documental resources.

For this study, we had analized the bibliographic references or cites of the scientific serials that had appeared in the papers of researchers and academic teachers of the Departamento de Física of the Facultad de Ciencias Exactas of the Universidad Nacional de La Plata, which were produced during the period 1997-2004, were published on line and were avalialble on the web site of the Cornell University Library, arxiv.org, from there they had downloaded.[41]

At a first stage, we had selected the papers of seventeen (17) researchers that had worked –like academic teachers at the Departamento de Fisica, and we had a priori considered that they had an important scientific production. This criteria was based on the data we had obtained from the institutional web site and for their important and well-known scientific trayectories and their users profiles. [42] Each article was searched and located in the database of arxiv.org.[43]

At a second stage, from the web site of arxiv.org we had downloaded all the works that the teachers and researchers had produced during the period 1997-2004 –till the moment of this part of the study, it had been available, for the later abridged of the searching to the period 1999-2003 –for operative resaons. The *Journal Citation Reports® Science Citation Index®*, only was avaliable at the Biblioteca of the Centro Atómico Constituyentes, Comisión Nacional de Energía Atómica (CAC, CNEA) where we could locate the data of the issue that had belonged to the year 2003. This had limited the analysis to the papers the had produced during the period 1999-2003.

At a third stage, from the papers that we had donwloaded from the web site of arxiv.org in PDF format, we had extrated the bibliographic references or cites that had appeared in each paper. Then we had put them on Excel worksheets –or each researcher and for each paper. We had considered the decreasing number of the bibliographic references that had appeared.

[41] See, http://arxiv.org/
[42] See, http://www.fisica.unlp.edu.ar
[43] See, http://arxiv.org/

At a fourth stage, the bibliographic references or cites that had corresponded to papers that were not recovered from that web site, we had formatted in calculus worsheets from the original paper. In some cases, these works were localized in the printed journals that are available in the own Library. In other cases, they had been downladed from the web site of the Electronic Library of Science and Technology, or, were requested to the information consortium *PrEBi-ISTEC-UNLP*.

The performance of this study, had involved a heavy work, because the high number of bibliographic references or cites of each paper that had certain difficults to identify some data of the journals titles –i. e., varying, fusion and mistyping, etc. This make indispensable, a work of identifying and data cleaning of each journal title that was referenced in the analized papers.

Getting the factual information.

We had made the following working tools –tables and graphics- that can be possible this study:

1. Data of the *references* of the serial titles that the researchers of the Departamento de Física had done, arranged by alphabetical order. (Annex 1: TABLE 1).
2. Data of the *references* of the serial titles that the researchers of the Departamento de Física had done, arranged by decreased order of the number of *references* that had received each other. (Annex 1: TABLE 2).
3. Data of the *references* of the serial titles that the the researchers of the Departamento de Física had done, by alphabetical order and by decreased quantity of papers that had been published in these journals. (Annex 1: TABLE 3).
4. Data of the bibliographic references by serial: Dispersion Tables. (Annex 1: TABLE 4).
5. List of the serial titles that we had estimated that coverage the minimun needs of the researchers of the Departamento de Física: HARDCORE OF SCIENTIFIC SERIALS. (Annex 1: TABLE 5, *Also see,* ANNEX A).
6. Percent of the serial titles that had referenced by the researchers of the Departamento de Física according to the coverage language. (Annex 1: TABLE 6).
8. Relationships that can allow to verify that it would be possible that, the journals which are more referenced are the same titles which have major *Impact Factor*

and major *Aged*: Relationship between the *Impact Factor* and the Quantity of *Bibliographic references*; Relationship between the *Aged* and the Quantity of *Bibliographic references*; Relationship between the *Impact Factor* and the *Aged*. (Annex 1: TABLE 7: RELATIONSHIPS).

11. List of the serial titles which were referenced in the scientific works of the researchers of the Departamento de Física. (Annex 2: TABLE 1).
12. List of the serial titles which were referenced in the published works of the researchers of the Departamento de Física, that had existed in the bibliographic collection of the Library. (Annex 2: TABLE 2).
13. List of the serial titles which were consulted or loan to researchers at the Biblioteca del Departamento de Física, and were referenced in the articles during the period 1999-2003. (Annex 2: TABLE 3).
14. List of the serial titles that had obtained only one (1) *reference* in the works of the researchers of the Departamento de Física had published, and are part of the bibliographic collection of the Library. (Annex 2: TABLE 4).
15. List of the serial titles that had existed in other libraries, that had received only one (1) reference in the published works of the researchers of the Departamento de Física. (Annex 2: TABLE 5).
16. List of the serial titles which were consulted or loan at the Biblioteca del Departamento de Física, that they had not obtained any reference in the published works of the researchers of the Departamento de Física. (Annex 2: TABLE 6).
17. List of the serial titles that had existed in other libraries, that had received *references* in the published works of the researchers of the Departamento de Física. (Annex 2: TABLE 7).
18. List of the serial titles available on the web, that were referenced in the published articles of the researchers of the Departamento de Física. (Annex 2: TABLE 8. *Also see,* Annex 3: TABLE 7).
19. List of the serial titles, in which the researchers of the Departamento de Física had published their papers, which were available on the web site of the Electronic Library of Science and Technology by editor. (Annex 3: TABLE 1-6).
20. List of the serial titles, in which the researchers of the Departamento de Física had published, and were avalilable on the web in full-text. (Annex 3: TABLE 7).
21. Serial titles that were available on the web site of the Electronic Library of Science and Technology, by coverage of the Exact and Astronomical Sciences. (Annex 3: TABLE 8).
22. List of the serial titles, in which the researchers of the Departamento de Física has published by researcher. (Annex 4: TABLE 1-2).
23. List of the serial titles, in which the researchers of the Departamento de Física has published, by quantity of published articles. (Annex 4: TABLE 3-5).
24. List of the serial titles, in which the researchers of the Departamento de Física has published, and which are relationed with the indexes and databases, where they were indexed. (Annex 4: TABLE 6-7).
25. Visibility of the serials, in which the researchers of the Departamento de Física has published, according to the *references* that were realized. (Annex 3: TABLE 1-8).

26. List of the serial titles, which were relationed with the Consume Information Indexes: Middle Age or Semiperiod, Index of Price, Law of Brookes. (Annex: CONSUME INFORMATION INDEX: TABLE 1-3).
27. Relationships that can allow to verify that it would be possible that, the journals which are more loan or consulted are the same titles which have major Impact Factor and major *Aged*: Relationship between the *Impact Factor* and the Quantity of Loan Transactions; Relationship between the Aged and the Quantity of Loan Transactions; Relationship between the *Impact Factor* and the *Aged*. (Annex 3: TABLE 7, GRAPHICS 5-7; WORKSHEET: RELATIONSHIPS).
30. Loans of the serial titles, during 1999, 2000, 2001, 2002, 2003. (WORKSHEETS: 1999, 2000, 2001, 2002 y 2003).
31. Ranking of the serial titles, which were more borrowed during the period 1999-2003 (annual laon transactions). (WORKSHEET: 1999-2003).
32. Productivity of the researchers of the Departamento de Física: Index of Scientific Production (index of *references* per article). (WORKSHEET: 1999-2003. GRAPHIC 2).
33. Evolution of the annual loan transactions of the serial titles, except which were consulted during the period 1999-2003 (annual laon transactions). (WORKSHEET: EVOLUTION OF LOAN TRANSACTIONS).
34. Dispersion Graphics: *Bradford.* (Annex 1-2; 1999-2003; WORKSHEET: EVOLUTION OF LOAN TRANSACTIONS; WORKSHEET: RELATIONSHIPS).

Conclusions.

At the First Part of this study, we had defined the hardcore of scientific serials that would assurance the coverage of a 80% of the researchers needs... with an exact coverage of the 80,19% of the needs of the scientists with 40 *bibliographic references or cites* of the serials titles.

At this time, the collection of scientific journals had 617 titles, only 4 subscriptions were open –which were acquired for bought by the Departamento de Fisica in printed format wth onlne access. These titles were *Acta Crystallographica A, Acta Crystallographica B, Acta Crystallographica C, Applied Journal of Crystallography*, at this time accessible from the Portal of Science and Technology.

The 4 titles of the journals that were referenced -and that were not on the Hemeroteca- were accessible on the web: 2 at CNEA, 1 was online from the Portal of Science and Technology, and 1 was probable able to be accessible by an scientific information consortium (i. e., PreBi-Istec-UNLP). These titles had clustered 348 bibliographic references that had corresponded to a 12,12%.

At this time, a lot of the titles that are inside the 89% -at which the researches had access, till march of 2004- were not subscribed on print format. The set of journals titles that were acquired by the SECTIP did not allowed the availability a some papers, that were the most demanded by the researchers of the Departamento de Física. For example, some issues of the *Nuclear Physics A*, *Nuclear Physics B* and *Nuclear Physics B: Proceedings Supplement*. That would represent a great difficult to the accessibilty that the scientists will require when they realize their researchs.[44]

The Faculty of Exact Sciences at which belong the Departamento de Fisica has an complex structure that included several titulations... and a lot of research lines. However, the data of the *bibliographic references* or *cites* we had analized do not show further dispersion about this knowledge area.

The researchers of the Departamento de Física participe on an strong international social web that had been increased by *invisible colleges*. In that way, the scientists could obtain most of the information resources by informal media communications.

From the 243 titles that had corresponded to the 41,6% of the referenced titles that are allowed in the Library, a 58,4% of the titles are available n other libraries (i. e., libraries of the UNLP, CNEA, or by information consortiums) and a 19,72% it is available on the web from the Electronic Library of Science and Technology. From the 74,49% of the online journals titles that, the researchers of the Departamento de Física had been referenced on their scientific works, to the 25,93% of the journals it would be available from the web ste of the BECTIP, and to a 48,56% from the web site of each editor o distribuidor.

The researchers of the Departamento de Fisica participe on an strong international social web that had been increased by *invisible colleges*. In that way, the scientists could obtain most of the information resources by informal media communications. For example, till 1999 they had to use the fax machine, and then digital archives lke attachment of e-mail messages. Actually, it had increased the quantity of titles of scientific serials of the physical sciences are being available, from the web site of the Electronic Library of Science and Technology, and from the data

[44] See, Science Direct (Elsevier) available at: http://www.sciencedirect.com

bases of *bibliographics cites* that it offers in the area of the Exact Sciences, Earth Sciences and Engineering.

At the Second Part of this study, we could stablished that the quantity of the obsolescence of the papers which were analized, was determinated by the calculus of the follow bibliometric indexes: the Middle Age or Semiperiod of the bibliographic references or cites (Burton y Kleber, 1960); the Index of Price (Price, 1965), and the Factor of obsolescence, by the *Law of Brookes* (1960) – mathematic law that can descrbe the temporal loss of the utility of a cluster of documents.

It could be stablish that the measure of the obsolescence [of the scientifc literature] it would be obtained in several forms: through the *bibliographics references* or *cites* of the scientific resources; through the *bibliographics references* or *cites* from the scientific resources, or through the papers that the researchers had had in circulation outside the Library of the Departamento de Física.

The Middle Age or Semiperiod of the bibliographic references or cites that it had calculated on the whole scientific serials from 1999 to 2003, was 29,72 years. The Middle Age that it was obtained from all the titles of the journals which were analized in the period 1999-2003, was 29,72 years. This data, seems too high if we have had considered –like a comparison- that the Middle Age of the Mathematic Literature is 10,5 years. From the values of Burton-Kleber, between both sciences could exist a difference of more than 19 years[45] Even though, these values did not have an exact equivalence with the values Burton & Kleber for these types of sciences. And we have to consider that this Burton-Kleber analysis have more than 40 years old, and it could be something aged.

However, we have to consider that the relationship between the data which was obtained from the papers of these authors, have demonstrated certain equivalence with the Burton-Kleber values. By the way, this is the reason because we still have considered these data like values relevant for this research. This patron, after 50 years, would be seem to be valid.

[45] Burton, R. E. y Kleber, R. W. op. cit., pag. 6.

At this conclusion, we also have arrived from the work of Podlubny, that had demonstrated that the total of the number of the bibliographic references among several sciences would be kept constant throughout the times.[46]

To can obtain the value of *Index of Price* we had used the calculus that can establish that, for each year must to be divided the whole number of the bibliographic references with an Aged minor to 5 years, according witn the date of publication of the papers, and then we had to multiply per 100 to obtain the *Consume Information Index*. The result that was obtained is variable and had high values. The maximun value of *Index of Price* was 53,17% for 1999, 41,08% for 2001, and the minimun value was 31,58% for 2002. The *Index of Price* for the whole bibliographic references was 42,52%.

Year	Quantity of articles published per year.	Number of bibliographic references of the articles.	Number of Ref. with Aged major to 5 years according with the date of publication.	Number of Ref. with Aged minor menor to 5 years according with the date of publication.	Index of Price
1999	93	3959	1854	2105	**53,17**
2000	51	2062	1292	770	37,34
2001	51	1553	915	638	**41,08**
2002	47	1425	975	450	31,58
2003	77	1551	1028	523	33,72
Total	**319**	10550	6064	4486	**42,52**

From: Annex: Consume Information Indexes, TABLE 1: Index of Price. GRAPHIC 1, pag. 1-2.

Rocca, Adriana Beatriz, *Trabajo de diploma*, Mar del Plata, march 2009.

[46] I. Podlubny (2005). "Comparison of scientific impact expressed by the number of citations in different fields of science." *Scientometrics*, 64 (1), 95-99.

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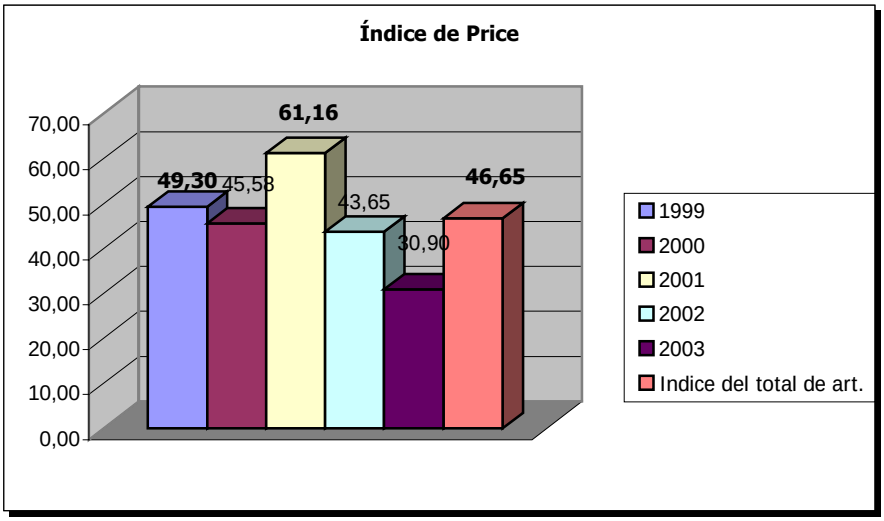

From: Annex: Consume Information Indexes, TABLE 1: Index of Price. GRAPHIC 1, pag 2.

Rocca, Adriana Beatriz, *Trabajo de diploma*, Mar del Plata, march 2009.

The studies of Price, Burton and Klebler, had allowed to determine that there is a difference between the speed of decreased of the aged of the scientific journals among several sciences. If the percent that had corresponded to the *Index of Price* is high, the publications aged more quickly, and viceversa. In order to that, we could Determined that disciples like Phyiscs, Mathematics, Astronomy, etc. are an strong front of the scientific research, and they had high values of the index.

Knowledge Áreas.	Middle Age
All the areas.	**29,72**
Physics.	**28,98**
Mathematics, Statistics, Astronomy, Geophysis, etc.	**30,17**
Chemistry, Biology, Medicine, Engeering, etc.	**29,73**

From: ANNEX: Consume Information Indexes, TABLE 2: Middle Age, pag 4-22.

Rocca, Adriana Beatriz, *Trabajo de diploma*, Mar del Plata, march 2009.

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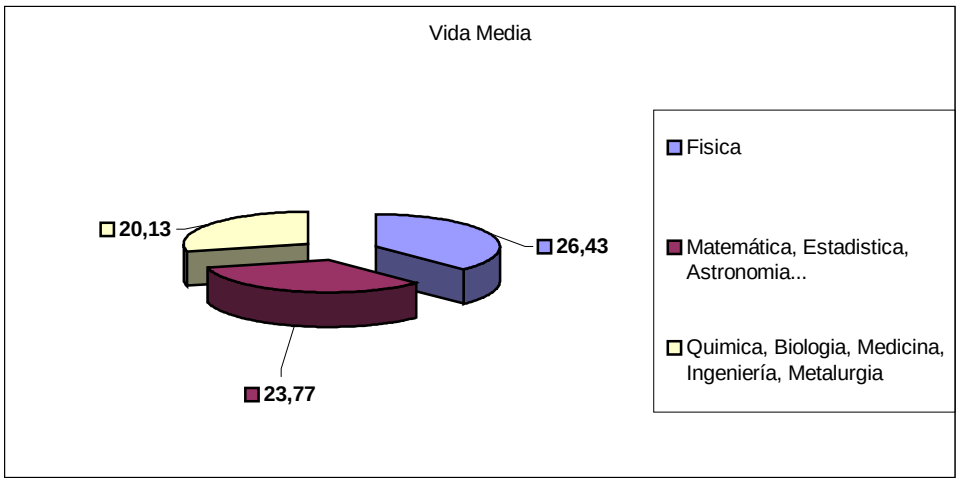
KNOWLEDGE ÁREAS	MEDIA	MEDIANA
All the areas	**27,83**	**26,50**
Physics	**26,43**	**27,50**
Matemathics, Statistics, Astronomy...	**23,77**	**21,50**
Chemistry, Biology, Medicine, Engeenering, Metalurgy	**20,13**	**14,00**

Middle Age or o Semiperiod, pag. 23.

Rocca, Adriana Beatriz, *Trabajo de diploma*, Mar del Plata, march 2009.



From: ANNEX: Consume Information Indexes, TABLE 2: Middle Age or Semiperiod, pag 23.

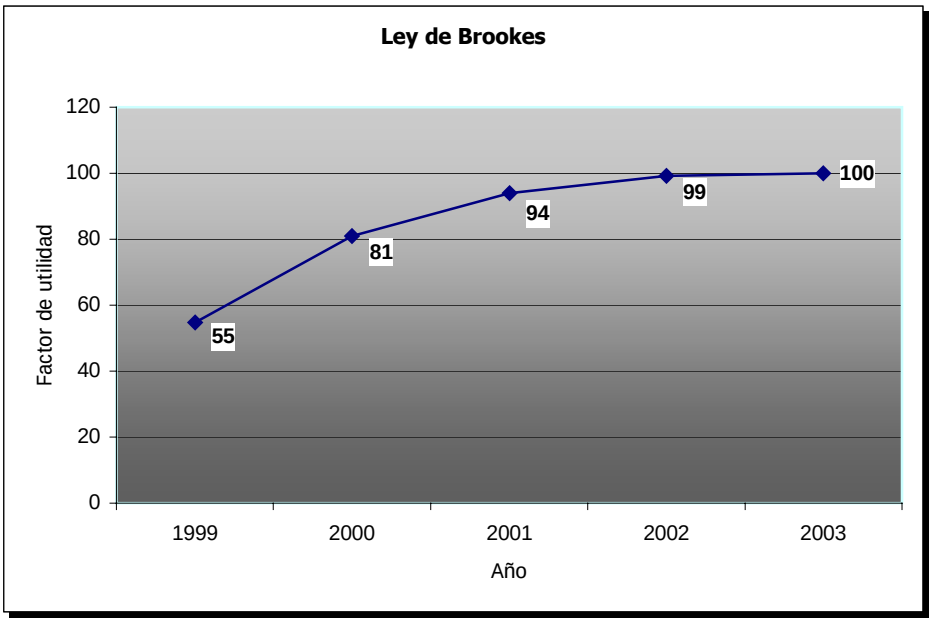
Rocca, Adriana Beatriz, *Trabajo de diploma*, Mar del Plata, march 2009.

From these results, we had concluded that the scientific literature that well-read the researchers of the Departamento de Física, in order to increase the scientific production had belonged to disciplines that had high Indexes, and in certain cases are very dynamic and will be aged more quickly.

During the period 1999-2003, furthermore the bibliographic references and cites of the scientific journals, that had harvested from proceedings, thesis, books, references books. In the same manner, there were personal communications, for example: e-mail, thelephone, fax. At this study, we only had considered the bibliographic references of the scientific journals, the rest of the bibliographic material and other information resources, are only mentioned to add a cuantitative data value of the usage of these kinds of documents.

Year	Information Usage Index
1999	**100**
2000	**99**
2001	**94**
2002	**81**
2003	**55**

From: Annex Consume Information Indexes. TABLE 3: Law of Brookes, pag 3.
Rocca, Adriana Beatriz, *Trabajo de diploma*, Mar del Plata, march 2009.



From: Annex Consume Information Indexes. TABLE 3: Law of Brookes. GRAPHIC 2, pag. 3.
Rocca, Adriana Beatriz, *Trabajo de diploma*, Mar del Plata, march 2009.

We could conclude that -according with the type of publication-, the journal article is the information resource which had more frequent use among the scientists. It would followed the proceedings, the thesis, the monographs, and a varied group of bibliographic references would belong to a very diverse *DOCUMENTAL TYPOLOGY* (pre-prints –available online, computers archieves -in PDF, HTML, WORD format). From the analysis of the scientific production of the Departamento de Fisica, we had detected a behavoir that had corresponded to the scientist of the physics sciences, which have an strong relation with the type of diffusion of their works, and the type of documents that they had consulted.[47]

[47] Sanz Casado E. y Martín Moreno, C., op. cit., pag. 10.

From the point of view of the language coverage, the serials which were referenced, because they are titles of the exact sciences, had showed the following data: 94,69%, had been written in English. Then, the *IDIOMATIC CAPABILITY*[48] or the frequency which the different languages had appeared in the scientific journals:

Quantity of titles	Percent	Language	ISO Code
232	94,69	English	En
9	3,67	Italian	It
1	0,41	Spanish	Es
1	0,41	French	Fr
1	0,41	German	De
1	0,41	Portuguese	Pt

Idiomatic Capability [See: ANNEX 1. TABLE 6, pag. 20].

Rocca, Adriana Beatriz, *Trabajo de diploma*, Mar del Plata, march 2009.

The table above, about the idiomatic capability has showed the distribution of the frequency of the bibliographic references according with the language of the publication. The English like the official language of the science, is the language that they had used with more frequency 97,80%, the second language is the Italian, with 1,06% of frequency, then we have the Portuguese, the Spanish, the German, and the French, witn more lower frequencies, with values minor than 1%.

Language	Quantity of Ref.	Frequency (%)
English	7026	97,80
Italian	76	1,06
Portuguese	54	0,75
Spanish	22	0,31
German	5	0,07
French	1	0,01
Total	**7184**	100,00

IDIOMATIC CAPABILITY [See: ANNEX 1. TABLE 6, pag. 20].

Rocca, Adriana Beatriz, *Trabajo de diploma*, Mar del Plata, march 2009.

[48] Sanz Casado, E. y Martín Moreno, C., íbidem.

In concern with the cooperation, there is an international geographic cooperation point of view, in which the Biblioteca del Departamento de Física had participed from 1996, the ISTEC-PrEBi -Proyecto de Enlace de Bibliotecas, information consortium between the Universidad Nacional de La Plata, Argentina and the New Mexico University, United States, and other countries like Brazil.

From 2005, some of the personal of the Library had participed on activities of the OUI Organisation Universitaire Interaméricaine, Québec, Montreal, Canada, non profit organization, which educational objectives will follow the cooperation between the Universities of the Americas (Canada, United States, Mexico, Central America, Caribbean, Brazil, Andean Countries, Colombia y Southern Cone). We had development a lot of cooperative activities among the university libraries and other centres of information: interlibrary loan; cooperation in conservation and preservation; colaborative projects on the development of information planning; free scholarships for technical personal, to posibilite their actualization and capacitation.

In concern with the science visibility analysis in Argentina at the Directory LATINDEX, OnLine Regional Information System to Scientific Serials of LatinAmerican, the Caribbean, Spain and Portugal, we had analized the standarization of the serial publication Anales Asociación Física Argentina and we had stablished that it would be necessary several elements in order that the web positioning it would be acceptable.[49] This serial publication maintains the necessary exchange to contribute the development and consolidation of the science of physics among others, including its applications, history and teaching. It would be like "...the argentine science journal onto the sector relate with physics...". Its puslished represents -along with the Anual Reunion of the Asociación Física Argentina, some of the most significant cooperation activities, that the international scientific communication had arranged.

[49] For further information, see Asociación Física Argentina, http://www.fisica.org.ar/

Latindex, "... is based on the co-operation of institutions that function in a coordinated manner in order to gather and diseminate bibliographic information concerning the scientific serial publications produced in the region..."[50]

The journal Anales AFA, is one of the most important communication media that can allow a general vision of the national scientific production.

Its mission is the best diffussion of the scientific activities and production of different groups of researchers, even in Argentina and others countries, is cumpliment from 1989, when de printed volumens of Anales AFA had began to be distributed among the research centres and groups of the country, through its members, by direct and indirect diffussion.

In the Anales AFA there are published the papers that the researchers had submitted to the Reuniones Anuales de la Asociación Física Argentina, which are evaluated by an expert peer-view commitee that are designed by the Editorial Commitee.

Since 1998, the printed of Anales AFA had been completely funded by its copyright. Before, it was supported by companies, consortiums and governamental organizations. Since 2005, it is available –with free access- the electonic version from the web site of the Asociación Física Argentina, from the Volumen 16 de 2004.[51] (Available at URL: Asociación Física Argentina, http://www.unicen.edu.ar/crecic/analesafa/).

Since 2006, Anales AFA had been included in LATINDEX, Online Regional Information System for Scholarly Journals from Latin America, the Caribbean, Spain and Portugal. It has been considered by the international scientific community like a journal that must be indexed.

[50] For further information, see Latindex: URL: http://www.latindex.unam.mx/latindex/busquedas1/english/latin.html

[51] For further information see Asociación Física Argentina, http://www.unicen.edu.ar/crecic/analesafa/

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