Investigación Bibliotecológica

ARCHIVONOMÍA, BIBLIOTECOLOGÍA E INFORMACIÓN

In English

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Editorial

Users as the base for the
development of library
collections: the public library

Information needs are the central element of library science theory, because the activities of the library and information are underpinned by satisfying the needs of the persons who, for example, go to the public library and whom we commonly call users.

According to Rendón Rojas,[1] in the information-support media-user-document-information unit relationship, the information user's needs drive the librarianship activities of the information unit to develop collection. Determining and satisfying these information needs may be deemed one of the basic purposes of information units, whether they be the public library, newspaper archive, documentation center, information center, etc. Therefore, the need for information consists of the insufficiency or lack of knowledge with regard to some objects or parts of objects, phenomena or events that, in order to be addressed, requires additional knowledge.[2]

1   Miguel Ángel Rendón Rojas, *Bases teóricas y filosóficas de la bibliotecología* (México: UNAM, Centro Universitario de Investigaciones Bibliotecológicas, 1997), 123.
2   The concept of information needs is treated in Juan José Calva González, *Las necesidades de información. Teoría y métodos* (México: UNAM, 2001), 76.

In this light, one should keep in mind that information is generated by humans and is recorded to a support for the purpose of subsequent use by others. People need to have certain information and knowledge for orientation in the world and to act in accord with their surroundings. The human mind has developed to adapt to the environment and transform it. This is the intrinsic feature of human beings. Among other means, information and knowledge are attained through the auspices of the work of libraries.[3]

The lack of information or knowledge of a given object, phenomenon or event produces internal insatisfaction and the information need to more completely understand the object, phenomenon or event. We may well assert that information needs are phenomena that arise repeatedly and without end in our current society, organizations and individuals

Communities or subjects are links to functions and members of society. We see this in commerce, doctors, hospitals, lawyers, law firms, teachers and students, schools, workers, factories, housewives, homes, accountants, accounting firms, etc. The diverse social sectors are associated with public libraries in that members of society need to be informed in order to ensure progress. In this light, information is a key factor for a citizens and the country's efforts to attain social, economic and political objectives.[4] The persons who comprise these social sectors require informational support from the public library in order to perform their activities. In order to achieve this objective, Mexico has established the National Network of Public Libraries. Every library should be properly apprised of the information needs of its respective community.

3   Rendón Rojas, *Bases teóricas…,* 40.
4   Elsa Barberena, *Las necesidades de información en el área científica* (México, n. d.), 6.

Interestingly, the literature on information needs of social sectors surrounding public libraries are quite scarce, suggesting that just what these needs are and how they can be meet are still relevant questions.[5] As such, more research on public libraries and the information needs of social sectors is required in Mexico and other countries.

The emergence and manifestation of the information needs of diverse social sectors can be influenced by several factors, including:

- The place where they live
- The objectives, functions and role they have within their social sector
- The area of activity (commerce, health, hacienda, etc.)
- Topic of interest at the time (influenza, elections, earthquakes, climate, drug trafficking, security, etc.)
- Supports for performing daily activities
- Knowledge and experience in the topic area (accounting, medicine, sales, etc.)
- Experience in the use they of information resources (public library, Internet, etc.)
- Use of resources and sources to obtain the information they need, and access to diverse information units.

It is necessary to identify the information needs of community served by the public library. This can be achieved by developing a complete profile of the community. The identification of information exists in three modalities: 1) about an author (e.g. Carlos Fuentes); 2) about a social problem (e.g. public safety) and 3) about a concrete topic (e.g. treatment of influenza).

5   Pablo Velásquez, *Las necesidades de los usuarios de la información agrícola en América Latina* (Buenos Aires: 1972), 5.

These three modalities may exist simultaneously in the information needs of the user of the public library.

When the public library has a working profile of its user community, it can determine its information needs and take appropriate action to develop collections of books, magazines, journals, documents, etc. This observation is in line with Negrete, who asserted: "[…] the development collections has as its objective the construction of a collection of documental materials whose contents effectively respond to the information needs of the community."[6]

In sum, research on the information needs of a given social sector served by a library and the development of its collection can be based on following factors:

- Diverse social sectors have information needs, which are manifested through an informational search behavior performed to meet such needs.
- The emergence of information needs of communities are influenced by diverse internal and external factors, which have great mobility.
- Over time, new information needs arise as a result of further inquiry into previously satisfied needs or from completely new impetuses.
- The person comprising the diverse social sectors may present three types of information needs simultaneously.
- The public library must identify the information needs of its community through diverse methods and use the results to guide development of collections.
- The information needs within the information-user-support media relationship are the foundation for developing collections. This means that

6   María del Carmen Negrete Gutiérrez, *La selección de materiales en el desarrollo de colecciones* (México: UNAM, Centro Universitario de Investigación Bibliotecológica, 1997), 23.

information units shall have the information re-
corded in some kind of electronic or hard copy
document.

Juan José Calva Gónzalez

ARTICLES

Human resources in Mexican public libraries: and exploratory inquiry

Federico Hernández Pacheco *
Diana Quezada Escamilla **

Abstract

Facing the new challenges of information society, Mexican public libraries need highly qualified human resources to satisfy demands of users and promote initiatives for ongoing improvement of library services. Library human resources are an essential part of public libraries; therefore, this research examines the human resources in several libraries of the National Network of Public Libraries in Mexico.

Resumen

Los recursos humanos en las bibliotecas públicas de México: una investigación exploratoria
Federico Hernández-Pacheco y *Diana Quezada-Escamilla*

Ante los nuevos retos que presenta la sociedad de la información, las bibliotecas públicas mexicanas requieren la participación de recursos humanos de alta calidad, que permitan satisfacer las demandas de sus usuarios e impulsar diversas iniciativas para la mejora continua de los servicios. El personal bibliotecario es un factor esencial; por ello, el interés de este trabajo es explorar el panorama actual de los recursos humanos en algunas de las bibliotecas que integran la Red Nacional de Bibliotecas Públicas de México.

Palabras clave: Red Nacional de Bibliotecas Públicas; Bibliotecas públicas; Recursos humanos; México.

Introduction

Public libraries play a strategic role in the construction of the social fabric of our country, in that that are required for cultural, ludic and educational development, which are key for facilitating the admittance of persons into the so-called "information and knowledge society" and diminishing prevailing inequalities.

In this sense, it is important to remember that the public library is democratic in nature *par excellence*, insofar as it provides informative and formative services in a peaceful context of liberty, inclusion and diversity, and within a framework that invites sharing. Regardless of technological advances, the public library will be present for many years in the daily lives of people.

It is indispensable; however, that all libraries be equipped with a proper site or infrastructure, vast information resources that match local needs, as well as with a variety of services and fair funding. Moreover, libraries must be staffed by properly trained personnel in order to ensure the efficient use and management of all media to the benefit of the library and the community it serves.

In effect, we know that the physical plant, budget, equipment, furnishings, etc. are basic resources for the proper operation of diverse public and private organizations; since without these elements it would be very difficult or impossible to carry out the tasks in workplaces where the exchange of goods and services occur, such as those interactions with users occurring in public libraries.

Nonetheless, there is a key resource upon which the proper operation of the organization depends, and this is the human resources, whose talent, work, creativity and effort can carry the organization to success or failure.[1]

Interestingly, the efficiency of the services provided by public libraries depends in large measure on the persons that work in them; since they play the preponderant role in the ongoing improvement and quality of the services of a given community.

Of course, there are diverse problems associated with human resources. In Mexico, for example, according to data gathered at the 11th Hispano-Mexican Seminar in Library Science and Documentation,[2] currently there are 16,000 persons working in the National Library Network. The federal, state, municipal and Mexico City delegational governments have the duty within their territorial authority to select, hire, train, remunerate and evaluate said personnel. Nonetheless, the situation on the ground invites further study of human resources in public libraries. For example, in state municipalities of the Republic of Mexico, personnel is rotated out or replaced every three years when municipal administrations change. The same thing happens at the state and federal levels, where the rotation of personnel is seen every six years. This means public monies must be spent to train new personnel. Most of these public library employees, who have only high school diplomas without any specialized studies in the field of Library Science, earn salaries of be-

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1   F. Hernández Pacheco, *Gestión y desarrollo de recursos humanos en bibliotecas*, 15.
2   Held April 23 to 25, 2014 in Ciudad Universitaria, UNAM, Mexico.

tween two and three thousand pesos. This study also will look at aspects of how human resources are evaluated in terms of performance and salary, job valuation and profiles and how personnel is selected.

> *IFLA/UNESCO Directives for development of public library services* clearly points out that the management of library personnel is in and of itself a key task. All personnel must have exhaustive knowledge of the library's service policy, tasks and duties, as well as of their conditions of employment and salaries, which must be properly regulated and competitive with other similar positions.[3]

Likewise, on March 18, 2014, the Organization for Economic Cooperation and Development (OECD) published its *Overview of the society*, which highlights that Mexico, an OECD member since 1994, has the lowest disposable income among its member states. Similarly, the report warns that income inequality and social divisions can worsen and become chronic unless governments act quickly to promote the support of the most vulnerable sectors of society.[4]

In this regard, Article Seven, subsection X of the General Libraries Act of Mexico requires the Secretariat of Public Education "to provide entertainment and training for the personnel assigned to the public library network," tasks that have been performed by CONACULTA since its inception through its General Libraries Directorate.

Moreover, Article Eight of the Act provides that states government shall:

VI. Designate the coordinator of the State Network who shall serve as the liaison with the Coordination of the National Network of Public Libraries.
VII. Appoint, assign and remunerate the personnel within the operations of the public libraries.

It is interesting to note, however, that these statements do not serve to clarify the matter of integral development of human resources, beyond such matters as assignment, designation, training and remuneration. As such, it is important to provide ongoing training of personnel within the framework of other basic human resources functions, including as strategic planning of positions, recruitment and selection based on scholarship and academic preparation in

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3   *Directrices IFLA/Unesco para el desarrollo del servicio de bibliotecas públicas.*
4   Roberto González Amador, "En México 4 de cada diez personas no tienen para comprar alimentos".

accord with job requirements. Moreover, it is important to keep in mind the analysis, description and valuation of positions; fair, equitable compensation packages, capacity and performance assessment s, and promotion of personnel/career development, effective communication and workplace climate, talent management, ergonomics and prevention of workplace risks, as well as human and labor relations, among other facets of the public library domain.

Under these premises, it is proper to consider performing a study of several public libraries belonging to the National Library Network to explore these problems and offer a series of proposals for improving human resources and, consequently, the quality of all of the processes and services of the public libraries in the country.

In this way, this study provides general answers to the following questions: What are the characteristics of personnel working in selected public libraries? What human resources preparation, labor conditions, abilities and activities exist in selected public libraries? What are the main problems associated with human resources in public libraries? To address these questions, this study has set the following objectives:

- To learn about the features of the personnel of in some Mexican public libraries.
- To describe the problems associated with human resources in Mexican public libraries.
- To offer suggestions for subsequent studies on the development of human resources in Mexican public libraries.

This exploratory, descriptive study has served to obtain information and delve deeper into diverse aspects and functions of human resources in Mexican public libraries. Further studies using correlational and explicative approaches shall support development of projects to improve the conditions of personnel and help fill in the theoretical and practical lacuna in this field.

This paper reports preliminary results of interviews and information gathered from several libraries of the National Library Network. These data shall serve to establish a human resources development model that can be replicated across the country in the future.

The beneficiaries of this study are largely those persons working in Mexican public libraries and the directors or decision makers leading these libraries,

who choose to implement this approach for detecting problems and finding solutions in this area. Through this lens, we can see the important social impact of human resources and the way in public library human resources can favor the dissemination and consumption of culture.

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DEFINITIONS AND GENERAL ASPECTS OF
PUBLIC LIBRARIES AND HUMAN RECOURSES

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The public library

According to the IFLA/UNESCO Manifesto on libraries published in 1994, the public library is:

> a local center of information that facilitates the users of all classes of information. The public library services are provided on the basis of equal access for all people, without regard to age, race, sex, religion, nationality, language or social condition. They must offer services and special materials for those users who for one reason or another cannot make use of the ordinary services and materials, for example, linguistic minorities, disabled persons, person in hospitals or those confined to prisons. All age groups should be able to find the materials to meet their needs. The collections and services should include all kinds of technologically based and traditional supports. High quality and local appropriateness are fundamental. The materials should reflect current trends and the evolution of society, as well as the memory of the efforts and imagination of humanity. Collections and services should never be subject to ideological, political or religious censure, and much less the pressure of commercial interests.[5]

Despite being twenty years old and in light of the fact that equality in public library is a fundamental value underpinning the identical treatment given to all persons and the value of inclusion, this definition is still valid in that it is based upon the desire to bring opportunities to all and ensure a fair distribution of resources in order that they may enjoy quality of life and well-being. Moreover, it also highlights the characteristics of collections of bibliographic materials in the public library that must be developed on the basis of the diversity of interests and needs of the community to which it belongs.

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5 Federación Internacional de Asociaciones de Bibliotecarios y Bibliotecas, *Manifiesto de la IFLA/Unesco sobre la biblioteca pública, 1994.*

The *IFLA/UNESCO Directives on the development of public library services* states:

> [the public library] is an established organization, supported and financed by the community, either through the auspices of an authority or local, regional or national agency, or by means of any other collective organization. It provides access to knowledge, information and intellectual works through a series of resources and services that are available to all members of the community without regard to race, nationality, age, sex, religion, language, disability, class, profession or educational attainment.[6]

This definition affords an additional element: the economic support, which in most cases is provided by the taxpayer, a fact that makes the entity an institution for all.

Moreover, by including the presence of a great diversity of users, the public library become an indispensable asset, a fact that IFLA/UNESCO highlights in the last lines of its definition establishing equal status to all users. In our country, the General Libraries Act under Article Two defines the public library as:

> All those establishments that hold printed or digital collections of a general nature of more than 500 titles that are catalogued and classified, and which are available for loan free of charge to any person requesting them under the terms of service and applicable administrative rules. The public library shall have the purpose of offering democratic access to all in order to consult books and other print and digital materials, as well as to other complementary cultural services, orientation and information that allows the user to acquire, share, grow and preserve knowledge in all fields without constraints.

Even though this definition dates from 1988 and is somewhat limited, highlights the concepts of free lending services, democracy and access for all persons and forms of expression, as well as the freedom to use materials independently to promote intellectual and collaborative work.

Article Two of the Libraries Act of the Federal District offers the following definitions:

> V.   Library. The physical space with an organizational structure, bibliographical collection, and newspaper clipping and document archive in any format, as

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6   P. Gill, *Directrices IFLA/Unesco para el desarrollo del servicio de bibliotecas públicas,* 26.

well as information and communication technologies, and whose mission is to contribute to the development of persons and their quality of life on the basis of equal opportunity to any visitor by means of dissemination of ideas and access to reading materials, information, research and cultural expressions.

VI. Public Library. Any library that provides service to the general public and is a dependency of the public administration of the Federal District.

In reality, the first definition comes closer to the mission and objectives of the public library, while that concerning the public library specifically is rather narrow in scope and leaves out many features of libraries of this kind, such as free service, inclusion and the broad base of knowledge covered by the collection, among other things.

Other features and tasks of the public library include:

- Storage, organization, and supply of information contained in any kind of documentary support issued by authorized, reliable sources.
- Making local and global information available that is useful to the community it serves. This suggests that it must face constant challenges in terms of access, coverage, breadth and depth.
- Providing cultural and artistic services that allow the population to acquire, grow and share knowledge for their personal development.
- The educational function positioning the library as a high caliber institution, in that through its services it helps form a better informed, more participative, fair and free society.

Taking into account these diverse definitions, one can conclude that the public library is a social space that contains collections of print and digitized materials on topics of general interest, whose basic function is to serve the locality through diverse informational and cultural services, which are provided under certain guidelines and always free of charge. Through diverse strategies and activities of the library personnel, these services are made available to users. These library employees must be properly trained and motivated, while enjoying workplace conditions that are adequate for the performance of such activities.

Human resources

Human resources are defined as the subset of persons that work in a public or private organization, performing diverse tasks and assignments in accord

with their abilities, talents and the daily operational needs. Dessler and Varela point out that

> the managzement of human resources entails the practices and policies needed to improve human relationships in administrative work, specifically recruiting, training, evaluating and remunerating, while offering a safe equitable workplace for the employees.[7]

Chiavenato asserts that

> Human resources are distributed in the institutional level of the organization (directorate), the middle levels (middle management) and the operational level (technicians, auxiliaries and operators). The human resource, he adds, is the only living, dynamic resource of the organization, and it manages the use of other, non-human, physical and material resources. Moreover, it constitutes a type of resource that possesses a vocation oriented toward growth and development.[8]

Both concepts invite reflection regarding the importance of people as a key element in organizations in a changing, globalized world. Similarly, the management or operation of people requires efficient organization and diverse functions or practices that are completely necessary for achieving ends. In this context, the *IFLA/UNESCO 1994 Manifesto of on the public library states*:

> The public library must be organized effectively and uphold professional standards of operation. The librarian is an active intermediary between users and resources. Librarians must have ongoing professional training in order to offer adequate services.[9]

Likewise, the *IFLA/UNESCO Directives for the development of public library services* recognizes the following:

> Personnel is a vital resource in the operation of a library [...] In order to provide optimal services to the community, utilize resources effectively and meet demand, trained and motivated personnel must be retained. [...] All personnel shall have exhaustive knowledge of the library service policies, and of the well-defined tasks

7   Gary Dessler and Ricardo A. Varela Juárez, *Administración de recursos humanos: enfoque latinoamericano,* 2.
8   Idalberto Chiavenato, *Administración de recursos humanos*, 128.
9   Federación Internacional de Asociaciones de Bibliotecarios y Bibliotecas, *Manifiesto...*

and duties, employment conditions and receive duly tabulated, competitive salaries.

The library personnel must have a series of aptitudes and qualities, such as sociability, social conscience, ability to work in teams and mastery of the practices and procedures of the institution.[10]

Both the Manifesto and the Directives acknowledge the importance of persons to achieve optimal management of the public library, in that "they are the suppliers of knowledge, abilities, competencies; and, above all, they provide their intelligence, which is their most important contribution to organizations […] persons constitute the intellectual capital of the organization."[11] The human resource is the one asset that surpasses all others is importance.

Persons are definitely the most important asset of the public library. As such, personnel should enjoy ongoing training under a vision that anticipates the needs of services; and they must be sufficiently qualified to provide adequate development and efficient management of human resources.

Method

This study uses an exploratory-descriptive method, whose aim is to make and initial approach to the current situation of human resources in the public libraries that belong to the National Network of Mexican Public Libraries.

The methodology employed uses both of quantitative and qualitative approaches. The quantitative technique consists of the application of an online survey to a sample of libraries, which were sent the questionnaire. On the other hand, the qualitative technique entails direct observation, participative observation and interviews held in the workplace.

Object of study

The object under study herein is the human resources population working in 7,388 public libraries of the National Library Network of Mexico. This population is diverse and, because of the lack of any official, updated registry of

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10   Gill, *Directrices…*, 125.
11   Idalberto Chiavenato, *Gestión del talento humano*, 10.

the personnel working in these libraries, the research object includes diverse types of human resources, whether they are salaried employees belonging to the union, contract administrators, volunteers and graduates fulfilling their social service and internships requirements.

Sample

In view of the diversity and size of the population, it is important to have a representative sample. The sampling method, the sample size and type were determined as follows:

Sampling method

In order to achieve the stated objectives and ensure representativeness of the sample, the elements of the population that were to make up the sample were selected using probability sampling with replacement formula, in which each libraries of the National Library Network would have the same likelihood of inclusion in the sample.

Type of sample

To perform the probabilistic extraction, the type of sampling to be used was random. This provided the possibility of receiving answers from any library in the Mexican Republic, resulting in a heterogeneous sample that include delegational libraries, central state public libraries, regional libraries and municipal libraries.

Sample size

The sample size was determined using the following formula:

$$n = \frac{N \, p \, q \, Z^2}{E^2 \, (N\text{-}1) + p \, q \, Z^2}$$

Where:

N (Size of finite population) = 7,388 public libraries
Z (Confidence level) = 90 %
E (Margin of error) = 5 %

p (Variability) = 40 %
q (Variability complement) = 60%

This operation provided a sample of 249 public libraries.

Data collection instrument

The quantitative technique employed in this research consisted of a survey to collect data. This instrument can be viewed at: http://es.surveymonkey.com/s/CJ5F5KC

This survey instrument addresses the situation of human resources on the basis of the following research variables:

1. Demographic features
2. Educational achievement
3. Labor situation
4. Job skills
5. Duties

The instrument is structured in ten query sets (See Appendix): The first set(1) consists of four open-ended fields focusing on knowledge of the public library where the respondent currently works, their job or position, and the location of their library (municipality, delegation and state).

The second two iems (2 and 3) deal with the first research variable, i.e. demographic data of the personnel (age and sex, respectively).

The second variable dealing with educational achievement of the personnel is structured in query set number 4, composed of eight options ranging from *no formal studies* to *doctorate degree.* The third variable, concerning the labor situation, is divided into four subsections: work schedule, salary earned by librarians, years on the job and training received. These variables are addressed in queries 5, 6, 7 and 8.

The fourth variable, job skills, is addressed in item 9, which provides a list of six basic skills that a librarian must have to perform the job. Each option requires the respondent to rate the degree to which they possess the skill on a scale of *good, average* or *poor.* Item 10 serves to assess the fifth research variable of job duties. For this purpose, we studied the duties that the personnel

of all public libraries should perform and compiled a list of administrative, technical and auxiliary tasks. For each of these task the respondent is asked to select those that they are required to perform most frequently.

Application of the instrument

Because the vast expanse of the country's territory, the research opted to apply the survey by electronic media. In this way, the data gathering instrument was designed with Survey Monkey software. The application strategy entailed sending the data gathering instrument to 31 state central libraries. To do this, we consulted the Directory of State Central Libraries of the National Network of Libraries at: http://www.rednacionaldebibliotecas.gob. mx/mapa_biblioteca_estalRed.php

On the basis of the information provided in said directory, an email was sent to each of the state central libraries, explaining the objective of the study and requesting their cooperation to respond to the survey and send it to the municipal and regional libraries of their respective states. The link to the online survey was available after July 7, 2013, and responses began to flow in on July 22. The data gathering was finalized on October 14, 2013.

Study limits

The development of the research was affected by three main factors:

a) Geographic limitations: The extension of the territory of the Mexican Republic makes it difficult to perform a field study in order to learn about the human resources situation in each of the public libraries in the country. Time was also a constraint. As such, we opted for the use of email and an online survey technique, which we understand may tend to skew the data gathered.

b) Deficiencies in communication and participation: One of the major problems faced by the research project was the lack of cooperation of state central libraries. This is evident from the scant number of email questionnaires they returned. While some states were more cooperative than others, some states did not respond at all. This uneven pattern of response exerted effects on the results, since there was a greater number of responses from some states and very few or none at all from others.

c) Risk to personal safety: In addition to these limitations, another factor that limited the qualitative aspect of the research of gathering data on site was the situation of criminality and violence prevailing in several regions of the country. Moreover, some regions of the country included in the sample are remote and difficult to reach.

Because of these limitations, this research regarding the human resources situation of personnel working in the country's public libraries shall for the moment be deemed preliminary in scope and of an exploratory-descriptive nature. The results obtained will provided orientation for future research in this field.

Library corpus under study

Of the questionnaires sent out to the 31 state entities, responses were received only from Campeche, Durango and Jalisco.

To complement the results obtained using the email survey instrument, we visited several nearby public libraries that were deemed representative of the research universe. Because of their social impact, ergonomic standards and good practices, site visits to gather data were made to the Biblioteca Pública Francisco Zarco (Delegation Benito Juarez, Mexico City), the Biblioteca Juventino Rosas (Delegation Magdalena Contreras, Mexico City) and the Biblioteca Beatriz Hampson Esquivel (Municipality of Ixtapaluca, State of Mexico).

The aforementioned data gathering instrument was applied to personnel working in libraries in the Federal District and the State of Mexico. All told, the survey was applied to 35 employees working in 10 public libraries in different states.

The following table is a list of the participating libraries:

Table 1. Corpus libraries under study

State	Municipality/Delegation	Public Library	Type
Campeche	San Francisco de Campeche	Francisco Sosa Escalante	Central State
Distrito Federal	Benito Juárez	Francisco Zarco	Central Delegational
Distrito Federal	Magdalena Contreras	Juventino Rosas	Central Delegational
Durango	Vicente Guerrero	Octavio Paz	Municipal

Durango	Vicente Guerrero	Tohue	Municipal
Durango	Vicente Guerrero	José Guadalupe Rodríguez	Municipal
Durango	Vicente Guerrero	José Ángel Ceniceros	Municipal
Durango	Nombre de Dios	Alberto Terrones Benítez	Regional
Estado de México	Ixtapaluca	Beatriz Hampson Esquivel	Municipal
Jalisco	Guadalajara	Profr. Ramón García Ruiz	Central State

Results

First variable. Demographics

A quarter of the workers surveyed are between 30 and 39 years of age, while a little more than a third are between 40 and 49 years-old. These two groups make up 71.43 % of the sample as can be seen in *Figure 1.* With regard to the data gathered, we can assert that senior citizens are a minority, while persons between 21 and 29 comprise about 17%. Thanks to the site visits to delegational libraries in Mexico City and the qualitative techniques employed, we can see that the work young people perform in public libraries is largely associated with social service obligations. These young people work largely in the Digital Services Modules, suggesting a strong correlation between their course of studies and the duties they perform.
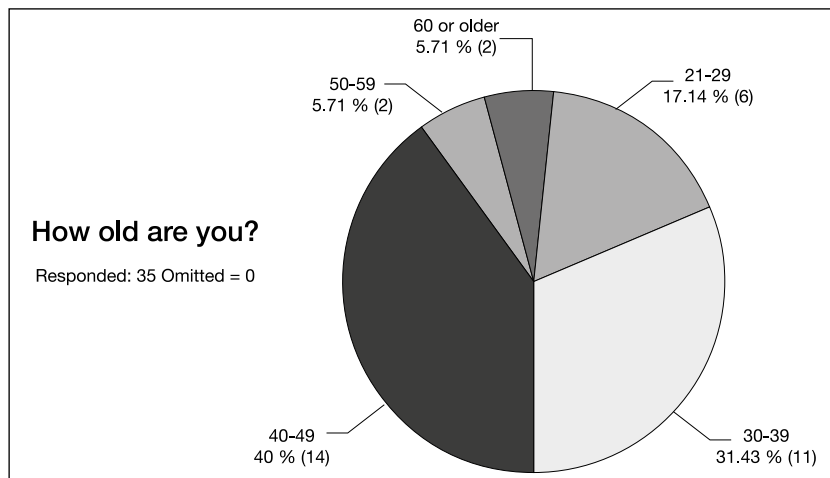
Figure 1. Age breakdown

Likewise, almost 90% of the human resources working in public libraries of the country are female (*Figure 2*). In the public libraries of the State of Mexico and the Federal District we see greater diversity, with the proportion of women to men about equal. Responses from the states of Jalisco, Campeche and Durango, however, have come exclusively from women.

Sex

Responded: 35 Omitted = 0

Male
11.43 % (4)

Female
88.57 % (31)
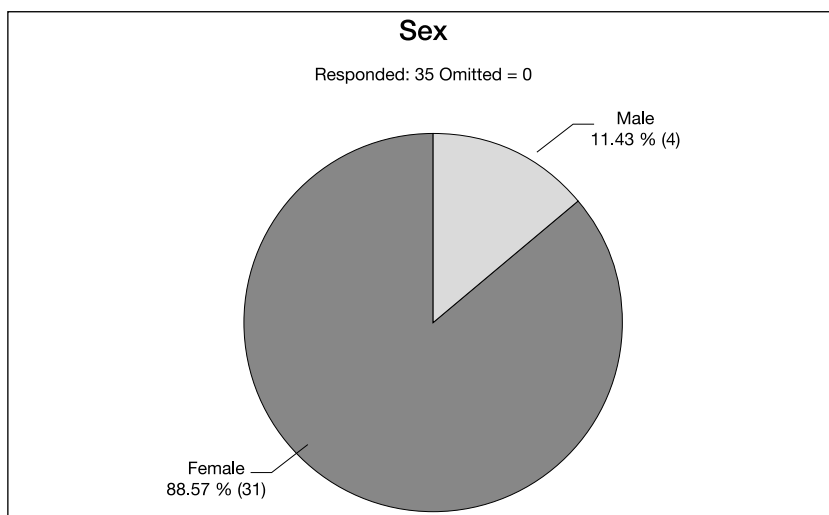
Figure 2. Sex of respondents

Second variable. Educational achievement

Formal training is a crucial part of matching people to jobs and ensuring productivity. It is also an ideal organizational strategy for developing competencies, promoting creativity and increasing their capacity to innovate.[12]

In this light, it is very important that library personnel have both general and specialized training in order to uphold and deliver library processes, not only in terms of development of the collections or new technology, but also with regard to services. As for the library sample under study, most public librarians have educational achievement that falls between secondary and high school, at 31% and 34 %, respectively. (*Figure 3*).

32

12   Hernández Pacheco, *Gestión y desarrollo…,* 187.
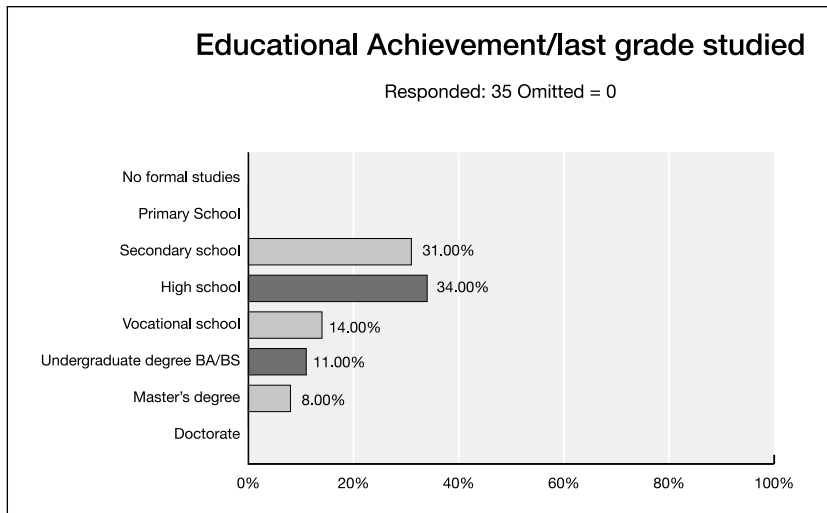
Figure 3. Educational achievement

The *IFLA/UNESCO Directives for the development of public* libraries state that: "librarians shall hold undergraduate or post-graduate degrees in library and information sciences from a library science school."[13] As can be seen, librarians in the sample holding a bachelor's degree comprise only 11%, and those holding a master's degree comprise 8%.

Moreover, most of the employees do not have formal training in library and/or information sciences. Many of these respondents reported holding degrees in Pedagogy, Economy, Nutrition, Law, Business Administration, Accounting and others.

Third variable. Job situation

Or the purposes of this study, the following labor situations of librarians are contemplated:

1. Years on the job
2. Schedule
3. Job training
4. Salary

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13   Gill, *Directrices…*, 58.

Years on the job

The variable of years or time on the job in the public library involves the experience of the employee, and the assumption that more time on the job correlates with higher expertise and better performance.

As can be observed in *Figure 4,* 48.57% of the personnel have five years or less on the job, meaning that nearly half of all library employees of public libraries are relatively new in their positions. This may come about because they have been transferred to the area recently or as a result of a change in the local (municipal, state or delegational) government administration.

How long have you been working in the library?

Responded: 35 Omitted 0

20 to 30 years
14.29 % (5)

5 years or less
48.57 % (17)

10 to 20 years
22.86 % (8)
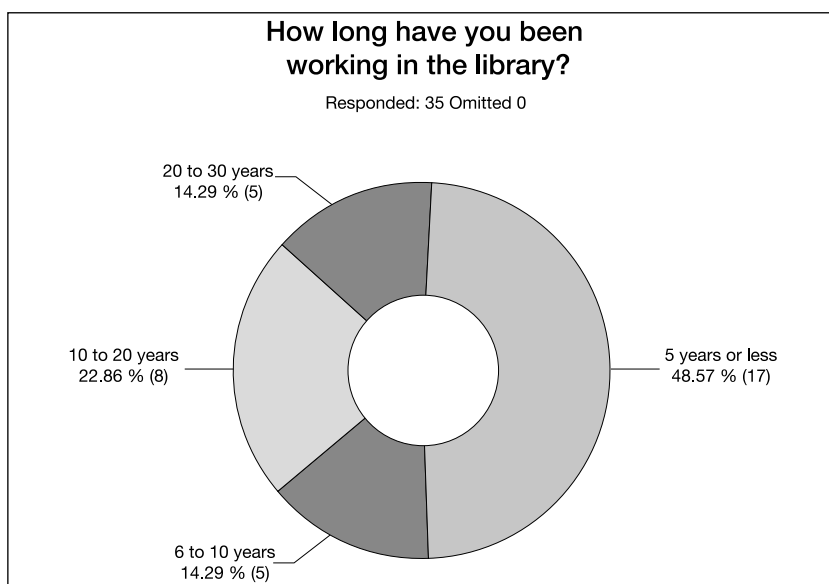
6 to 10 years
14.29 % (5)

Figure 4. Years on the job

Moreover, 22.86% report having from 10 to 20 years on the job, while 14.29% report between 6 and ten years of experience. Those reporting from 6 to 10 and 10 to 20 years on the job were in all cases the head librarians and coordinators of the libraries in the sample. It would seem that longer experience correlates with higher positions.

Work schedule

The UNESCO Manifesto on public libraries states that the proper operation of a library entails offering a broad array of services within a suitable space and a sufficient and appropriate schedule.[14]

The data gathered in this study shows that almost all of the personnel (97%) work from Monday to Friday, while only 3% work on the weekend. (See *Figure 5*). This breakdown stands in opposition to *IFLA/UNESCO Directives for the the development of public libraries,* which state: "in order to provide optimal access to services, the library must offer the most practical schedule for those who live, work and study in the community."[15]
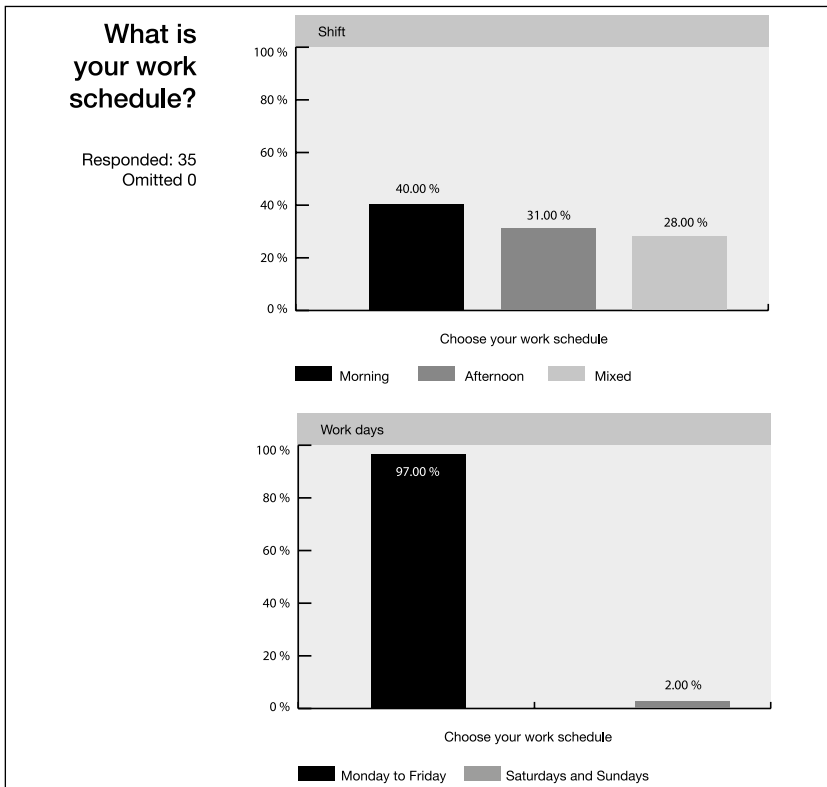
Figure 5. Work schedule

14   Federación Internacional de Asociaciones de Bibliotecarios y Bibliotecas, *Manifiesto…,* 3.
15   Gill, *Directrices…,* 40.

We can see that most libraries are open only during typical work or school hours from Monday to Friday, which excludes are large part of the population who cannot use or enjoy the library services. This is a concern because the public library is not only and information center and complement to school; it is also a recreational center and a place to spend free time. As such, weekend hours should always be made available in public libraries.[16]

In terms of work shift, 40% of the personnel surveyed report working the morning shift, while 31% report working the afternoon shift. Central delegational library coordinators in the Federal District report a lack of personnel to cover these shifts. As such, fully 28% of the personnel surveyed report covering both morning and afternoon shifts.

Job training

According to *IFLA/UNESCO Directives for the development of public libraries*, training is a key part of library activities:

> There must be a planned, ongoing training program in place for all library personnel at all levels, whether they work full or part time. The fast pace of progress in information technology makes the need for periodic training even more urgent. The training programs must emphasize networking and access to alternative sources of information.[17]

Since the librarian serves as an intermediary between the information resources and the user, it is important they receive ongoing training in order to provide proper services.[18] According to the data gathered, however, the situation of training in Mexican public libraries is deficient, with 51% of the personnel reporting having received training on rare occasions (see *Figure 6*).

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16 This proposal entails a series of efforts: expand weekend staff by increasing the budgets allocated to public libraries. This change, however, implies an urgent reformulation of public library policy in our country.
17 Gill, *Directrices…*, 59.
18 Federación Internacional de Asociaciones de Bibliotecarios y Bibliotecas, *Manifiesto…,* 3.

How often to do attend training courses?

Responded: 35 Omitted 0

Monthly	2.00%
3 to 4 time per year	45.00%
Very rarely	51.00%
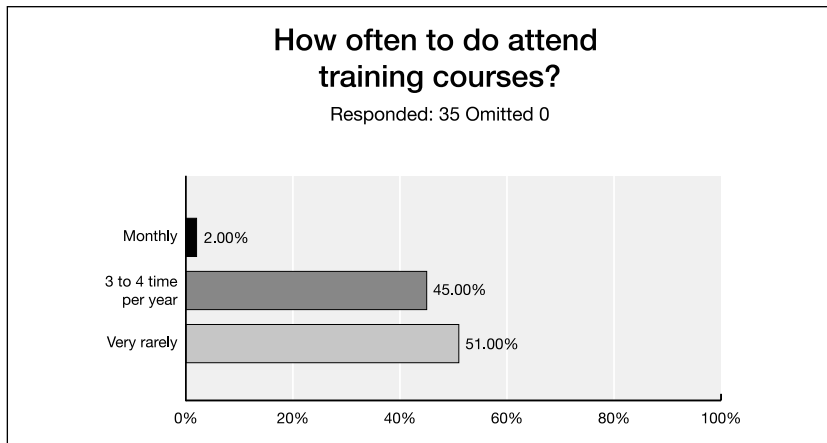
Figure 6. Training received

Nonetheless, nearly half (45%) of those surveyed report receiving training three or four times per year, though these training sessions generally last from three to five days, suggesting the training is somewhat superficial. Moreover, the topics covered are largely library services, reading promotion and operations such as lending. Meanwhile, courses in information technology management, specifically the operation of the Digital Services Modules, are being offered in libraries across the country. The value of training and education is indispensable, because an employee receiving ongoing training will offer broader and higher quality services to the user public.

In our country, only 2% of library employees receive monthly training. Because of the lack of ongoing training, job performance, services and library processes tend to suffer. This in turn leads to dissatisfaction among users who are unable to find the information they need. When this happens they may well resort to other sources of information.

Salary

Salaries earned by the employees of public libraries should be viewed in relation to the other variables addressed. For example, a salary should match the educational achievement of the individual, as well as his or her competencies and abilities. Salary is the determining factor in job performance, because a fair, equitable salary allows the employee to meet their personal needs without taking on other work to make ends meet. Moreover, properly adjusted salaries ensure that employees give their best on the job.

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Workplace conditions are indispensable to job performance of librarians. As such, all public library personnel must work in conditions that are safe, clean and with sufficient space, in addition to earning proper salaries. In this regard Phillip Gill has asserted: "Salaries should be matched to the job performed and should be competitive with those paid for similar jobs in the community."[19]

These matters notwithstanding, *Figure 7* shows that salaries of more than half of the personnel surveyed oscillate between 2,000 and 3,000 pesos per month, while fully a third of those surveyed report salaries above this range.
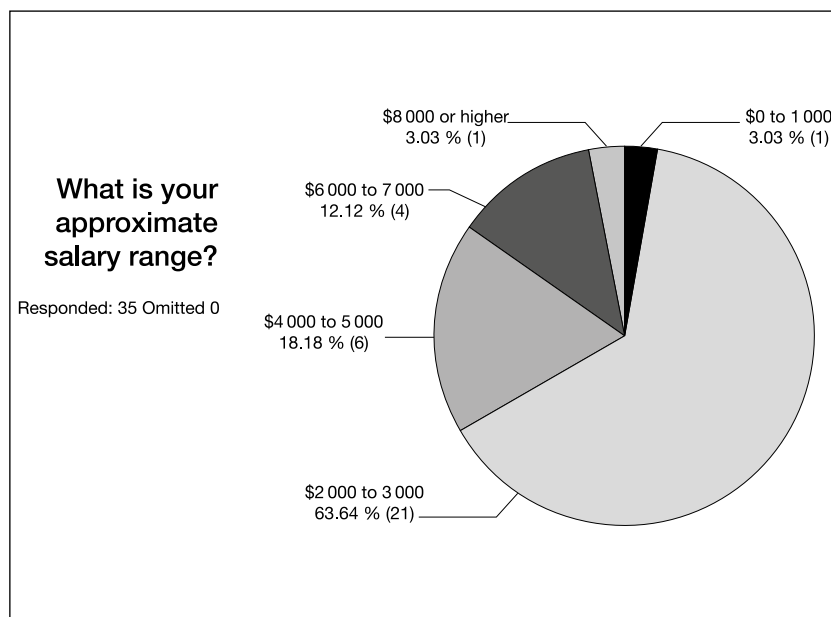
Figure 7. Salary

Furthermore, the study provided a coincident results for job position and the salaries paid. Those working as auxiliaries (the majority) earn salaries in the range of 2000-3000. These employees work in lending and serving the public in the Digital Services Modules. Some of these library auxiliaries hold bachelor's degrees, while others have only finished secondary school. Despite this, they earn practically the same salary. The *General Libraries Act of Mexico* (1988) does not address pay scales or matters of remuneration as

19   Gill, *Directrices…*, 59.

it pertains to the qualifications of personnel. Moreover, salary policy and a pay scale derived from a study of librarian salaries and duties have yet to be developed. Because of this lack of orientation in the area of salaries, many librarians receive inequitable salaries. Salary differentials from region to region is also observed and is exacerbated when there is a change in the local administration which often affects budgets allocated to the library.

Currently, we recommend a remuneration system based on competencies, which entails considering the knowledge, skills, abilities and aptitudes of the personnel and how these relate to the proper operation of the organization. These qualification are the essential components in the operation of the library that must be duly remunerated.[20]

In this sense, the results obtained show the case of a librarian in Durango in the position of auxiliary who holds a bachelor's degree and works both morning and afternoon shifts from Monday to Friday, while earning about 3,000 pesos monthly. In contrast, a librarian heading a municipal public library, who holds a bachelor's degree, diplomas and librarian certification, earns about 7,000 pesos per month for working weekends. In another case, a librarian reporting 20 to 30 years on the job who has technical training works earns less than 2000 pesos per month working in the Digital Services Module.

As can be observed, in terms of salary, a proper appraisal of job positions needs to be performed. This would entail comparative studies and a library policy that stands in line with the demands of the country, the competencies of librarians and the duties they fulfill in public libraries. No doubt, the results provided herein will serve to encourage further research in these matters.

Further research will provide more information on this variable and the degree to which pay is correlated to educational achievement and job duties in public libraries.

Fourth variable. Job skills

As social institutions, public libraries provide services to a community of users that have diverse needs and characteristics. The library personnel must

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20   Hernández Pacheco, *Gestión y desarrollo…,* 170.

have a set of aptitudes and qualities to meet the demands of an ever changing community. The *IFLA/UNESCO Directives for the development of public libraries* include a list of the main qualities and aptitudes required of the personnel working in the public library. These include:[21]

- The ability to communicate positively with people
- The ability to understand the needs of the users
- The ability to cooperate with persons and groups in the community
- Knowledge and understanding of cultural diversity
- Knowledge of the material comprising the library collection and how to gain access to it
- Knowledge of the principles of public service and an ability to adhere to them
- The ability work with others to provide effective library services
- Flexible organizational aptitudes allowing for implementation of changes
- Imagination, vision and openness to new ideas and practices
- The ability to modify work methods in order to respond to new situations
- Knowledge of information and communications technology

On the basis of this list, the following abilities are established:

1. Cooperation and work with the rest of the personnel
2. Positive communication with others
3. Effective attention to the needs of users
4. Knowledge of the library collection
5. Bringing new ideas for the library
6. Use of information technologies

Figure 8 shows that personnel see their abilities positively in all but the last two skill factors.

21   Ibid., 55.
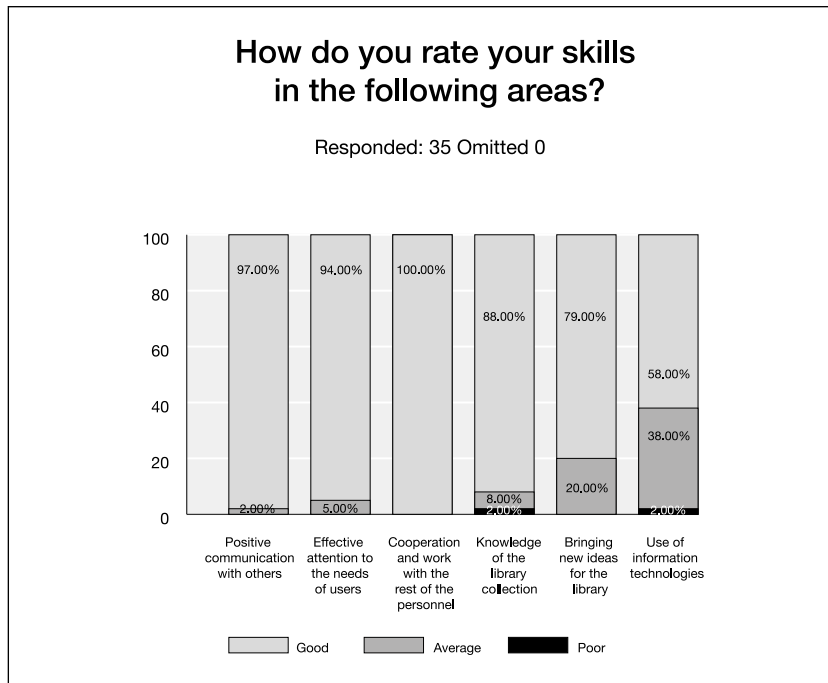
Figure 8. Job skills

Those skills for which 90% respondents gave themselves good ratings are as follows:

- Cooperation and work with the rest of the personnel (good = 100 %).
- Positive communication with others (good = 97 %).
- Effective Attention to the needs of users (good = 94 %).
- Knowledge of the library collection (good = 88 %).

For the skill factor of Bringing new ideas for the library, 20% reported middling ability, while for use of information technology, fully 40% reported having poor skills.

The skill factor is linked to the skill variables of years on the job, educational achievement and age.

The results show that many librarians who consider themselves good across the five skill factors are those with 10 to 20 years on the job. These employees, moreover, report not receiving ongoing training. As such, we can deduce

that they have learned on the job. Additionally, personnel with less than five years on the job, report having less knowledge of the collection and low skills with regard to bringing new ideas to the institution.

With regard to age, results show that librarians over the age of 40 have lower self-ratings for use of information technologies. Furthermore, they report receiving very few training courses, something that ensures the persistence of the technology gap.

We also find that employees between the ages of 20 to 29 are most often assigned to man the Digital Services Modules. This segment also reports the highest self-ratings in the use of information technologies, while also reporting low knowledge of the library collection. The results regarding the skills of the personnel can help fine tune training programs. By knowing just where improvement is needed, formal, skills-focused training programs can be developed and deployed.

Fifth variable. Duties

To study this factor on the basis of the *IFLA/UNESCO Directives for the development of public libraries*,[22] we have used a series of duties considered basic to the operations of public libraries *(Table 2)*. In accord with this list, we have established four groupings of basic activities:

Table 2. Basic duties performed by library personnel

From the list of options, check those you perform most often		
Response options	Response	
Shelving books	85.71%	30
Book loan check out	77.14%	27
Helping users find information they need	88.57%	31
Staff the library computer room	57.14%	20
Cleaning of library installations	74.29%	26
Watch over the security of the installations and the user community	77.14%	27
Watch over and control entry of users to the library	82.86%	29
Manage acquisitions of resources and materials for the library	74.29%	26
Analyze the information needs of the community	62.86%	22
Formulate and implement policies to broaden services	65.71%	23
Plan services for the public	71.43%	25

22   Gill, *Directrices…*, 56.

Administer the library budget	25.71%	9
Administer personnel relations	42.86%	15
Manage relationships with other libraries	45.71%	16
Catalogue and classify library materials	77.14%	27
Label books and other documents	82.86%	29
Book binding	34.29%	12
Make posters and other promotional materials for the library	65.71%	23
Participate in library extension activities (theater works, music, workshops, films, storytelling, etc.)	68.57%	24
Total respondents: 35		

With regard to the duties performed by public library personnel, we found that for the total of 19 proposed in the item, more than 80% of those surveyed reported working in the following activities:

Group A
- Shelving books (= 85.71 %).
- Helping users find information they need (= 88.57 %).
- Watch over and control entry of users to the library (= 82.86 %).
- Label books and other documents (= 82.86 %).

Between 70 % and 79% report six activities:

Group B
- Book loan check out (= 77.14 %).
- Catalogue and classify library materials (77.14 %).
- Cleaning of library installations (=74.29%).
- Watch over the security of the installations and the user community (= 77.14%).
- Manage acquisitions of resources and materials for the library (= 74.29 %)
- Plan services for the public (= 71.43%).

Between 50% and 69% report five other activities:

Group C
- Participate in library extension activities 68.57 %).
- Make posters and other promotional materials for the library (= 65.71 %).
- Formulate and implement policies to broaden services (= 65.71 %).
- Analyze the information needs of the community (= 62.86%).
- Staff the library computer room (= 57.14%).

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The following four activities were reported by less than 50% of the respondents:

Group D
• Manage relationships with other libraries (= 45.71 %).
• Administer personnel relations (= 42.86 %).
• Book binding (= 34.29 %).
• Administer the library budget (= 25.71%).

The majority of respondents perform the activities of group A. These activities are considered basic to the public library. In contrast, the Group B activities are associated with certain processes and services. Thus, for example, some libraries catalogue and classify their materials. The Group C activities are performed in many public libraries and are of increasing importance. The Group D activities are executive in nature or entail specialization, such as book binding. Some of the activities included in Group B may also be considered executive in nature, such as those duties associated with acquisitions and planning services.

Conclusions

This study provides a glimpse of the human resources situation in public libraries in Mexico. It has detected a labor profile that invites further, broad and in-depth research. The study also reveals the following employee profile in our library system:

> An adult librarian with mid-level educational achievement, relatively few years on the job, working a mixed schedule (though slightly more often in the morning shift), who has not received training for the job and earns less than two minimum wages, and who brings four basic library skills to the table, while lacking in information technology skills. This employee performs the duties listed in Group A.

This report is exploratory in nature and not conclusive. As mentioned throughout this paper, the following matters require further examination:

• What ongoing training or education exists, in light of the fact that half of all respondents report having received no training whatsoever?
• What is the salary situation of personnel receiving the lowest salaries? What benefits do they enjoy, and can they live on their salaries?

- Is there is a correlation between salary and educational achievement of library personnel?
- How can the personnel reporting the lowest job skills be helped to raise them? Proposals and new ideas for managing information technologies in libraries.
- How do employees perform their duties in libraries? Specifically, we need to know the competencies they bring to the table.
- How can human resources improvement proposals be implemented in public libraries?

In view of these preliminary results, we believe action is needed to improve the situation. To this end we suggest the following actions:

- Establishment of a data base of the personnel working in Mexican public libraries, containing the factors indicated herein and other factors associated with management and development of human resources.
- Establishment of formulas for selecting and evaluating personnel, and the creation of job profiles that link to the other factors.
- Establishment of a methodology for analyzing and describing job profiles in public libraries for the purpose of ensuring the quality of performance and planning ongoing improvement of services.
- Establishment of a pay scale for the personnel working in public libraries in accord with the minimum wage for each economic zone and other factors such as educational achievement and competencies.
- Development of innovative teaching-learning tools to aid ongoing training and development of competencies of the employees in public libraries
- Development and implementation of survey on labor climate
- Incorporation of strategic planning elements to develop human resources

The efforts to implement these improvements should not ignore that fact

that libraries, as agents of change, have the duty to evaluate their own performance and impact on society. To this end, they must adapt and integrate personnel management and development paradigms proven to be effective in other organizations and institutions around the world.[23]

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23 Hernández Pacheco, *Gestión y desarrollo…,* 294.

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Appendix

Survey applied to personnel of the National Public Library Network

Survey of human resources in the Network of Mexican Public Libraries

1. State the name of the library where you work and other relevant infromation.

   Name of library: _____
   Job or position: _____
   Municipality or Delegation: _____
   State or Region: _____

2. Your age falls into the following range:

   ☐ 17 years-old or less
   ☐ 18-20
   ☐ 21-29
   ☐ 30-39
   ☐ 40-49
   ☐ 50-59
   ☐ 60 o más

3. Sex

   ☐ Male
   ☐ Female

4. Educational achievement / last grade of studies completed:

   ☐ No formal studies   ☐ High School   ☐ Master's Degree
   ☐ Elementary School   ☐ Vocational School   ☐ Doctorate
   ☐ Secondary   ☐ Bachelor's Degree

   For vocational school, bachelor's degree or post-graduate degree, specify the major area of study:
   _____
   _____

5. State your work schedule.

   Select the schedule, shift   Shift   Workdays
   and days you work in the library   [_____ ▼]   [_____ ▼]

6. Approximately, what is your current monthly salary?
   _____
   _____

7. How long have you been working in the library?
   ☐ 5 years or less
   ☐ 6 to 10 years

☐ 10 to 20 years
☐ 20 to 30 years
☐ More than 30 years

8. How often do you attend training courses?

☐ Monthly   ☐ 3 or 4 times per years   ☐ Very rarely

9. To the best of your ability, rate your degree of skill for each of the following skill descriptors:

	Good	Average	Poor
· Positive communication with others	☐	☐	☐
· Effectively attending to the needs of users	☐	☐	☐
· Cooperation and work with the rest of the personnel	☐	☐	☐
· Knowledge of the library collection	☐	☐	☐
· Bringing new ideas for the library	☐	☐	☐
· Use of information technologies	☐	☐	☐

10. From the following list of duties, mark those that you perform most frequently

☐ Shelving books
☐ Book loan check out
☐ Helping users find information they need
☐ Staff the library computer room
☐ Cleaning of library installations
☐ Watch over the security of the installations and the user community
☐ Watch over and control entry of users to the library
☐ Manage acquisitions of resources and materials for the library
☐ Analyze the information needs of the community
☐ Formulate and implement policies to broaden services
☐ Plan services for the public
☐ Administer the library budget
☐ Administer personnel relations
☐ Manage relationships with other libraries
☐ Catalogue and classify library materials
☐ Label books and other documents
☐ Book binding
☐ Make posters and other promotional materials for the library
☐ Participate in library extension activities (theater works, music, workshops, films, sto-
   rytelling, etc.)
Other (Specify.)

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Growth of Literature on Bradford's Law

Rubén Urbizagástegui Alvarado *

Abstract

This paper analyzes the literature produced on Bradford's Law from 1934 to June 2012. The study compiled 936 documents produced by 1,123 authors, working in sixteen languages to communicate the results of their research, with English the leading language, followed by Chinese, Spanish and Portuguese. The study reveals the fifteen most productive authors, all of which work in English in both academic journals and conference settings. This literature is growing exponentially ($R^2 =$ 0.974), at a rate of 5.4% per year and doubling in size every 13.2 years.

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Keywords: Bradford's law; Exponential growth; Bibliometrics; Infometrics; Scientometrics.

Resumen

El crecimiento de la literatura sobre la ley de Bradford
Rubén Urbizagástegui-Alvarado

Se analiza la literatura producida sobre la ley de Brad-ford desde 1934 hasta junio del 2012. Se encontraron 936 documentos producidos por 1 123 autores diferen-tes. Estos autores utilizaron 16 idiomas para comuni-car los resultados de sus investigaciones; el inglés fue el idioma dominante, seguido del chino, español y portugués. Se identificó también a 15 autores como los más productivos, quienes publican sus investigaciones en inglés, en la forma de artículos en revistas académi-cas, y las presentan en congresos del área. Esta litera-tura crece de forma exponencial ($R^2 = 0.974$), a una ta-sa de 5.4 % al año y duplica su tamaño cada 13.2 años.

Palabras clave: Ley de Bradford; Crecimiento de la literatura; Bibliometría; Informetría; Ciencio-me-tría.

Introduction

The term "literature" refers to the subset of documents published on a given topic. Generally these documents are scientific modalities such as journal papers, book chapters, papers read at conferences, pamphlets, monographs, books, academic theses and grey literature, etc. The term can convey diverse levels of granularity; for example, it may refer to a body of general literature, as in the literature on chemistry or of the field of chemis-try; and it can also be employed to specify a narrower range of documents, such as the literature on the greenhouse effect. What is held as knowledge in a given scientific field, however, extends beyond the formal literature; and even though most of this knowledge issues from this literature "we must look at knowledge of any given field as consisting of three layers. First, there is original research carried out by researchers that is subsequently published. Then there are the systematic or conceptual reviews that come in response

to such research, but which do not move beyond the confines of that body of literature. Finally, there are perceptions, conclusions and interpretations made by people in informal conversations that also become part of the tradition of the field" (Kennedy, 2007: 141). The published literature is collected and indexed in specialized bibliographic data bases; but as knowledge grows so does the literature explicating it. Therefore, one must pay close attention to the annual growth rate and rate of duplication.

Bradford's Law was proposed in 1934. Since that time a vast amount of literature has been produced; but, to the best of this author's knowledge, only biographies (Quemel *et al.*, 1980) and literature reviews (Lockett, 1989) have been published that do not attempt any analysis of the growth of literature on this particular bibliometric technique. As such, the purpose of this paper is to analyze the growth of literature on Bradford's Law published since 1934 to June 2012, a span of 79 years, during which time we expect the published literature to expand and grow. This mathematical model in conjunction with others, i.e., Lotka's Law, Zipt's Law, the 80/20 rule, literature growth and obsolescence models, citation analysis, etc., make up the organic structure of the field of Bibliometrics (Urbizagástegui, 2007).

Bradford (1934) hypothesized that most of the papers on a specialized topic are in fact published by a limited subset of specialized journals and some journals existing on the fringes of the topic area and many others with a wider, more general editorial scope. As such, the subset of journals in a given field would act as a family with successive generations of diminishing parentage, in which each succeeding generation is more numerous that the preceding one. The practical application of Bradford's Law provides mechanisms for selecting the periodicals that are not only the most productive, but also most relevant for covering a given area of knowledge. When the literature of a given field is studied through the lens of citations or internal use in libraries and information centers, it also provides mechanisms for discard of seldom used magazines and books, and for assigning low demand bibliographic materials to regional storage and depositories. The growth of this literature is the focus of this paper. The research questions to answer are as follows: What kinds of documents are published in this topic area? Who are the most productive authors writing on Bradford's Law? What types of documents do these authors produce and in what languages? Is this topic area still in a growth phase or has it reached its saturation point? If it is still growing, what is its duplication rate?

To achieve the proposed objective, this paper is organized in six sections. The first section presents an introduction to the topic, detailing the problem and posing the research questions. The second section provides the theoretical framework of studies of literature growth. The third section describes the methodology used to apply the chosen growth model, emphasizing how data is collected and measured. The fourth section reports results, and the fifth section offers conclusions and further discussion. |The sixth and final section contains the bibliography.

Theoretical framework

The foundation of knowledge in any scientific field is contained in its published literature. As such, the quantitative measure of its volume constitutes the size and structure of this literature, since any new information and contribution springs forth from earlier publications (Braun, Schubert and Kostoff, 2000). For this reason, one of the most obvious features of scientific practice has always been the growth of the published scientific literature. This literature presents new problems, new methods for approaching research problems, novel points of view or applications in diverse lines of research or knowledge sub-fields.

The growth of literature is expressed in terms of an estimated average rate, using statistical models to analyze data gathered chronologically as per year of publication. Early examinations of this area focused only on the form of growth, but did not provide estimations of growth rate. For example, Houzeau and Lancaster (1880, cited by Jaschek, 1989: 164) compiled the total number of papers written on astronomy over a period of 170 years, showing that this literature grew exponentially. Tamiya (1931) studied literature on aspergillus fungi, showing that it grew logistically. Wilson and Fred (1935) studied literature on nitrogen fixation in plants and verified that this literature grew along a logistical curve. For Crane (1944) literature in the field of chemistry grew exponentially, and the same was found to be true in the field of biochemistry by Schwartz and Powers (1963).

These early studies attained methodological consistency only after 1951, when Price (1951) launched a series of studies on the growth of science as gauged by published scientific literature. This author held that: "the number of scientific papers published each year can serve as an approximate indicator of the activity deployed in any general or specialized field of research"

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(Price, 1951: 86). He performed a statistical analysis of the *Physics Abstracts,* which cover a broad range of the general field of physics; and the theory of determinants and matrices, a specialized field of mathematics, showing that in normal times a general field such as physics exhibits nearly perfect exponential growth; while a highly specialized field such as matrices and determinants exhibits exponential growth only to a certain point, after which growth patterns become linear. The literature in both cases doubled every 10 or 11 years.

At a later time, Price (1956) asserted that a yearly count of the number of abstracts in *Physical Abstracts* and *Chemical Abstracts* would provide a gauge of the number of articles published in these fields over a given period. These data serve to posit three important conclusions: 1) almost all growth curves exhibit the same tendency; 2) growth is exponential, and 3) the constant of the exponential curve is capable of doubling in size every 10 to 15 years. It would seem that the exponential law governs the size of science. Moreover, "data sets that go back as far as the year 1700 or earlier clearly show that the 'size' of science has been growing in this way over the entire period of the scientific revolution and the age of Newton" (Price, 1956: 518). Conrad (1957) studied the growth of literature in the field of biology by examining the *Biological Abstracts*, finding the literature in this field exhibits exponential growth. In this way he projected the 348,000 papers in this field by the year 2010. Strong and Benfey (1960) performed a study of the growth of literature in the field of chemistry, examining *Chemical Abstracts* and the Beilstein *Handbuch der Organischen Chemie,* showing that this literature doubles approximately every 13 years.

In 1963, Price published a paper on the growth of literature in the field of Physics using a count of the abstracts in *Physical Abstracts* from 1900 to 1950. Price proved that the literature in the field of physics grows exponentially, doubling every 12 years. May (1966) studied the growth of mathematics literature on the basis of the *Jahrbuch über die Fortschritte der Mathematik* from 1868 to 1940, and the *Mathematical Reviews* from 1941 to 1965. This study showed that the number of published papers grew from 800 to 13,000, with a mean growth of 2.5% per year and doubling period of about 28 years and quadrupling approximately every one-hundred years. Stoddart (1967) studied the growth of the number of journals and associations in the field of geography, finding an exponential growth rate for journals and a doubling period of 30 years. He also found that associations also grow exponentially, doubling every 22 years.

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Menard (1971) studied the literature of several sub-fields of geology, finding that the literature on vertebrate paleontology grew slowly until the end of the eighteenth century and thereafter began to grow exponentially at a doubling time of 15 years. Brookes (1973) asserted that in light of the number of articles published each year, the literature produced in most scientific fields tends to exhibit exponential growth, doubling every 10 years. After these times, it is commonly held that "in the field of science, contributions accumulate like successive rows of bricks in a wall. Each researchers adds his brick to the wall in an orderly way that at least in theory, shall remain in place as an intellectual edifice built from abilities and artifices standing upon foundational ideas and extending upwards to the edge of research knowledge" (Price, 1975: 162). To exemplify this, Price states that "[...] the number of journals has grown exponentially rather than linearly. Instead of there being an exact number of new journals each year, the number doubles over the period of several years. This doubling time is a constant of about 15 years, which is a power of 10 in 50 years and factor of one thousand over a century and a half" (Price, 1975: 169). According to Price (1975: 169), this "exponential law is the mathematical consequence of having an amount that increases in such a way that the larger the number the faster the rate of growth"; so much so that the "exponential growth law found for the number of scientific journals is also obeyed by the real number of scientific papers in those journals" (Price, 1975: 170).

Price illustrates the study of the growth of publications, and insists that "it is remarkable that since 1918 to date the total number of papers in the field of physics recorded in abstracts [...] has accurately followed an exponential growth curve without variance of more than 1% of the total. There are now nearly 180,000 papers recorded in *Physics Abstracts,* and the number has doubled at a rate even faster than every fifteen years" (Price, 1975: 171). In view of this type of growth, one can clearly discern the following phases: first there are the precursors; then constant exponential growth, followed by a decline to linear growth, when no new labor force enters the field. Finally, we observe the collapse of the field, a when few papers are produced, or alternatively a rebirth when the field's contents and operational modalities are redefined" (Price, 1975: 173).

Following up on the work of Price (1951, 1956, 1963, 1975), there have been many studies of the literature of diverse areas of knowledge. For example, Hall (1989) found that the literature of the field of geology doubled every eight years, but between 1945 and 1970 it had doubled every six years. Ur-

bizagástegui and Lane-Urbizagástegui (2008) studied the literature on medicinal plants of Peru, finding that this body of literature grew exponentially, with a yearly growth rate of 6.5%, doubling every 11.3 years. Urbizagástegui (2009) studied the growth of literature on Lotka's Law and found that it has an annual growth rate of 7.5% per year, doubling every 9.6 years. Biglu (2009) studied the relationship between patents and scientific publications in the field of medicine on the basis of the *Medline* index. All of the publication indexed with the term "patents" in *Medline* between 1965 and 2005 were extracted and analyzed. The study shows exponential growth of the literature at an annual growth rate of 3.1% and doubling time of 22.5 years. Urbizagástegui and Lane-Urbizagástegui (2007) again analyzed the literature on plant dyes and found that it grew at an annual rate of 3.4%, doubling in a period of 20.7 years. Finally, Restrepo (2011) studied the literature produced by historians working in the Colegio de México, showing this output obeys an exponential growth pattern, with an annual growth rate of 7.1% and doubling time of 10.1 years.

Materials and methods

The data examined consists of each paper published in academic journals, chapters of books and papers read at conferences that address Bradford's Law or which employ this model in the analysis of any discipline or sub-field. Books, thesis, monographs and gray literature are not included in the data set, since such literature is not indexed in the bibliographic data bases used in this research. The period of the data set is 1934 to June of 2012. To collect the data, the following search terms were used: "Bradford's law", "Bradford's distribution", "Bradford Scattering law", "Bradford type distribution", "Bradford analysis", "Bradford curve", "Bradford zones" and "Bradford core journals". These terms were entered using diverse idiomatic forms in English, French, German, Portuguese and Spanish, etc. The terms were entered into the search engines for titles, descriptors and abstracts of the following bibliographic data bases: *Library Literature & Information Science Full Text, Library and Information Science Abstract (LISA), Library, Information Science & Technology Abstracts (LISTA), Agrícola, Biosis, CAB Abstracts, Medline, Anthropological Literature, Anthropological Index, Anthropology Plus, WorldCat, HAPI, ArticleFirst, Science Citation Expanded Index, Web of Science, Scopus, Elsevier, JSTOR* and another 120 data bases available in the University of California, Riverside, including the Spanish-language data bases *ISOC, ICYT* and *Dialnet*. The research also included searches of Latin American data bases

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such *INFOBILA* in Mexico and *LICI* of the Instituto Brasileiro de Informação em Ciência e Tecnologia (IBICT); Chinese data bases such as *China Academic Journals* via EastView Online Services, and Japanese data bases via: Citation Information by National Institute of Informatics (CiNii), Japanese Scholarly & Academic Information; the *Russian Academy of Sciences Bibliographies*, as well as German and Arabic bibliographic sources. Researchers also made visits to repositories such as Scielo Brasil, Scielo México, Scielo Venezuela, Scielo Colombia, Scielo Chile, Scielo Argentina and Scielo Bolivia, among others.

The citations identified were loaded to EndNote X5 in order to create a data base specific to this matter. Thereafter, researchers read the details of each of the documents identified in the search, paying special attention to each citation found. Any reference to Bradford's Law was run against the data base and, if not already identified, duly included. Duplicate citations were eliminated, so that each citation appeared only once. This close reading served to produce a bibliography of 936 citations produced between 1934 and June 2012, which include papers published in journals, book chapters, papers read at conferences and other venues. This body of work constitutes the universe under study. The period covered by the data gathered is sufficiently long to expect a growth pattern to be discernible.

It should be noted, however, that without knowing the shape of literature growth point cloud it is difficult to present a measure of the data collected. It is impossible to assert beforehand whether this literature will exhibit linear or exponential growth or by power law or as per a Gompertz curve, etc. Nonetheless, researchers expect to find exponential growth, because it is the most common pattern found in studies of literature production over long periods. Exponential growth represents an increase in the population in a fixed proportion within each unit of time. It is expressed in percentages, with a constant rate of growth and unlimited ceiling. The model not only provides a mean growth rate, but also a doubling time. Generally, exponential curves first exhibit a concave shape. The function is represented mathematically as follows:

$$C(t) = CO \, ea^t$$

In accord with Egghe and Ravichandra Rao (1992), the function can be written as follows:

$C(t) = c\,g^t$

Where,

$c > 0,\ g > 1,\ y\ t \geq 0.$

The study of the growth of literature entails a postulation of the relationship between time measured in years (the independent variable) and the accrued volume of the literature measured in units produced (the dependent variable). This bivariate relationship, it is assumed, can be modeled statistically. To assess the model's fit, a dispersion cloud is plotted on the basis of the observed data. This allows one to discern whether there is any regularity in the frequency distribution observed. When this regularity matches up with curve shown in the graph, one attempts to adjust the curve to the point cloud through nonlinear regression. In an exponential growth distribution, one attempts to show that the accrued production volume of documents in accord with the years t arises from an exponential distribution, i.e., the probability of a frequency in the sample being equally probable for all frequencies in the same situation.

The calculation of the parameters of the exponential distribution was performed by determining the nonlinear regression using the SPSS 17.0 statistical package for Windows. Since a high correlation between the dependent and independent variables is expected, this correlation was examined with a determination correlation (R^2) and significance level of 0.01.

Results

Nine-hundred and thirty six papers by 1,123 different authors were found. *Table 1* shows the number of documents published on Bradford's Law since 1934, when Bradford first proposed his theory, to 2012. The volume of documents was grouped by decades.

Table 1. Numbers of papers published by decade

Decade	Papers published	Percentage
2003-2012	333	35.58
1993-2002	190	20.30
1983-1992	174	18.59

1973-1982	174	18.59
1963-1972	54	5.77
1953-1962	5	0.53
1943-1952	4	0.43
1934-1942	2	0.21
Total	936	100.0

The literature published on Bradford's Law has growth steadily decade by decade, moving from 0.2% of the total in the first decade under study (1934-1942) to 19% in the fifth decade (1973-1982), and on to 36% of the total in the last decade (2003-2012). The range of distribution moves from one paper at the lowest end to 52 publications at the highest. The mean number of papers published is 11.85 ± 12 papers per year, with a standard deviation of 1.4 papers. The median is 13 papers with a variance of 155.6 documents published and standard deviation of 12.5 papers.

Figure 1 is a bar graph showing this growth by decade. After the decade of 1934-1942, the literature published grows gradually until it reaches its maximum volume in the decade of 2003-2012. The growth gradient is easily apparent at first glance and does not require further emphasis. The years expressed in decades span from the next consecutive year to the next year shown in the graph. For example, 1972 means the decade spans from 1963 to 1972.

The 1,123 authors writing on Bradford's Law identified in this study published in 16 languages. *Table 2* shows that publications in English constituted 65% of the output, with 35% of the output coming in other languages. Papers published in Chinese comprised 12% of the output, followed by those in Spanish at 9.0%, Portuguese at 6.0% and Russian with 2.0%. Japanese- and German-language papers each accounted for 1.0%, while French- and Arabic-language publication came in a 0.8% and 0.6%, respectfully. The remainder of the output was comprised of papers in Turkish (0.4%), Danish (0.3%), Slovene (0.3%) and Czech and Italian each with 0.1% of the total output under study. This is not a surprising finding, since Price (1971) estimated that fully half of all scientific and philosophical output in the world is published in English.
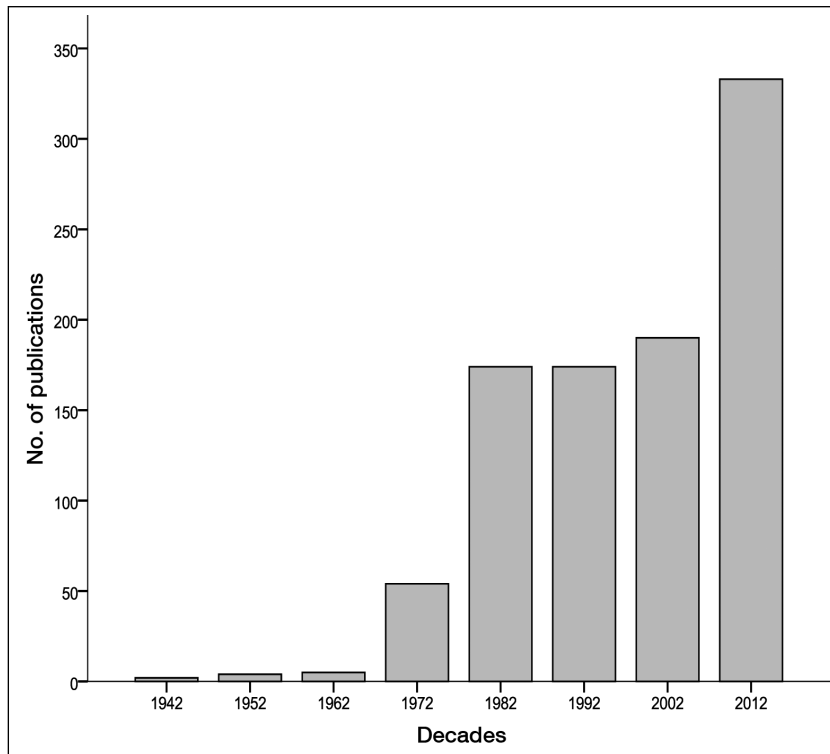
Figure 1. Volume of publication by decade

Table 2. Types of documents publish by language

Language	Book chapters	Journal papers	Papers read in conferences	Online articles	Reports	Letter to the editor	Total
German	-	8	1	-	-	-	9
Arabic	-	6	-	-	-	-	6
Czech	-	1	-	-	-	-	1
Chinese	-	116	-	-	-	-	116
Danish	1	2	-	-	-	-	3
Slovene	1	1	1	-	-	-	3
Spanish	1	70	11	1	-	-	83
French	2	6	-	-	-	-	8
Hungarian	-	2	-	-	-	-	2
English	15	514	61	1	2	18	611
Italian	-	1	-	-	-	-	1
Japanese	-	11	-	-	-	-	11

Portuguese	-	42	11	-	-	-	53
Rumanian	-	6	-	-	-	-	6
Russian	-	19	-	-	-	-	19
Turkish	-	4	-	-	-	-	4
Total	20	809	85	2	2	18	936

The most prevalent form of publication is the journal article comprising 86% of the output total across all languages. This is followed by papers read at conferences at 9.0% and book chapters at 2.0%. These three modalities represent 98% of the total output under study up to 2012. All types of works are published in English, with 84% all English-language publications in this modality, while papers read at conferences comprise 10%, and book chapters 2.5%. Spanish- and Portuguese-language publications follow a similar pattern. For all other languages the prevalent modality of publication is the journal article. Interestingly, the universe of publications contains letters to the editor only in English.

Table 3 shows the most productive authors by language of publication. Most of these authors publish in English. Of the 15 most productive authors, Ming-Yueh Tsay also publishes in his native Chinese. The Spanish researcher Francisco López Muñoz also publishes in English, most likely in the interest of gaining a broader readership (Miranda, 1982, 1998). Yasar Tonta of Turkey prefers to publish in English as does the German researcher Philipp Mayr. Resisting the English language bias in science and technology, Urbizagástegui, publishes in Portuguese and Spanish. Most of these authors publish papers in journals and present research results in specialized conferences and congresses.

Table 3. Most productive authors by language

Authors	Language							
	English	Chinese	French	Spanish	Portuguese	Turkish	German	Total
Brookes, Bertram C.	26	-	-	-	-	-	-	26
Tsay, Ming-Yueh	8	5	-	-	-	-	-	13
Urbizagástegui, Rubén	-	-	-	6	6	-	-	12
Rousseau, Ronald	12	-	-	-	-	-	-	12
Egghe, Leo	11	-	1	-	-	-	-	12
Leimkuhler, F. F.	8	-	-	-	-	-	-	8
López Muñóz, Francisco	5	-	-	2	-	-	-	7
Oluic-Vukovic, Vesna	7	-	-	-	-	-	-	7

Bradford, Samuel C.	6	-	-	-	-	-	-	6
Wilson, Concepcion S.	6	-	-	-	-	-	-	6
Bookstein, Abraham	6	-	-	-	-	-	-	6
Sen, Subir K.	6	-	-	-	-	-	-	6
Tonta, Yasar	5	-	-	-	-	1	-	6
Patra, Swapan Kumar	6	-	-	-	-	-	-	6
Mayr, Philipp	5	-	-	-	-	-	1	6
Total	117	5	1	8	6	1	1	139

One author alone (Brookes) sent six letters to the editor of several academic journals in which he addressed aspects of Bradford's Law. Brookes was a great advocate of Bibliometrics and especially Bradford's Law, publishing 20 academic papers in journals on the subject as well as lecturing in congresses (see *Table 4*).

Table 4. Types of publications of the most productive authors

Author	Journal paper	Presentation in congress	Book chapter	Letters to the editor	Total
Brookes, Bertram C.	20	1	-	5	26
Tsay, Ming-Yueh	13	-	-	-	13
Urbizagástegui, Rubén	10	2	-	-	12
Rousseau, Ronald	12	-	-	-	12
Egghe, Leo	10	1	1	-	12
Leimkuhler, Ferdinand F.	8	-	-	-	8
López Muñóz, Francisco	6	-	1	-	7
Oluic-Vukovic, Vesna	6	-	1	-	7
Bradford, Samuel Clement	2	3	1	-	6
Wilson, Concepcion S.	4	1	1	-	6
Bookstein, Abraham	5	1	-	-	6
Sen, Subir K.	6	-	-	-	6
Tonta, Yasar	4	2	-	-	6
Patra, Swapan Kumar	6	-	-	-	6
Mayr, Philipp	5	1	-	-	6
Total	117	12	5	5	139

Figure 2 shows the shape of the growth of literature on Bradford's Law. Initially the curve is concave, with the point cloud increasing steadily until 2012, though there are minor oscillations between 1979-1980 and 1985-2008. One can observe that publications on Bradford's Law up are quite flat to 1968 after which steady growth begins.
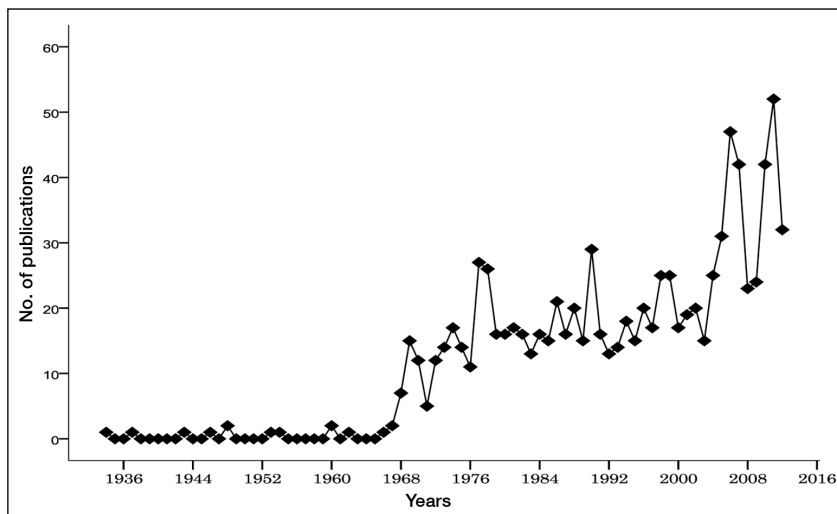
Figure 2. Growth of literature per year from 1934 to 2012.

Bradford's model of dispersion of papers in academic journals postulated in 1934 and presented in the 14th ASLIB conference in 1937 was a unique approach to the subject. He also published articles in the *Proceedings of the British Society for International Bibliography* (Bradford, 1943, 1946) with only modest impact. In 1948 he includes the Chapter "Documentary Chaos" in his book *Documentation* (Bradford, 1948). Shortly thereafter, Vickery (1948) publishes an article that is critical of Bradford's mathematical approach. Five years later, Stevens (1953) publishes and paper citing Vickery (1948) and Bradford (1948) in which he explains the features of dispersion of specialized literature. In the early 1960s, three references to Bradford appear, i.e., Fourmont and Kervégant (1960), Kendall (1960) and Cole (1962). Every year from 1966 and until 2012 an average of 12 papers per year employing the strategies proposed by Bradford (1934, 1948) were found in the sample under study. It is important to remember that 1961 saw the publication of *Science Since Babylon* (Price, 1961) and in 1963 *Little Science, Big Science* (Price, 1963) was published. These works called attention to the possibilities opened up by analyzing the literature published in the field of science, while establishing the foundations of Bibliometrics and the systematic study of the sciences. Both books comment on the growth of literature and the universe of scientists, especially in the fields of physics and chemistry. At the end of the decade, Pritchard (1969) coins the terms "bibliometrics." From that moment on, bibliometrics is considered a discipline within Information Science, and the literature addressing the subject begins to grow constantly. In this way, Bradford's Law

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becomes a key element in the practice of bibliometrics. *Figure 3* shows the distribution of the data by year.
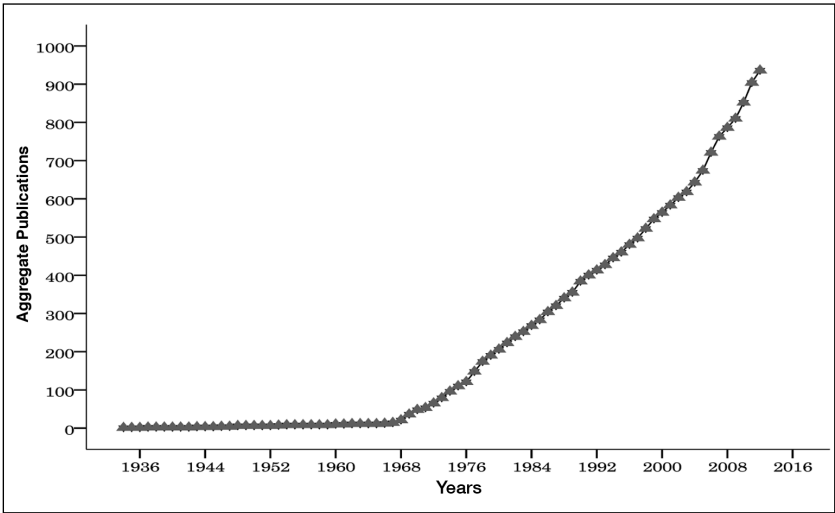
Figure 3. Growth of literature on Bradford's Law, 1934-2012

These cumulative data were used to estimate the growth and doubling rate of the literature on Bradford's Law. This body of literature stayed stable until 1968, after which its growth accelerated, tracing a nearly straight line of growth until 2012. The shape of the dispersion cloud makes it evident that we are observing exponential growth. The nearly straight line indicates that it is continuing to grow and the saturation point is still in the offing. As Price (1975) asserts, a literature may be linear, then become exponential until it reaches a saturation point with a logistical form. This does not appear to be the case for the literature on Bradford's Law, which over the course of 79 years is still growing. *Table 5* shows the parameters and values obtained from applying the exponential model using the non-linear regression model.

Table 5. Parameters and values obtained with exponential model

Parameters	Estimated value	Standard deviation	Confidence interval of 95 %	
			Lower limit	Upper limit
c	16.835	1.704	13.354	20.316
g	1.054	1.002	1.051	1.057

The value of c came to 16.835, and the value of g was 1.054. Using these known values in the following equation allows one to predict the exponential growth of the literature published on Branford's Law:

$$C(t) = 16.835 \times 1.054^t$$

The equation demonstrates that the literature on Bradford's Law since 1934 has grown at a rate of 5.4% annually and its volume doubles every 13.2 years. A graph of these values and the estimated data is provided in *Figure 4.* It is important to note the proximity of the observed values and the estimate data using the non-linear regression method, where R^2 came to 0.974, indicating there is only a 2.6% probability of error in the estimate of the projected values.
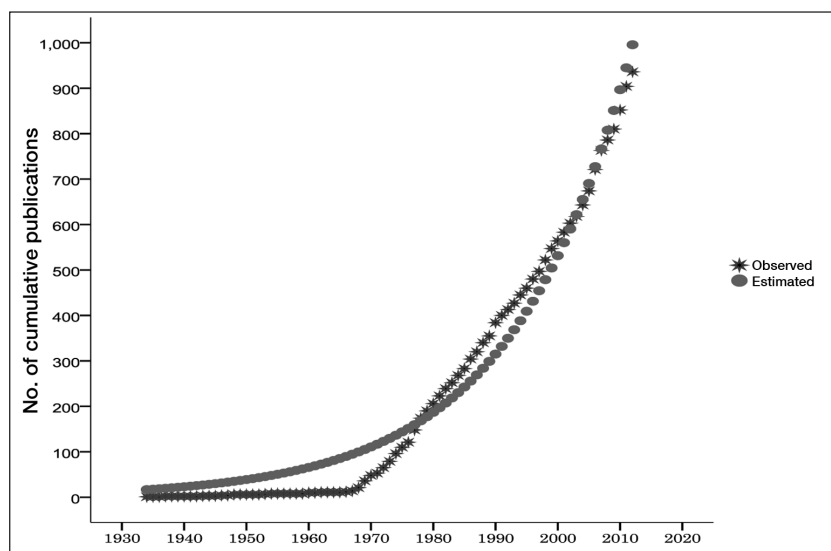
Figure 4. Graph of observed and estimated values

Discussion and conclusions

The study of the growth of a body a literature is important because it makes claims on the several kinds of spaces in libraries, i.e., shelves, computer memory, etc. Space is synonymous, of course, with financial resources, overhead and capital investment. The growth of literature also has sociological implications regarding matters of access to information (Egghe, 1994). The study

of such matters is also important because it serves to make projections. "A simple way to compare diverse exponential growth rates is to look at doubling times" (Braun, Lyon and Bujdosó, 1977: 682A) and annual growth rates. It is also common to find "the growth of an exponential function described in terms of the doubling period, the annual growth rate or the exponential index" (Gilbert and Woolgar, 1974: 280).

Over the period under study, we observed that the growth of the body of literature on Bradford's Law fits an exponential growth model, with an annual growth rate of 5.4% and doubling period of 13.2 years. This annual growth rate is very near to the 5.5% observed by Holt and Schrank (1968) in the field of economy and the 6.5% rate observed by Urbizagástegui and Lane-Urbizagástegui (2008) in the field of medicinal plants in Peru. The doubling period of this literature was slightly more than the 10-year period observed by Brookes (1973) for the general body of science literature and somewhat below the 15 year doubling period observed by Menard (1971) in the field of geology. Moreover it falls within the range of 11 to 15 years found by Price (1951, 1956) for physics and chemistry.

These results contradict Egghe and Ravichandra Rao (1992), who asserted that the doubling time in social sciences is less than that of pure and applied sciences. If this were the case, bibliometrics, specifically the Branford's Law sub-discipline, would be much closer to the bibliometrics of pure and applied sciences than to bibliometrics of social sciences and humanities. It would seems that the growth rate of a body of literature is not a function of the field, whether pure or social science, but rather a function of the intensity of research and number of researchers working in a given field. Where there are more researchers, there is a greater propensity for a larger volume of literature. The converse is also true. If a given field of research has 10,000 researchers and each one publishes one paper per year, this means 10,000 papers are added to the body of literature every year. On the other hand, if a field has only 100 researcher publishing one paper per year, only 100 papers are accrued to the body of literature. As such, the duplication period achieved by 10,000 researchers shall be much shorter than that attained by the 100 researchers in the other hypothetical field. This comportment has been observed by Menard (1971) in the field of geology, where he found that the several sub-disciplines of geology grew at different rates, and that the best growth predictors were achieved when the relations between these sub-disciplines were closely observed.

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This research found 1,123 authors writing in sixteen languages. Fully 65% of the research was published in English, with the balance of 35% coming in other languages, confirming that English is the preferred language in the field of bibliometrics. It is important to keep in mind that: "the English language can slant the direction of social sciences in the same way the front page of a newspaper skews the news. Slanting in this sense can take the form of emphasizing some topics to the detriment of others" (Ortiz, 2009). The study also identifies the 15 most productive authors in the field of Bradford's Law, most of which publish only in English.

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�

Do fixed citation windows affect the impact maturation rates of scientific journals?

María Isabel Dorta González *
Pablo Dorta González **

Abstract

Scientific fields employ distinct citation practices. As such, bibliometric indicators based on citations need to be standardized to allow comparisons between fields. This paper examines more than six hundred journals in eight *JCR* categories. Results indicate that impact maturation rates vary considerably from one category to another. The time elapsed until the citation distribution reaches a maximum oscillates between two and five years; hence the opening and closing of the citation window is crucial to the impact factor. Some journals are penalized by the two-year impact factor and benefited by the five-year impact

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factor, and the reverse situation was also found. None-theless, there are impact factors of variable citation windows that produce closer measures of central tendency.

Keywords: Journals Assessment; Bibliometric Indicator; Citations Analysis; Journal Impact Factor; Citation Window; Impact Maturity Time.

Resumen

¿Se ajustan las ventanas fijas de citación a las velocidades de maduración del impacto de las revistas científicas?
María Isabel Dorta-González y *Pablo Dorta-González*

Los distintos campos científicos presentan prácticas de citación diferentes. Por ello, los indicadores bibliométricos basados en citas necesitan ser normalizados para permitir comparaciones entre campos. En este trabajo se analizan más de 600 revistas de ocho categorías *JCR*. Los resultados obtenidos indican que la velocidad de maduración del impacto varía considerablemente de una categoría a otra. El tiempo transcurrido hasta que la distribución de citas alcanza su máximo oscila entre 2 y 5 años, de ahí que el comienzo y finalización de la ventana de citación tengan un efecto determinante sobre el factor de impacto. Algunas revistas son penalizadas por el factor de impacto a 2 años y favorecidas por el de 5 años, y viceversa. Sin embargo, existen factores de impacto con ventanas variables de citación que producen, en términos generales, medidas de tendencia central más próximas.

Palabras clave: Evaluación de revistas; Indicador bibliométrico; Análisis de citas; Factor de impacto de revistas; Ventana de citación; Tiempo de maduración del impacto.

Introduction

For several decades now the field of bibliometrics has accepted the impact factor (IF) as a valid indicator for evaluation of journals. In recent times,

however, more and more arguments against the use of IF as the sole criterion for making comparisons have been proffered (Waltman and Van Eck, 2013).

The two-year impact factor released by Thomson Reuters in *Journal Citation Reports* (*JCR*) is the average number of citations of each journal in the current year with regard to the citable items published in a journal in the two previous years. (Garfield, 1972). Since its formulation, IF has been subject to some criticism with regard to arbitrariness, such as in the definition of "citable items" and the focus on a two-year window, to name just two (Bensman, 2007; Moed *et al.,* 2012). These criticisms have led to several adjustments to how IF is calculated (Althouse *et al.,* 2009; Bornmann and Daniel, 2008). In 2007, Thomson Reuters incorporated three indicators that employ a five-year citation window. These indicators are as follows: the five-year IF itself, the *eigenfactor score* and the *article influence score* (Bergstrom, 2007). These additions notwithstanding, there are no significant differences between the ranking of journals using the two-year and five-year approaches (Leydesdorff, 2009), even while in many instances those using the five-year window attain higher impacts than those using the two-year modality (Rousseau, 2009).

These indicators are useful for comparing the impacts of journals in the same field; however, they are not as useful for making comparisons between fields. This problem arises from the institutional evaluation, since scientists in research centers have diverse educational antecedents (Leydesdorff and Bornmann, 2011; Van Raan *et al.,* 2010; Wagner *et al.,* 2011). Before comparing journals, these diverse publication and citation habits require standardization of bibliometric indicators based on citations.

There are statistical patterns that can provide IF standardization. Garfield (1979) proposes the term "citation potential," based on the average number of citations in order to adjust the systemic differences existing between scientific fields. For example, in the biomedical field, lists of fifty or more citations is quite common, while in mathematics less than twenty citations are most common (Dorta-González and Dorta-González, 2013a). These differences are owing to distinct citation cultures that significantly affect the IF by conditioning the likelihood of citation. The citation average has been used frequently in the literature to adjust differences existing between fields (Leydesdorff and Bornmann, 2011; Moed, 2010; Zitt and Small, 2008). The average number of citations is not among the variables that can fully explain IF variance (Dorta-González and Dorta-González, 2014). As such, the standardization process should take into account other sources of this variance,

such as growth of the field, the citation to *JCR* journal ratio, the *JCR* citation to citation window ratio and the citing-document to cited documents ratio. Because of the significant differences in citation practices from field to field, bibliometric indicators must be developed to allow meaningful comparisons between fields (Waltman and Van Eck, 2013).

Traditionally, the standardization of the differences existing between fields has been based on some sort of journal classification system. This approach places each journal into one or more groups, and its IF is calculated against that of the other publications in the group. Most efforts to classify journals focus on correlation between citation patterns, such as the *JCR* journal categories. In this case, for example, Egghe and Rousseau (2002) propose the *aggregate impact factor* that treats all of the journals within a category as a single meta-journal. The field to which many journals belong, however, is often difficult to determine with any precision; and some journals are assigned to two or more categories. Moreover, the defining the boundaries of scientific fields and specializations is a persistent bugbear for bibliometrics, since these borders are quite porous and often shift over time. As such, the use of fixed categories to classify a dynamic system can lead to errors, because such a classification relies on historical data, while science unfolds dynamically (Leydesdorff, 2012: 359).

A recent alternative proposal would standardize on the basis of source rather than on field. In this approach, standardization is a function of the citing journals. The quality of a journal is a complex, multidimensional concept that is difficult to state in a single indicator (Moed *et al.,* 2012*:* 368). Because of this difficulty, many indicators have been put forth, such as the fractional recount impact factor (Leydesdorff and Bornmann, 2011), the audience factor (Zitt and Small, 2008), the source standardized impact factor (Moed, 2010), the topic standardized impact factor (Dorta-González *et al.,* 2014), the Scimago group's SJR (González-Pereira, Guerrero-Bote and Moya-Anegón, 2009) and the central area index (Egghe, 2013; Dorta-González and Dorta-González, 2010, 2011), to name a few. While these indicators have their uses, none of them can genuinely reflect the differences against impact maturation times.

As previously mentioned, bibliometrics literature has examined these matters using IF with fixed citation windows of between two to five years. To the best of our knowledge, there have been no studies published that analyze indicators on the basis of year of start and year of conclusion of these citation windows. This paper shall examine hoe IF is affected by year of start

and year of end of the citation windows. For this purpose, the impact factors of the fixed, two- and five-year windows shall be contrasted to others using variable windows.

This new methodology seeks to detect the differences between fields, adjusting the start year and the amplitude of the citation window to the citation maturation time in each field. To achieve this, an empirical comparison is made of five indicators for 600 journals across eight categories.

<div align="center">CITATION WINDOW AND IMPACT MATURATION TIME</div>

A journal impact indicator is the gauge of the number of times that the papers published in a given census period cite the papers published within a previously set citation window. The impact maturation time of a journal is related to the time lapsed from publication of a volume of the same to the year in which its citation distribution reaches its maximum value.

Two- and five-year citation windows

The census period of the two-year IF issued by Thomson Reuters is one year and it employs the previous two years as the citation window. As an average, this indicator is based on two elements: the numerator, which is the number of citations in the current year of items published in a journal in the two previous years; and the denominator, which is the number of "citable items" published in those same two years (Garfield, 1972). The items published include citable items, editorials, news, corrections, etc. Similarly, the five-year IF covers a census period of one years and a citation window consisting of the five previous years. Where $NArt_t^i$ is the number of citable items in the year t of journal i, and $NCit_{t,\,t-j}^i$ is the number of times in year t that the volumes of year t-j of journal i are cited. The n-year IF for year t of the journal is attained as follows:

$$n\text{-}FI_t^{\,i} = \sum\nolimits_{j=1}^{n} NCit_{t,\,t-j}^i \Big/ \sum\nolimits_{j=1}^{n} NArt_{t-j}^{\,i}.$$

The two-and five-year IF are calculated respectively as follows:

$$2\text{-}FI_t^{\,i} = \frac{NCit_{t,\,t-1}^i + NCit_{t,\,t-2}^i}{NArt_{t-1}^{\,i} + NArt_{t-2}^{\,i}}$$

and

$$5\text{-}FI_{t}^{i} = \sum_{j=1}^{5} NCit_{t,\,t-j}^{i} \Big/ \sum_{j=1}^{5} NArt_{t-j}^{i} \; .$$

The citation potential is a source of variance in the IF of n years. This potential depends on the scientific field and is determined by the frequency and speed with which the authors cite other works, as well as by the depths with which the field in question is covered by the data base examined. In this way, the citation potential is a gauge of the currency and popularity of the field (Moed *et al.,* 2012). The most popular fields tend to attract many authors with shared interests. As such, these fields develop rapidly. The papers are published in a limited number of highly visible journals, and the authors tend to cite their colleagues' most recent work. These fields often attain higher two-year IF (Moed *et al.,* 2012).

In this way, there is no optimal n value possible for all journals and fields. In some cases, the two-year window provides a very good gauge of impact, while in other cases three or more years are needed.

Three-year citation window

The Elsevier Scopus impact indicator also uses a census period of one year, while employing the three previous years as the citation window. The numerator is the number of citations in the current year of the items published in the three previous years, and the denominator is the number of items that have passed peer review (papers, reviews and congress records) and have been published in that same period. This intermediate citation window, however, does not provide a solution to the problem, since in some cases the maximum citation distribution is reached before the end of the three-year period, while in other instances this maximum is attained later.

Complete citation window

In addition to the variance within each year, the inter-annual variance can be reduced using all of the citations, that is, by employing the complete citation window instead of that with the last n years. This model, however, does not improve upon the model that employs the window of the previous n years (Leydesdorff and Bornmann, 2011: 228).

Citation window with variable
start year and amplitude

As previously stated, an impact indicator is a measure of the number of times that papers published in a given census period cite the papers published during a previously determined citation window. The optimal amplitude of the citation window, however, may vary over time and from field to field. Moreover, despite the decades-long use of fixed citation windows, there is no evidence in the literature to justify the preference of fixed over variable citation windows.

The problem of defining boundaries between fields and specializations is one that persists in bibliometrics, because any such delimiters tend to become porous because of the dynamism of scientific fields. For this reason, citation windows established on the basis of topical category are not recommendable.

Researchers in fields with rapidly maturing impacts tend to "consume" scientific output immediately, which is to say they spread and cite such output with alacrity. This occurs most notably; for example, in biomedicine and computer science. In contrast, the consumption of scientific output is less rapid in fields with slower impact maturation, such as mathematics and economy.

There is no single maturation time valid for all journals. The selection of a variable citation window, rather than a fixed window of two, three or five years, is done on the basis of empirical evidence that many fields do not reach their maximum values in two years, while in other fields this value is reached well before five years. As such, the use of a variable window represents an optimal compromise for those fields that are slower to reach maximum citation values, and without penalizing those fields whose impacts mature more rapidly.

Figure 1 shows the distribution of citations for four journals. Journals A and C belong to a rapid impact maturation field, while B and C belong to a slow impact maturation field. Since the number of citations is the numerator in the impact formula, when all of these journals have published the same number of papers in recent years, A shall have a greater impact than C, and B shall have a greater impact than D. Nonetheless, the question of which journals (A or B, C or D) have the greater impact persists.
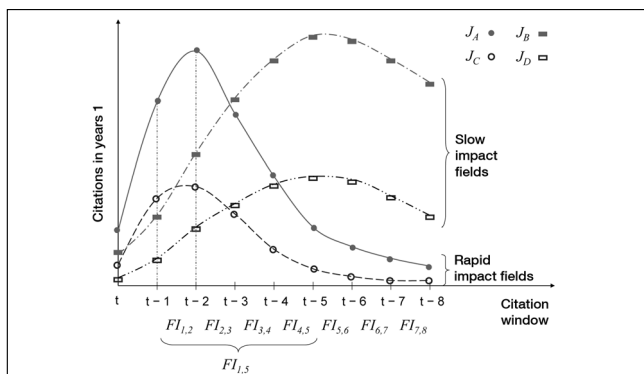
Figure 1. Distribution of citation in journals in rapid and slow impact fields
(A having greater impact than C and B greater than D, respectively)

For year t of journal i, we define the IF with a start window at j and end at k, as follows:

$$FI_{t;j,k}^{i} = \frac{NCit_{t,\,t-j}^{i} + NCit_{t,\,t-j-1}^{i} + \text{L} + NCit_{t,\,t-k}^{i}}{NArt_{t-j}^{i} + NArt_{t-j-1}^{i} + \text{L} + NArt_{t-k}^{i}}, \ j,k = 1,2,...;\ j < k.$$

For the purpose of simplicity, we shall use the notation $FI_{j,k}$, in the understanding that the journal and the year are fixed. For example $FI_{3,4}$ represents the IF with a window starting at three and ending in 4, i.e., accounting for citations of papers occurring between three and four years ago. *Figure 1* shows several IF with citations windows with different starts and ends, in which one can observe that the Thomson Reuters IF at two and five years, respectively, of $FI_{1,2}$ y $FI_{1,5}$ coincide.

For year t of journal i, we define the *impact maturation time* as the number of years transpiring from t to the time the journal reaches maximum impact. *Figure 1* shows how the impact maturation time of journals A and C is two years, while the impact maturation time of journals B and D is six years. The impact maturation speed is, therefore, much higher in journals A and C.

Methods and materials

In the empirical application under study we find that the citation window for the IF produces closer data distributions, central tendencies and variabilities across several scientific fields. The bibliometric data used were gathered

from the online version of *Journal Citation Reports* (*JCR*) of 2011, during the first week of November 2012. The *JCR* data base is managed by Thomson Reuters (Philadelphia, USA) and is hosted at: www.webofscience.com. In the *JCR*, the experts at Thomas Reuters assign journals to one or more categories in accord with the journals cited and citing journals. These categories are treated as scientific fields or specializations.

The comparative analysis performed in this study employs a randomly selected journal category from each of the eight clusters obtained by Dorta-González and Dorta-González (2013a, 2013b). This is done in order obtain journals with significantly diverse publication and citation habits. The research mentioned analyzes all of the thematic categories in the *Science Citation Index Expanded* and *Social Science Citation Index*. From among the eight clusters identified, six include a significant number of categories. Two of these are quite large, each with more than 25% of the categories that include physical and life sciences (mathematics, physics, chemistry and biomedicine). The next two clusters contain those areas of the social sciences that are less reliant on mathematics (education, sociology, languages and law). The final two clusters include life sciences with an important social component and those sciences generally more reliant on mathematics (psychology, economy and business).

This study examines a total of 618 journals, which in terms of numbers break down as follows: Astronomy & Astrophysics (56); Biology (85); Ecology (134); Engineering, Aerospace (27); History & Philosophy of Science (56); Mathematics, Interdisciplinary Applications (92); Medicine, Research & Experimental (112); Multidisciplinary Sciences (56).

Results and discussion

Table 1 shows a sample of 24 journals randomly selected from the most widely cited journals in eight *JCR* categories. This table contains the citations in 2011 of items and in the period 2006-2010 and number of publications. One can easily observe the significant differences in number of publications and the citations occurring between journals and fields. This variance in the data directly affects the variability of the impact factors. Particularly, one can observe an exponential increase in the number of publication in *PLOS ONE* and linear reductions in ANN *NY ACAD SCI* and *LIFE SCI*.

Table 1. Sample of 24 randomly selected journals from the most often cited JCR category

Abbreviated title	Category JCR	Number of citations					Number of publications				
		2010	2009	2008	2007	2006	2006	2007	2008	2009	2010
AIAA J	EA	239	354	474	418	467	356	311	301	286	275
AM NAT	E	663	1.052	1.028	1.159	1.003	179	197	190	192	171
ANN NY ACAD SCI	MS	2.505	3.382	3.827	2.947	3.193	1.415	1.034	975	1.164	702
ASTRON ASTROPHYS	A&A	8.657	8.330	6.992	7.174	6.270	1.935	1.977	1.789	1.787	1.916
ASTROPHYS J	A&A	14.641	17.267	12.160	11.738	10.412	2.707	2.848	2.128	2.796	2.501
BIOL PHILOS	H&PS	66	29	39	59	49	28	35	36	40	39
BIOMETRIKA	B	103	203	222	246	225	79	74	75	81	79
BRIT J PHILOS SCI	H&PS	27	41	59	38	45	28	32	32	31	31
ECOLOGY	E	1.292	2.073	2.317	2.227	2.237	333	317	345	337	357
ECONOMETRICA	MIA	136	239	228	326	373	53	51	47	61	65
EXP HEMATOL	MR&E	308	485	627	644	570	194	214	172	146	127
FASEB J	B	2.348	2.633	2.845	2.655	3.200	486	388	412	410	462
HIST SCI	H&PS	9	15	12	12	10	16	17	14	19	17
IEEE T AERO ELEC SYS	EA	124	163	216	270	302	117	133	128	126	136
J ECONOMETRICS	MIA	156	165	435	541	448	124	176	161	99	139
J GUID CONTROL DYNAM	EA	151	213	261	268	208	177	203	183	200	187
LIFE SCI	MR&E	538	675	883	1.364	1.919	702	498	289	252	228
P NATL ACAD SCI USA	MS	31.558	41.331	39.642	38.547	35.707	3.306	3.494	3.508	3.765	3.764
P ROY SOC A-MATH PHY	MS	397	346	323	453	359	196	197	175	194	183
PHYS REV D	A&A	13.330	12.498	11.508	8.183	7.528	2.375	2.268	2.863	2.813	2.854
PLOS ONE	B	22.741	22.780	15.676	7.041	765	137	1.230	2.717	4.403	6.722
STRUCT EQU MODELING	MIA	99	193	98	308	374	28	29	30	31	31
TRENDS ECOL EVOL	E	965	1.476	1.527	1.468	1.594	78	89	92	80	75
VACCINE	MR&E	3.729	4.702	3.787	3.536	3.182	928	1.046	905	1.134	1.105

JCR Categories: A&A, Astronomy & Astrophysics; B, Biology; E, Ecology; EA, Engineering, Aerospace; H&PS, History & Philosophy of Science; MIA, Mathematics, Interdisciplinary Applications; MR&E, Medicine, Research & Experimental; MS, Multidisciplinary Sciences.

Table 2 shows some impact factors for the journals under study with variations of the years of start and end of the citation window. The impact maturation time varies considerably from one category to another. The number of years transpiring until the citation distribution attains its maximum oscillates between two and five years, and one can also observe the amplitude in the variation interval for each indicator. For example, $FI_{1,2}$ varies between 0.667 and 15.748.

Table 2. Effect of the citation window on impact factor

Abbreviated title	Category	$FI_{1,2}$	$FI_{2,3}$	$FI_{3,4}$	$FI_{4,5}$	$FI_{1,5}$	Impact maturation
AIAA J	EA	1.057	1.411	1.458	1.327	1.277	4
AM NAT	E	4.725	5.445	5.651	5.750	5.280	5
ANN NY ACAD SCI	MS	3.155	3.370	3.372	2.507	2.997	4
ASTRON ASTROPHYS	A&A	4.587	4.285	3.762	3.437	3.979	2
ASTROPHYS J	A&A	6.024	5.976	4.803	3.987	5.102	2
BIOL PHILOS	H&PS	1.203	0.895	1.380	1.714	1.360	5
BIOMETRIKA	B	1.913	2.724	3.141	3.078	2.575	4
BRIT J PHILOS SCI	H&PS	1.097	1.587	1.516	1.383	1.364	3
ECOLOGY	E	4.849	6.437	6.864	6.868	6.007	5
ECONOMETRICA	MIA	2.976	4.324	5.653	6.721	4.700	5
EXP HEMATOL	MR&E	2.905	3.497	3.293	2.975	3.088	3
FASEB J	B	5.712	6.664	6.875	6.699	6.340	4
HIST SCI	H&PS	0.667	0.818	0.774	0.667	0.699	3
IEEE T AERO ELEC SYS	EA	1.095	1.492	1.862	2.288	1.680	5
J ECONOMETRICS	MIA	1.349	2.308	2.896	3.297	2.496	5
J GUID CONTROL DYNAM	EA	0.941	1.238	1.370	1.253	1.159	4
LIFE SCI	MR&E	2.527	2.880	2.855	2.736	2.732	3
P NATL ACAD SCI USA	MS	9.681	11.133	11.167	10.920	10.472	4
P ROY SOC A-MATH PHY	MS	1.971	1.813	2.086	2.066	1.987	4
PHYS REV D	A&A	4.558	4.229	3.838	3.384	4.027	2
PLOS ONE	B	4.092	5.401	5.756	5.710	4.537	4
STRUCT EQU MODELING	MIA	4.710	4.770	6.881	11.965	7.195	5
TRENDS ECOL EVOL	E	15.748	17.459	16.547	18.335	16.981	5
VACCINE	MR&E	3.766	4.163	3.753	3.403	3.700	3

Impact maturation: Year in which citation distribution attains peak. JCR Categories: *A&A, Astronomy & Astrophysics; B, Biology; E, Ecology; EA, Engineering, Aerospace; H&PS, History & Philosophy of Science; MIA, Mathematics, Interdisciplinary Applications; MR&E, Medicine, Research & Experimental; MS, Multidisciplinary Sciences.*

Table 3 provides the Pearson correlation coefficient for all of the indicator pairs, considering windows of two years for both the journal categories and the aggregated data, in the sample of 618 journals across eight *JCR* categories.

The general pattern observed in this table is a strong correlation, with most correlations above 0.90. One must be cautious; however, before drawing conclusions from these correlations. The different indicators have skewed distributions, with many journals exhibiting rather low values and only a small number of journals exhibiting high values. These skewed distributions often give rise to high Pearson correlations.

Table 3. Pearson correlations for rankings with two-year citation window

JCR category	Number of journals		$FI_{2,3}$	$FI_{3,4}$	$FI_{4,5}$
Astronomy & Astrophysics	56	$FI_{1,2}$	0.96	0.93	0.92
		$FI_{2,3}$		0.94	0.91
		$FI_{3,4}$			0.88
Biology	85	$FI_{1,2}$	0.98	0.93	0.94
		$FI_{2,3}$		0.98	0.96
		$FI_{3,4}$			0.98
Ecology	134	$FI_{1,2}$	0.99	0.98	0.97
		$FI_{2,3}$		0.98	0.95
		$FI_{3,4}$			0.97
Engineering, Aerospace	27	$FI_{1,2}$	0.95	0.83	0.83
		$FI_{2,3}$		0.91	0.90
		$FI_{3,4}$			0.98
History & Philosophy of Science	56	$FI_{1,2}$	0.89	0.82	0.85
		$FI_{2,3}$		0.93	0.83
		$FI_{3,4}$			0.92
Mathematics, Interdisciplinary Applications	92	$FI_{1,2}$	0.91	0.81	0.77
		$FI_{2,3}$		0.92	0.82
		$FI_{3,4}$			0.90
Medicine, Research & Experimental	112	$FI_{1,2}$	0.90	0.80	0.76
		$FI_{2,3}$		0.94	0.89
		$FI_{3,4}$			0.96
Multidisciplinary Sciences	56	$FI_{1,2}$	0.96	0.91	0.91
		$FI_{2,3}$		0.97	0.94
		$FI_{3,4}$			0.94
Total	618	$FI_{1,2}$	0.97	0.93	0.91
		$FI_{2,3}$		0.97	0.94
		$FI_{3,4}$			0.96

Table 4 shows the number of journals whose impact factors top out within the two-year citation window. It is interesting to note that there is no optimal

impact maturation time for all fields. In some cases, a good gauge of impact is obtained in two years, but for others three years or more are needed. One can observe that the impact matures rapidly in Astronomy & Astrophysics (two years), followed by Medicine, Research & Experimental (three years). In Ecology, Mathematics and Interdisciplinary Applications impact matures much more slowly (five years). The remaining fields stand somewhere in between (four to five years).

Table 4. Number of journals with impact maturation
within the citation window

JCR category	Number of journals	$FI_{1,2}$	$FI_{2,3}$	$FI_{3,4}$	$FI_{4,5}$
Astronomy & Astrophysics	56	22 39.3%	17 30.4%	11 19.6%	6 10.7%
Biology	85	13 15.3%	25 29.4%	28 32.9%	19 22.4%
Ecology	134	7 5.2%	31 23.1%	41 30.6%	55 41.0%
Engineering, Aerospace	27	4 14.8%	7 25.9%	8 29.6%	8 29.6%
History & Philosophy of Science	56	12 21.4%	16 28.6%	12 21.4%	16 28.6%
Mathematics, Interdisciplinary Applications	92	10 10.9%	22 23.9%	22 23.9%	38 41.3%
Medicine, Research & Experimental	112	22 19.6%	46 41.1%	22 19.6%	22 19.6%
Multidisciplinary Sciences	56	13 23.2%	14 25.0%	18 32.1%	11 19.6%
Total	618	103 16.7%	178 28.8%	162 26.2%	175 28.3%

Finally, *Table 5* shows the measures of central tendency and variability for the eight *JCR* categories under study. All indicators exhibit skewed distributions, with many journals having relatively low indicator values, and only a few with high values. This is why the medians of the distribution are well below the averages in all cases. One can observe large differences in the medians, means and standard deviations from category to category. In Multidisciplinary Sciences the means is four times the median and has a larger standard deviation. In general terms, it seems that $FI_{3,4}$ produces medians closer to the means.

Table 5. Central tendency and variability

JCR category	Measure of central tendency	$FI_{1,2}$	$FI_{2,3}$	$FI_{3,4}$	$FI_{4,5}$	$FI_{1,5}$
Astronomy & Astrophysics	Median	1.683	1.874	1.679	1.600	1.757
	Mean	3.070	3.407	3.551	2.868	3.180
	Standard deviation	4.292	5.563	5.597	4.931	4.803
Biology	Median	1.540	1.505	1.553	1.624	1.719
	Mean	2.097	2.341	2.346	2.500	2.374
	Standard deviation	2.115	2.293	2.488	2.897	2.390
Ecology	Median	1.829	2.343	2.421	2.425	2.250
	Mean	2.643	3.168	3.292	3.530	3.122
	Standard deviation	2.681	3.056	2.858	3.444	2.871
Engineering, Aerospace	Median	0.549	0.623	0.737	0.672	0.654
	Mean	0.680	0.799	0.869	0.885	0.833
	Standard deviation	0.605	0.762	0.787	0.880	0.727
History & Philosophy of Science	Median	0.442	0.446	0.500	0.588	0.553
	Mean	0.580	0.659	0.682	0.735	0.725
	Standard deviation	0.603	0.694	0.642	0.672	0.632
Mathematics, Interdisciplinary Applications	Median	0.893	1.079	1.230	1.132	1.131
	Mean	1.108	1.291	1.435	1.593	1.394
	Standard deviation	0.771	0.884	1.087	1.662	1.033
Medicine, Research & Experimental	Median	2.297	2.376	2.320	2.274	2.418
	Mean	3.033	3.476	3.121	3.291	3.337
	Standard deviation	3.290	3.979	3.943	4.197	3.635
Multidisciplinary Sciences	Median	0.510	0.571	0.828	0.650	0.789
	Mean	2.313	2.461	2.471	2.521	2.866
	Standard deviation	6.419	7.003	6.918	6.823	7.231

Conclusions

The results obtained indicate that the start and end years of the citation window exert a definitive effect on IF. The journal categories studied herein are quite diverse. The years needed for the distribution of citations to top out oscillates between two and five years. As such, the impact maturation time varies considerably from one category to another. Some journals are penalized by the two-year IF and favored by the five year IF. The reverse is also

observed. This is why one should be cautious when comparing the IF of journals from different fields. There are variable window IF that in general terms produce measures of central tendency that are relatively close.

With regard to the research question (Do fixed citation windows affect the impact maturation times of scientific journals?), results indicate that citation windows with fixed starts and ends and which have been used frequently in the literature do not reflect the various maturation rates of scientific journals. Moreover, this approach favors some and penalizes other. These facts recommend the adoption of some kind of variable start and end citation window that is better suited to the field of research under analysis.

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A case study of knowledge organization patterns within Curricular Information Systems

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Abstract

History teaches us that need to systematize knowledge of the outside world is the main driver in the creation of classification systems of scientific knowledge. The development and evolution of the prevailing systems of information and knowledge management have achieved a respectable representation of the complexity of the organization of knowledge, even in the face of the unfolding nature of the knowledge classified, its systemic features and interdisciplinary essence. This research aims principally to provide an analysis of the classification of knowledge of scientific research results and identify compositional patterns that may serve to

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enhance its management. The paper consists of a case study of scientific researchers of the University of Pinar del Río, and employs the curricular approach entailed in the Institutional Information and Knowledge Management System of the University of Pinar del Rio, as well as other diagnostic techniques to identify patterns in the structuring of the institution's knowledge.

Keywords: Knowledge Organization; Information Systems Curriculum; Taxonomies of Scientific Knowledge.

Resumen

Patrones para la organización del conocimiento en los Sistemas de Información Curricular. Un caso de estudio
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La historia de la humanidad delata que la imperiosa necesidad de sistematizar todos los conocimientos sobre el mundo exterior ha sido una de las causas fundamentales de la aparición de las clasificaciones del conocimiento científico. En la actualidad, el desarrollo y evolución de los sistemas de gestión de información y conocimiento han logrado representar bastante bien la complejidad de la organización del conocimiento, a pesar de la naturaleza desarrolladora del propio conocimiento que se clasifica, y sus características sistémicas y esencia interdisciplinar. El objetivo principal de esta investigación es el análisis de la clasificación del conocimiento procedente de los resultados científicos de los proyectos de investigación para identificar patrones en su composición que permitan su gestión. Se toman como caso de estudio los profesores investigadores que desarrollan proyectos científicos en la Universidad de Pinar del Río y se propone como instrumentos el Sistema de Gestión de Información y Conocimiento Institucional de la Universidad de Pinar del Río con enfoque curricular, así como otras técnicas de diagnóstico para la identificación de patrones en la estructuración del conocimiento de la institución.

Palabras clave: Organización del conocimiento; Sistemas de información curricular; Taxonomías del conocimiento científico.

Introduction

The organization of knowledge is the science of systematically structuring groups of knowledge units (concepts) in accord with inherent features (Dahlberg, 2006). Postulates from decade of the 1990s hold that the organization of knowledge is inclined toward social and interpretive points of view. Such is the case of analysis of discourse, gender studies and domain analysis. Since then, several semiotic and critical-hermeneutic approaches have been developed (Hjørland, 2005). The main objective of this science is to apply operations such as classification and ordination to create systems of physical and intellectual distribution that respect sequence, hierarchy, association and other key features in order to guarantee the retrieval of information and knowledge at the institutional level.

The development of the process of scientific research itself is a consequent outgrowth of the complexity of knowledge organization. It is evident that new scientific problems and phenomena cannot be reduced to any single disciplinary vision. At the same time, we must face current reality from a new scientific-methodological standpoint or vision. Greater openness is needed and the interaction can provide greater enrichment of the scientific perception of reality (Morin, 1995). Whenever knowledge is classified and organized, its dynamic essence must be taken into account, especially in the development and application of information systems in the organizational environment.

Despite considerable efforts made by science and technology organisms, problems persist in many institutions (Navarrete and Banqueri, 2008), including:

- Coexistent instruments for capturing data that do not provide standardized systems of storage and retrieval.
- Inefficient integration of interoperability and communication capacities among data bases and insufficient homogenization of formats of researchers' curricula.
- Under exploitation of the information that is systematized by science and technology information management organizations, with regard to both strategic management and policy making and for the purpose of promoting and increasing the visibility of results. This creates a bottleneck on exchanges, collaboration and communication among scientists and researchers at the regional, national and international levels.

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Many of these problems have been solved through implementation of Scientific Information Systems (SIS) calibrated to the characteristics of each organization or region, even though certain problems with the focus and scope of such systems persist. This problem is reflected in shortcomings in the management of science and technology activities and their results, the impossibility of structuring the scientific knowledge held by and institution and efficiently measuring scientific impact as a social process (Armas, Díaz and Giraldes, 2008; Báez *et al.*, 2008).

While this paper approaches some of these issues, it is specifically focused on an analysis of the structuring of knowledge held by an organization and its representation using diverse tools for structuring what the organization has come to know through research in the areas of knowledge it studies. The main objective is to analyze the classification of knowledge proceeding from the results of scientific research projects in order to identify compositional patterns that serve the purposes of management. This paper consists of a case study of researchers at the Universidad de Pinar del Río and proposes an Institutional Information and Knowledge Management System of the Universidad de Pinar del Río (CV-UPR) with a curricular focus, as well as other diagnostic techniques for identifying patterns in the structure of knowledge in said institution.

<center>Materials and methods</center>

The Universidad de Pinar del Río designed and implemented the CV-UPR several years. It is registered and certified and has been validated in other studies. In this system, the Curriculum Vitae (CV) of the researcher constitutes the sole and main source of data entry and update. One of its main features is that it was developed for research activity, since a hierarchal structure was designed that includes all of the activity and its composition, including diverse taxonomies for classifying scientific results (Armas, Díaz and Giraldes, 2008). For documental analysis, the reports and methodological documents issued by the Vice-Rector's Office of Research, Information Systems and Postgraduate Studies (VRIIP) were examined, as were the Science and Technology Balances for the period under study.

To complement this study, empirical techniques were used that allow quantitative information to be secured from non-documental sources. A diagno-

sis of the population under study was performed. This population consists of UPR researchers responsible for coordinating research projects. Research projects in course in the period from 2001 to 2013 were examined. The diagnostic was applied to 33 researchers who coordinate projects in the period under study. Sampling of this population was discarded in favor of applying the survey questionnaire to every subject researcher. For the purpose of better interpretation and association of results, data analysis was performed using the Statistical Package for Social Science (SPSS, version 11.5, 2004) and Microsoft Excel (2010).

Results

In general terms, science is viewed as a knowledge production system, existing largely in the form of publications. Publication is understood as any "information recorded in permanent supports and available for common use" (Spinak, 1998:142). This recorded information may be published in numbered, high impact journals, though it also exists in the daily processes of science at the institutional levels and in everything the researcher does as the driver of this process. The process of management of science and technology entails definition and assessment of policies needed to promote science at the national or regional level. To fulfill this purpose, the parties responsible for these activities need to design methodologies that guide both the gathering of information and the use of information systems that facilitate analysis and provide approximations of scientific capacities and dynamics.

The design of these systems seeks to respond to the concrete operational management needs at micro, meso and macro levels of the organizations or institutions that promote research and technological development. In the institutional field, SIS aspire to the following objectives (Armas, Díaz and Giraldes, 2008):

- To structure operative and functional information needed by organizations to operate efficiently and achieve results.
- To respond to the concrete needs of organizations that promote science and technology research in sustainable development of innovation and technological change.
- To develop and support science and technology macro policies needed by organizations and their processes.

- To define and evaluate strategies followed in research, development and innovation activities (R+D+I).
- To evaluate the scientific and technological production and activities of researchers and institutions.
- To provide proper management of the distribution of material and human resources devoted to R+D+I.
- To promote national and international collaboration, exchange and transfer of innovations in science and technology.

These purposes clearly reflect the internal and external interactions of the SIS. The activities of the researcher and their interactions with other actors in the field of science occur in an institutional setting. As such, the institutional standpoint offers greater regional results in terms of implementation of indicators for managing science and technology. The CVs of researchers provide valuable information that make up part of the results of research. The observation of the activity surrounding any given researcher allows:

> evaluation of the CVs of scientists and surveys as a source of information. The first as a subset of data for obtaining indicators of scientific activity and the second as a source of information to establish […] the social (organizational structure of the environment, available human capital, etc.) and economic (research funding) framework in which scientists habitually work (Martín-Sempere and Rey-Rocha, 2009: 2)

The empirical literature examines works that use the CV as a source of information for studying the behavior of science at its diverse levels where it is practiced. These studies are performed in order to assess the impact of researchers' affiliation to research centers on their productivity, collaboration and funding (Gaughan, Branco and Bozeman, 2007). For the researcher, the CV is a representation of their "knowledge value" (Jaramillo, Lopera and Albán, 2008).

UPR recognizes the importance of each research professor's CV and the power of curricular information systems in the management of science and technology activities at the institutional level. This is why the Institutional Information and Knowledge Management System of the Universidad de Pinar del Río (CV-UPR) was developed. Among its main management, evaluation and projection objectives is to account for the behavior of scientific activity in all areas, including identification of research patterns and the structuring of all the knowledge held by the university in accord with existing national and international taxonomies.

As the researcher publishes work, secures degrees and generally undergoes professional development, the data and fields of knowledge reflected in the CV are updated. The following is a list of occasions that researcher will often update in the associated CV field:

- Securing postgraduate degrees: results associated with research performed to obtain the postgraduate degree.
- Work as thesis advisor: results associated with serving as thesis advisor in both undergraduate and postgraduate programs.
- Results of research associated with projects, or associated with research work in the research project to which he or she is tied.
- Results of research not associated with projects that are relevant to the researcher and the institution.

Through this structure, the results of the research process are deepened for each researcher and the institution, whether generated or not within a research project. At the same time, the diverse results (methodology, product, etc.) generate a broad subset of output typologies, including articles, patents, books, monographs, informatics and non-informatics product registries, brands, standards, etc.

In the structure of the CV-UPR, each result output includes different areas of knowledge. In this case, the research professor classifies each one of their results in accord with three taxonomies: The Taxonomy of the United Nations Organization for Education, Science and Culture (UNESCO), the Taxonomy of the Organization for Cooperation and Economic Development (OCED), and classification taxonomy currently in use in Cuban. The UNESCO taxonomy is international in nature and the OCED taxonomy is widely used in Spanish speaking countries of the greater Americas.

Figure 1 shows the structure of the fields used by CV-UPR for collecting data derived from research: types of results, fields of knowledge and result outputs. This distribution allows for the measurement of knowledge generated by each type of research activity and structuring research results as a function of the activity that produced them in accord with the nature of the knowledge itself.
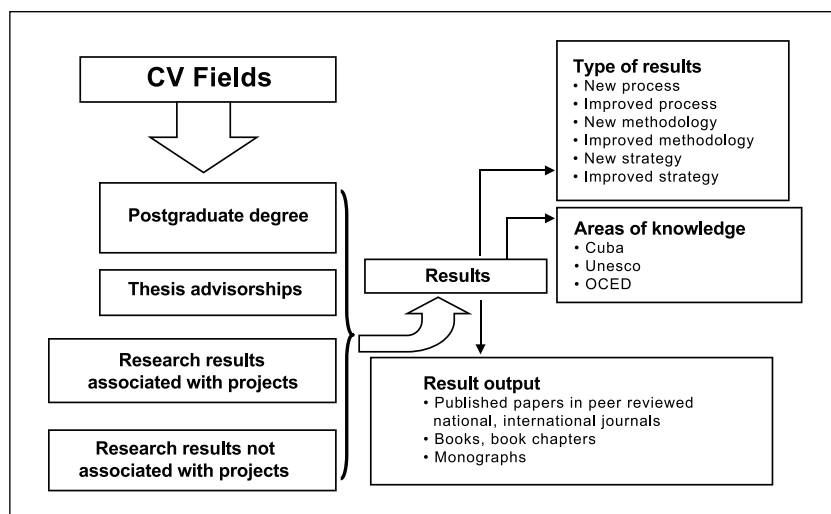
Figure 1. CV fields that are updated with research results.
Source: Armas, Diaz and Giraldes, 2008

This distribution within the CV-UPR system has allowed one to know about the disciplinary composition of research in the university. One can infer the existence of a propensity to establish interdisciplinary relationships in diverse areas of UPR. To corroborate this, we propose performing a diagnosis of the results arising from research project.

The results of the techniques employed exhibited a broad group of interdisciplinary research whose results issue from distinct areas and disciplines of knowledge. As such, in several instances they are difficult to classify using these taxonomies. Interdisciplinary approaches also prevail in doctoral dissertations. This behavior merits further study in order to discern the characteristics of the research projects of the institutions and the lines of research and researchers involved.

Eighty percent of the coordinators assert that the results of the projects they coordinate are associated with more than one scientific discipline (*Figure 2*).

By crossing two of the variables under study, 37% of those surveyed assert that their project has at least 5 or 10 members and it is associated with more than one scientific discipline (*Figure 3*).
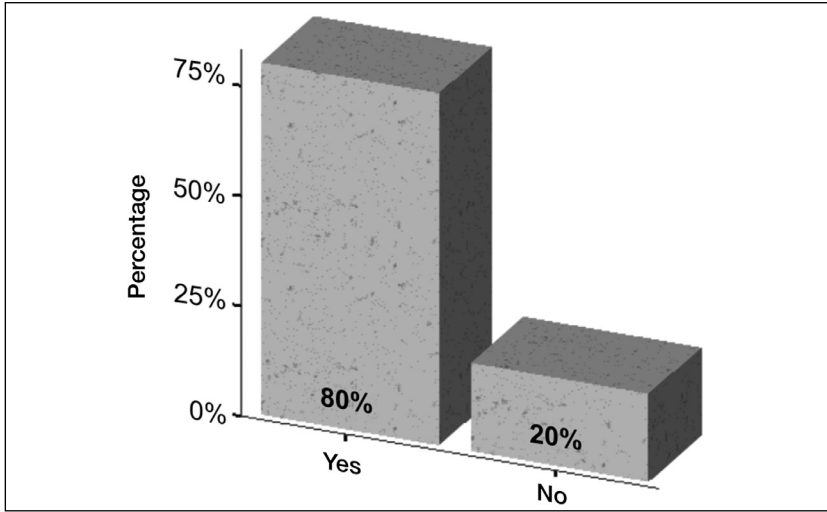
Figure 2. Response to question 5 in the survey
Source: By author on the basis of SPSS
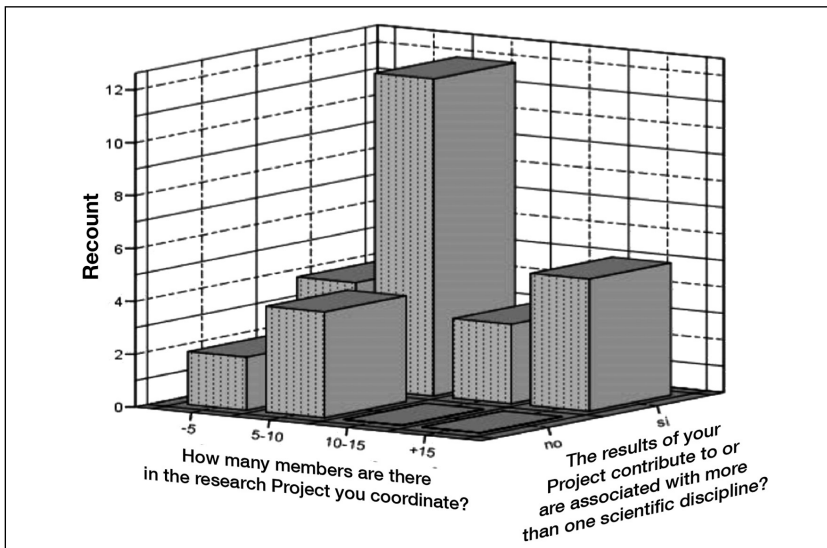
Figure 3. Cross comparison of responses to two questions
Source: By author on the basis of SPSS

Similarly, those who coordinate projects with more than 15 members report having results associated with several scientific disciplines. This analysis evidences that there are certain features of the projects analyzed that can influ-

ence the determination of interdisciplinary relationships. This is one of the factors that makes of results resistant to being pigeonholed under a given classification approach.

The number of members working in a project, the objective sought, the scope and level of interaction with other disciplines for solving a given problem constitute factors that influence the degree of interdisciplinary cooperation. The areas associated with social sciences, in general, exhibit a distinctive pattern of comportment with regard to interdisciplinary cooperation.

The study showed that of the 61 lines of research of the UPR in the period under analysis, thirty work in conjunction or require contributions from other fields of science. Salient among these are Pedagogical Science, Forestry Science, Economic Science and Technical Science (*Figure 4*). The most frequent combinations are as follows:

- Mathematics
- Applied Social Sciences, Mathematics, Economic Sciences, Agrarian Sciences
- Applied Social Sciences, Mathematics, Economic Sciences
- Mathematics, Economic Sciences, Agrarian Sciences
- Biological Sciences
- Economic Sciences, Mathematics
- Chemistry
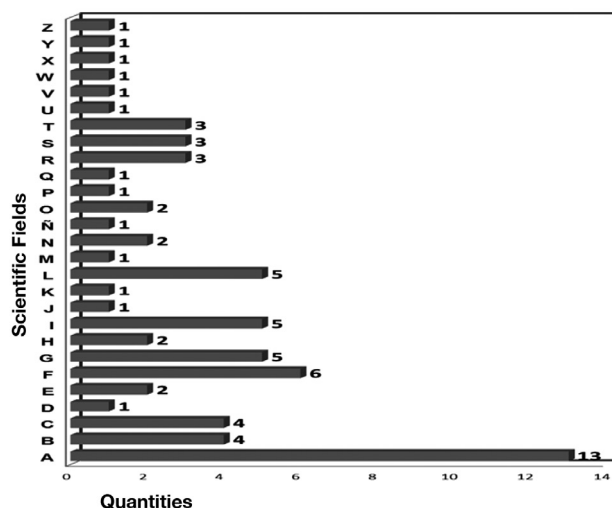
Legend	
A	Mathematics
B	Applied Social Sciences, Mathematics, Economic Sciences , Agrarian Sciences
C	Applied Social Sciences, Mathematics, Economic Sciences
D	Technical Sciences
E	Mathematics and Chemistry
F	Mathematics, Economic Sciences , Agrarian Sciences
G	Biological Sciences
H	Mathematics, Economic Sciences, Chemistry and Informatics
I	Economic Sciences, Mathematics
J	Sociology
K	Mathematics, Sociology, Agrarian Sciences Chemistry, Biology, Psychology
L	Química
M	Economic Sciences, Political Sciences and Mathematics
N	Mathematics, Agrarian Sciences and Informatics
Ñ	Applied Social Sciences, Mathematics, Geology, Biology
O	Agronomy and Biology
P	Sociology, Psychology, Economic Sciences
Q	Philosophy and Applied Social Sciences
R	Applied Social Sciences
S	Agrarian Sciences
T	Sciences of Education
U	Mathematics and Technical Sciences
V	Regional Geology and Mineral Deposits
W	Economic Sciences
X	Psychology and Theory of Communication
Y	Mathematics and Geochemistry
Z	Physics

Figure 4. Areas of science that contribute results to doctoral dissertations
Source: By author based on SPSS

Mathematics is a representative example in *Figure 5,* because it contributes the methodologies needed in other research. The same holds true for Statistics. We can conclude that interdisciplinary research projects are those that exhibit the greatest number of combinations of areas with their results. Each doctoral dissertation, in turn, matches a given line of research, which manifests the existence of several lines of research in the institutions that are nourished by diverse fields of science.
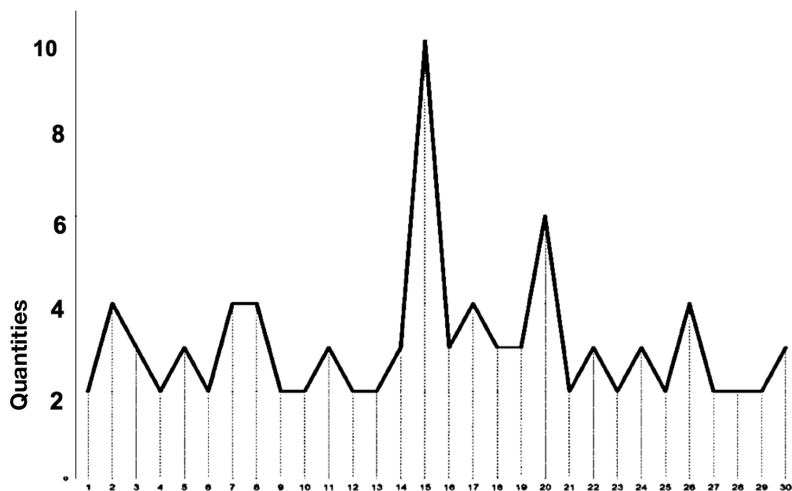
Lines of research in PhD dissertations

Legend	
1	Patentometrics
2	Cooperation
3	Rural tourism management
4	Hydrogeology
5	Construction of forestry roads
6	Integrated pest management
7	Wood technology
8	University-business cooperation
9	Accounting processes informatics
10	Financial economic management of technological innovation projects
11	Thermochemical processes
12	Commercialization system for higher education
13	Administration and management of companies
14	International Economy
15	Pedagogy and didactics in higher education
16	Payment for environmental services
17	Human resources management
18	Economic theory of the transition to socialism
19	Forestry
20	Coastal ecosystems and environmental education
21	Agro-ecology of the forestry system
22	Communitarian social development and popular education
23	Pyrolysis and gasification in fluidized solid waste bed
24	Psychopedagogical orientation of students in the New Cuban University
25	Geochemical of rocks and mines
26	Linguistics
27	Linguodidactics
28	Pre-lexicographical and pre-terminographical studies

| 29 | Marine intrusion, water quality and environmental geology |
| 30 | Forestry inventory |

Figure 5. Number of areas of knowledge that contribute results to research
Source: By author based on SPSS

The lines associated with the greatest number of science fields are Pedagogy and Didactics in Higher Education, Coastal Ecosystems and Environmental Education (*Figure 5*). These lines are respectively associated with 10 and 6 areas of science. There are five lines of research that are associated with four following sciences: Cooperativisim, Technology of Wood, University-Business cooperation, Human Resources Management and Linguistics.

Discussion of the results

As Hjørland and Albrechtsen (1995) have stated, in the complex scenario of the organization of knowledge the best way to focus its application to the reality of Information Systems is to study how people think and imitate these regularities of thought. In the case study under analysis, this assertion is fulfilled by contrasting the results of research in research projects and the classifications in the taxonomies used in the CV-CPR system.

It has been shown that there is no single way to organize the knowledge derived from institutional research projects, and that existing taxonomies are not absolute. With regard to information from research projects, it is important to design representations that facilitate the organization of knowledge in accord with its particularities, and on basis of diverse criteria or positions, such as relevance of the topic or line of research, connections existing between diverse disciplines (of the same area or of distinct areas), the demands exerted by results of research on other areas of science, and the number and diversity of members of the projects.

It is clear that the social aspect exerts a considerable influence on the process of organization of knowledge through ideologies, traditions and paradigms which combine with intellectual aspects. Fundamentally, one must make the use of knowledge viable for real or potential users (Hjørland, 2003; Peña, 2010).

On the basis of these ideas, this study proposes performing the classification of research results on the basis of the lines of research to which each work

belongs, since the research project leaders, department heads and heads of research centers and research groups have the greatest capacity for classifying these lines into the distinct fields and disciplines of the taxonomies used to organize scientific knowledge.

This proposal directly associates the lines of research with tributary research. The lines would appear classified in the taxonomies used by the CV-UPR system, and researchers must classify themselves in the line to which they belong. This is a simple task for the researcher, because it is part of their everyday work. Those responsible for classifying the lines of research are the project leaders, department heads, heads of research centers and research groups and other authorities within the research realm of the institution. All of these persons must be trained in this regard. In this way, classification and organization of knowledge for structuring in the CV-UPR system is facilitated.

The analysis offers both advantages and disadvantages as listed below:

Advantages:
- There is integration in the development of research project among specialists belonging to the distinct areas of the institution and outside of it.
- The clients of the projects work lines of research associated with research activities of the university.
- The coordinators of the projects know about the phenomenon of interdisciplinary approaches and they associate it with profiles and lines of research that work in the diverse projects they direct.

Disadvantages:
- The researchers confuse the field with the scientific discipline when classifying their results.
- The information on science and technology in the UPR is very disperse in the distinct areas of the institution. The main source is the researchers themselves. As such, ongoing consultation must be possible.
- Processing and analysis of results and performance of the research project become onerous processes for the persons in charge of coordinate the projects and for institutional authorities.

Finally, it is worth highlighting that most of the results derived from the research projects are associated with the area of Science of Education. In the classification of researchers in accord with the three taxonomies, the highest percentages are found in fields associated with this activity used. The study

shows that there is complete harmony between the criteria of the researchers analyzed and the information from the research balance reports of URP over the same period of time.

Under this proposal, organization of knowledge is performed with a plural conception that pools cognitive, social and technological features, allowing one a view of the entire length of the participative process. In this case, the logical-semantic and discursive organization, which the researchers themselves have used to construct and organize their knowledge, is respected (García, 2001), and the organization of knowledge is performed more harmoniously within the information system, one of the main paradigms within the process of scientific research (Smiraglia, 2012).

Conclusions

The study of scientific bibliography, in conjunction with the empirical techniques used, showed the validity of including the organization of knowledge resulting from the research in the scientific information system of the institution.

The classification of the results of research must be structured in taxonomies of scientific knowledge that exist nationally and internationally.

At the international level, the categories of knowledge or scientific areas establish a classification of knowledge in terms of discipline. On occasions, this behavior encumbers the process of categorization of the results of a given science, since they are increasingly influenced by the combination of disciplines and the emergence of new interrelated sub-disciplines.

The diagnosis performed of researchers who head up projects shows that the practice of classifying results by areas of knowledge is not habitual nor is it required by authorities. We recommend incorporating this procedure at the outset of research projects that articulate diverse areas of knowledge while obtaining varied interdisciplinary results.

We propose the institutional management systems of curricular information as the best tool for managing the scientific knowledge of an institution, as well as for the identification and interpretation of patterns for structuring institutional knowledge. In this case study, we have validated the Information and Institutional Knowledge Management System (CV-UPR) as a platform for ob-

taining and contrasting relevant information on the structuring of knowledge derived from the results of research in accord with established taxonomies and the analysis of patterns as per lines of research and research projects.

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Methods and trends of biomedical and genomic information retrieval based on semantic relations of thesauri and MeSH

Ariel Antonio Morán Reyes *
Catalina Naumis Peña **

Abstract

In the field of genomic science and medicine in general, there are two methods of retrieving information from documents, namely: 1) through the combined use of associations determined by the Medical Subject Headings, and 2) by employing specific terminologies, such as those in folksonomies, alternative medical-genomic terms in use in the general language, or acronyms or apocopes from the genomics field. To some extent, many thinkers in matters of indexing hold that the combination of two methods may be the best approach. While few authors advocate for keeping the

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structure of controlled vocabularies, built up over many years of content interpretation, unchanged, there are numerous proposals for expanding the search horizons of thesauri, whether through social cataloging, algorithmic domain analyses that contrast indicators or the semantic web, using markers of meaningful semantic lexicons contained in digitized text.

Keywords: Library Science and Terminology; Automated Information Retrieval; Medical Subjects Headings; Thesauri.

Resumen

Métodos y tendencias de recuperación de información biomédica y genómica basados en las relaciones semánticas de los tesauros y los MeSH
Ariel Antonio Morán-Reyes y *Catalina Naumis-Peña*

Existen dos métodos de recuperación de información de documentos propios de la ciencia genómica y de medicina en general, a saber: uno está basado en el uso combinado de las relaciones determinadas por el Medical Subject Headings, mientras que el otro emplea las terminologías particulares, como pueden ser folksonomías, nombres alternativos de los términos médico-genómicos de uso en el lenguaje más general o los acrónimos o apócopes comunes en áreas como la genómica. Numerosos teóricos e indizadores consideran que la combinación de dos métodos puede funcionar mejor y es capaz de ofrecer mejoras significativas. Pese a que son pocos los autores que pugnan por no modificar la estructura de los vocabularios controlados, construidos a través de años de interpretación de contenidos, la multiplicidad de propuestas se reúnen bajo la tendencia de expandir el horizonte de búsqueda de los tesauros, ya sea con la catalogación social, el análisis de dominio realizado con algoritmos que contrastan indicadores o la web semántica, a través de la propuesta de marcado de unidades lexicales significativas en los textos digitalizados.

Palabras clave: Bibliotecología y terminología; Recuperación de información automatizada; Encabezamientos de temas médicos; Tesauros.

The Medical Subject Headings (MeSH) is a body of terms put together by the National Library of Medicine (NLM) of the United States of America. Through the *PubMed* free access search engine, these lexical units are used to index and retrieve documents in the fields of biomedicine, genomic science and associated areas of knowledge from the citation and abstracts data bases. Both resources are also offered by NLM. *PubMed* offered a wide variety of notably efficient automated tools (*PubMed Tools*), including *BioSample, Assembly* and *Genome* and others. *Genome*, for example, organizes information from the area of genomics and includes sequences, maps, graphic representations of chromosomes and annotations by means of three main procedures. Each of these tools employs a distinct information retrieval method. In the case of *Genome*, thesauri structures have proven to be the most effective representation of information for the purpose of retrieval (Chute, 2005). Nonetheless, in recent years other methods and approaches have been proposed that seek to expand the possibilities of indexing and consultation of documents, though without abandoning the use of MeSH (Bodenreider, Rindflesch and Burgun, 2002: 54).

Several of these proposals rely on the fact that most of the terms have several denominations. For example, phytomenadione is a synonym of vitamin K, and dihydroxyacetone phosphate is also know by the anagram DHAP. It is also common to see the use of apocope, such as *cocidioidosis* for coccidioidomycosis. Moreover, they may be acceptable alternate spellings of concepts (Zweigenbaum and Grabar, 2004). While a search is generally perform using only a single terms, this method enriches the search criteria with derivations and alternate names for the concept sought. When there are a variety of names for a given concept, this does not mean that one is deemed correct at the expense of others. In the field of genomics, for example, synonymous terms are used in distinct contextual situations. A text retrieved from a public health science journal is not the same as that retrieved from a genomic map of cancer published in a highly specialized journal. Both documents are scientific in nature, but their respective outlooks are quite distinct, and they are targeted at different readership and satisfy different informational needs. Similarly, an academic discussion in an article on ascorbic acid ($C_6H_8O_6$) is not the same thing as an informative blurb on vitamin C, even though the substance being discussed is the same chemical. Clearly, in such a case, the writers' respective purposes are very different.

The degree of specificity and the community are not the only criteria for distinguishing between the diverse uses of a term. BIREME [Latin America and Caribbean Center of Health Information], which was first founded in 1967 as the Regional Library of Medicine with the support of the World Health Organization (WHO), developed the Health Science Descriptors (HSD) based on MeSH, incorporating Spanish and Portuguese terms from the fields of homeopathy and sanitary oversight fields, as well as terms in English. This vocabulary supports the Virtual Health Library (VHL) and LILACS, which is the most important health index in Latin America and the Caribbean. There are communities, such as the Francophone, that do not choose to use medical headings and are more inclined to use names that diverge from those authorized by NLM. This happens in part because of the linguistic play of daily life and the adoption of the lexicon of the community. It is likely in such a case, that we would be speaking about folksonomies (Zweigenbaum *et al.*, 2003). For example, the *Catalogue et Index des Sites Médicaux de Langue Française* (CISMEF) uses MeSH and other vocabularies with metadata, which can exploit the rigor of the controlled vocabulary in conjunction with social cataloguing alternatives gathered from the community (Deacon, Smith and Tow, 2001). Some authors, such as Mary Rajathei David and Selvaraj Samuel, have proposed the Frequent Nearer Terms of the Domain (FNTD) designed by *PubMED*, as a method of retrieving information more efficiently. Such terms may or may not be authorized by NLM, and include derivations. The key criteria is that they are terms genuinely employed on a daily basis in the medical community (Rajathei David and Samuel, 2012: 20).

The editorial aim of *CISMEF* is to establish precise descriptions of documents largely on the basis of modified or improved of MeSH. It constantly explores new descriptive approaches for retrieval of medical information (Kerdelhué, 2007). Some *CISMEF* contributors, working in the University Hospital of Rouen and led by Magaly Douyère, have attempted to adapt the broader, more general medical terminology used on the internet, instead of first resorting to scientific articles in the MEDLINE bibliographic base data. As already stated, *CISMEF* employs two standard tools to organize information: MeSH and several subsets of Dublin Core metadata. The heterogeneous nature of online health information resources, however, led the *CISMEF* team to look for ways to improve MeSH, first by designing a random algorithm assigning certain values to semantic links (Névéol *et al.*, 2004), quite exhaus-

tive but insufficient; and then by introducing the concepts of resource type and meta-terms. A resource type describes the nature of the document, not only the topic, as it happens with key words and MeSH based qualifiers. A meta-term is often a broad term, such as the name of a discipline or medical treatment, offering semantic connections between MeSH and the types of resources. *CISMEF* offers simple and advanced search options. The simple search requires the user to enter a single term or expression. This is complemented by a complete text search. The advanced search option performs complex searches with a combination of Boolean operators emplyed with meta-terms, key words, alternate names and resource types. This approach combines two tools to perform the search, i.e., MeSH and the Dublin Core metadata format. As such, the documents are described jointly with the two tools. As such, documents are described with title, author or creator, topic, key words, description, editors, date, resource type, format, identifier and language (Darmoni *et al.*, 2001: 167).

Bundschus and colleagues at the University of Munich and the company Siemens have opted for the term meta-information, which they use to complement the information, instead of the explicit distinction between the types of resources and the meta-terms used in France. The question is that by enriching medical information systems by including new documents while indexing with MeSH terms, descriptions can be completed with this additional information: "This meta-information provides a rich source of knowledge that can be exploited in order to discover biomedical knowledge and data mining tasks" (Bundschus *et al.*, 2008: 11). Bundschus adds:

> The term/concept model discovers new information from a set of biomedical texts, including the extraction of the structure of the concept of a hidden topic, using all of the MeSH terms that concur within that subset […]. In contrast to standard topic models, in which the topics are represented exclusively by the most likely words, the topic-concept can be interpreted as a richer topic representations, especially by the link to MeSH concepts. As such, this enriched topic representation provides important additional information as a terminological ontology (Bundschus *et al.,* 2008: 18).

The Bundschus sciencometrics team has also explored applications such as extraction of statistical relationships between generic topics and MeSH terms for the purpose of automated extraction of information (Leydesdorff, Rotolo and Rafols, 2012). In accord with proposals that do not circumscribe searches to authorized terms, two Spanish research projects show that gene

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AcCoAS has nine alternate names in the biomedical literature, all of which are registered in the main human genome catalogue, the Online *Mendelian Inheritance in Man* (OMIM) as follows: CG9390, acetato-coenzima-A-ligasa, acetil-CoA sintetasa, acetil coa sintasa, Acetil CoA sintasa, acs, Acetil-CoA synthasa, Acetil CoA sintetasa, and best:-gh2840 (Galveza and Moya-Anegón, 2006: 345). On the basis of this example, the operation of the *CISMeF* proposal can be shown (*Figure 1*).
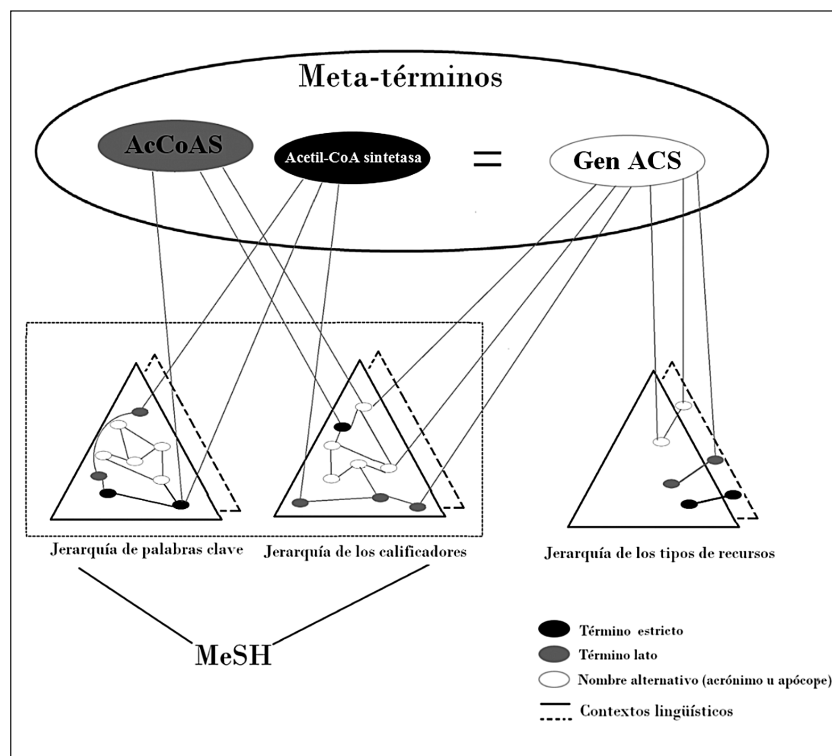
Figure 1. Exemplification of the functioning of CISMeF
Source: Douyère *et al.* (2004: 255)

CISMeF's efforts to renovate MeSH is not new. In the early years of the twenty-first century, the *Gesundheitsinformationsnetz Österreich* (Austrian Health Information Network, GIN), offered information to patients (identified as knowledge consumers), regarding not only preventive medicine, but also reliable medical information regarding illnesses, well-being and easily understood instructions for management of illness and access to information to better understand diagnoses. The system also provides specific data on

the Austrian health system and organizations. Even though the description by GIN were initially controlled by the MeSH thesaurus, it was observed that users often did use scientific terms and expressions to understand their diagnoses. For this reason, they tried to match colloquial terminology to the more rigorous terminology using the vectorial method, in such a way that users were able to use the information system (Göbel *et al.*, 2001: 242-244). Like the *CISMeF*, they used the informatics algorithm to perform automated searches, in this case the Floyd-Marshall algorithm.

Meanwhile, the Dutch researchers Radu Serban and Annette ten Teije (2009) favor the controlled vocabulary as an information representation and retrieval tool, believing that its structure should not be modified, nor should its specialized vocabulary be alternated with a more colloquial lexicon. In contrast, Edgar Meij and his group of archivists at the University of Amsterdam assert that the best method for retrieving information should be based on complex relationships of a controlled vocabulary. They hold that each descriptive record of a MeSH term must be equal to a document on that term (and not that a term be equal to a document or that it should retrieve several documents). With this idea, it would be inadmissible to discard an immense variety of alternate names for a term that are useful for the expansion of the methods of information retrieval and are more effective representation of a document than that supplied by MeSH alone (Meij *et al.*, 2005; Nelson, Johnson and Humphreys, 2001: 177).

In the case of a Swiss epistemic community, the particular terminology of a group of researchers is used, specifically that of the Swiss-Prot Group (a question that often concerns such communities). This research group alternates the use of MeSH with their particular terminology in order to make search more reliable (Mottaz, 2006: 18). More than ten years ago, Dieuwke Brand-de Heer adduced:

> […] MEDLINE certainly does not cover "the totality" of medical literature. Other data bases contain additional information; for example, Excerpta Medica also covers medical topics. Moreover, for some fields these alternative data bases behave better than MEDLINE, for example in pharmacology. There is also BIOSIS PREVIAS, which contains additional relevant information for doctors not included in MEDLINE (2001: 112).

The Slovenian specialist in medical literature Tomaz Bartol holds that the use of broader terms is useful, because it improves the retrieval of relevant

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documents. He recently performed a study on the information on herbal medicine, arguing that:

> In our study, we have placed special emphasis on the importance of the question of co-occurrence of different terms, especially descriptors, in the same document. This type of research generally entails descriptors based on a dictionary of synonyms, such as MeSH. The alternative terms and names hold meaning only in the "contexts of their use." The traditional classification systems, however, are often resistant to context. The indexation terms in thesauri are generally based on vast, rigid structures and predefined hierarchies, which do not always perform effective retrievals within a given topic area (Bartol, 2012: 286).

In accord with Meij, Bartol asserts the need to expand the horizons of searches by using controlled vocabularies and enriching their structure. Bartol provides the example of the term *dittany,* which in many data bases is conflated with the term *salvia.* According to Meiji and his team, using the term *dittany* would not retrieve the same documents that would otherwise be retrieved by the term *salvia*, despite the fact that both terms refer to the same plant. This is because these denominations denote distinct contexts and will bring back different documents ("each term for each document"). Bartol points out that it would be a mistake to tie both terms together in the description in order to ensure retrieval of the same document from a data base using either search term. Each search term should represent a distinct information need.

Unification of medical language

Little by little, the use of alternative names has influenced the structure of MeSH itself, and more so now that records contain not only medical headings as descriptions, but also alternative names. These description include notes on the scope of nomenclature, acronyms and references to names used previously. For several years, the National Library of Medicine has a linguistic tool working in addition to the medical topic headings. This tool is the Meta-thesaurus of the Unified Medical Language System (UMLS), in which other medical information systems also collaborate. As technology progresses, it is used to create new ways to index for the purpose of information retrieval. The Macro-thesaurus aims initially to be an ontology that integrates the knowledge of diverse thesauri and other sources. This done not in order to expand the search, but to specify the retrieval of information (Humphreys and Schuyler, 1993).

In this sense, Hassan, Htroy and Palombi (2010) propose two main approaches for representing the medical knowledge:

- Image based focus: classic atlas, informatics atlas and probabilistic atlas. These atlases provide a model for some organs and the labeling of these organs is often manual.
- Ontological based focus. An ontology is, by definition, a formal representation of a subset of concepts within a domain, in addition to the relationships among these concepts.

"An ontology is a formal specification of shared conceptualization." This definition was coined in 1998 by Studer, Benjamin and Fensel. Pastor Sánchez has taken it up again and provides the following exposition:

> The term conceptualization refers to an abstract model of concrete reality that is obtained by identifying the concepts relevant to the same. By explicit, we mean that the type of concept used and the restrictions of its use are explicitly defined. Formal refers to the fact that the ontology should be legible for the computer; and shared reflects the notion that an ontology captures knowledge that is not object of a single individual, but rather accepted by a group in a consensual way (2011: 20).

The Meta-thesaurus is only one of the tool of UMLS, which is also integrated by other tools such as Semantic Network and SPECIALIST Lexicon. The UMLS project has developed slowly. It attempts to combine three tools to achieve effective retrieval of information. The Meta-thesaurus is in charge of the concepts; SEMANTIC Network of the categories and relationships, and SPECIALIST Lexicon is in charge of the resources and tools (Kostoff *et al.*, 2004: 518). Meta-thesaurus began in 1988 and is constituted on the basis of automated versions of diverse thesauri and heading lists (in diverse languages other than English, including Spanish, French. Dutch, Italian, Japanese and Portuguese), codes and lists of controlled terms used in patient care, such as GIN, public health statistics and the indexation of biomedical literature. The terms in the Meta-thesaurus are organized by meaning, and they are assigned a unique concept identifier (with several associated lexical identifiers). All the original data of the source vocabulary, the definitions or written variants are organized. The MeSH has been limited by the delay in the adoption of new terminology. Meta-thesaurus, moreover, does not always incorporate the newest topics in a timely way. For this reason after 2004, the use of metadata by Meta-thesaurus produced a weighty change in the way documents are managed and NML formats (*Figure 2*).

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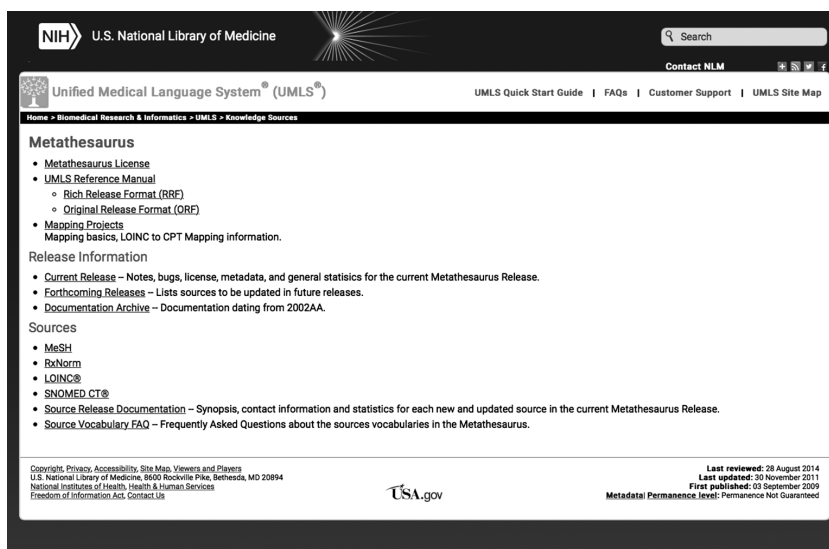
Figure 2. UMLS Meta-thesaurus Interface

In order to allow for the complex description that includes acronyms and abbreviations indexed in the *Systematized Nomenclature of Medicine*, UMLS developed the Rich Release Format (RRF) (Chute, 2005: 176). For complete retrieval of information of both MeSH terms and alternative names, better search strategies must be incorporated. Nonetheless, Meta-thesaurus has the merit of using metadata to provide a greater search scope, which with headings is insufficient. It has nearly forty labels, the most representative of which are the following table.

Table 1. Main labels in Rich Release Format (RRF)

Labels	Features
MRCONSO.RRF	Names, synonyms, terms, types of terms
MRREL.RRF	Semantic relations
MRFILES.RRF	All files of subset
MRHIER.RRF	Hierarchies
MRSAT.RRF	Attributes
MRDEF.RRF	Definitions
MRMAP.RRF	Assignations
MRSMAP.RRF	Simplified assignations
MRSTY.RRF	Semantic types (organisms, anatomical structures, biological functions, concepts and ideas)

These functions enrich the Meta-thesaurus. This is only one of the three UMLS tools. (*Figure 3*).
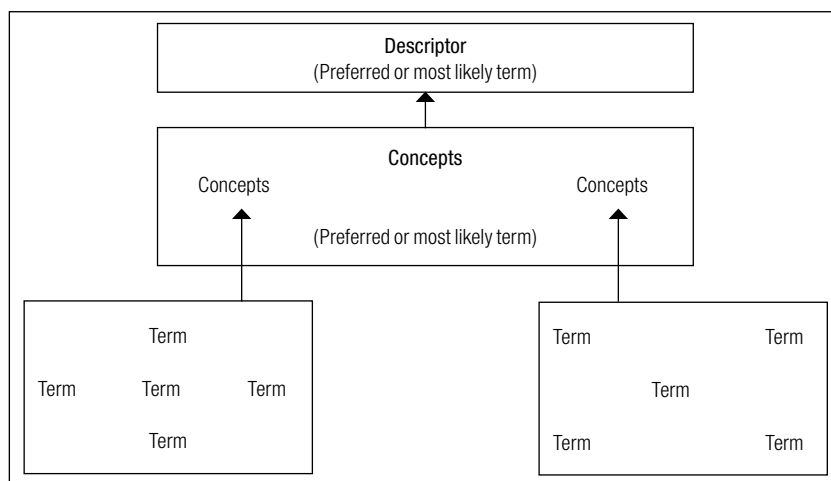
Figure 3. Operation of umls Meta-thesaurus search on the basis of metadata records and the relationships established between terms, concepts and descriptors.
Source: Mottaz, 2006: 8

From the perspective of informatics, Christopher Chute adds: "Previously, the UMLS process of formatting performed information transfer 'with losses.' The modern vision of UMLS is to become a definitive source and format for publication of the main biomedical terminologies, which is a significant advance" (2005:

176-177). This means that the pretension of unifying language by UML is not only a matter of terms, but also a question of improving the computational systems. UMLS have tried to establish an information exchange format for the medical area that little by little contributes to this end. Nonetheless, the most advanced projects is still the *CISMeF*:

> In *CISMeF*, resources are described using a set of metadata on the basis of a structured terminology that "encapsulates" the French language version of the MeSH thesaurus. Now the objective is to migrate the *CISMeF* terminology and, thereby, MeSH to a formal ontology in order to obtain a more powerful search tool (Soualmia, Golbreich and Darmoni, 2001: 1).

Currently, the particular terminology of *CISMeF* has been "formalized" on the Web Ontology Language (OWL), in its DL version, in contrast to the ontologized thesauri that are in the OWL-Full version.

Conclusions

Diverse cases across the international scenario point toward the need to expand the horizons of representation and retrieval of information. The structure of the controlled vocabularies should be complemented by other methods. Despite the general belief that the use of layman language brings back a list with an enormous number of results, the reality is that, in the area of health, the terminology can be very specific when discovering a document, and terms in the strict sense can very likely be retrieved. Finally, sooner or later, the thesaurus shall have be integrated fully with the semantic web, perhaps as onto-thesauri (if one wishes to view thesauri as ontologies). In genomic sciences and health, the combination of the semantic relationships of a thesaurus, a terminology alternative and the metadata and search engines would create a tool with unimaginable potential. This is an important endeavor for the field of Library Science research.

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Publishing output in the field of didactics of the Universidad Estatal a Distancia de Costa Rica: A diagnosis on the basis of the content model of industry

Jenny Teresita Guerra González *

Abstract

This paper analyzes the publishing output in the field of education at the *Universidad Estatal a Distancia de Costa Rica* (UNED), a public, distance-learning institution of higher education. Researchers examined the Written Didactic Materials Production Program (PROMADE by its Spanish-language acronym) using a methodology based on a digital convergence model. *Content industries* include all the output targeted for new information and communications technologies and digital convergence for the purpose of enhancing social inclusion. They also include the interactivity and mobility made possible by mobile phones, portable computers, tablets and other electronic devices.

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Keywords: Educational publishing, university publishing, content industries, Costa Rica

Resumen

La producción editorial didáctica de la Universidad Estatal a Distancia de Costa Rica: un diagnóstico a partir del modelo de industrias de contenidos
Jenny Teresita Guerra-González

En este artículo se analiza la producción editorial didáctica de la Universidad Estatal a Distancia de Costa Rica (UNED), institución pública que imparte enseñanza a nivel superior en la modalidad a distancia. Se estudia al Programa de Producción de Material Didáctico Escrito (PROMADE) a partir de una metodología basada en el modelo de industria de contenidos para la convergencia digital. Las *industrias de contenidos* comprenden toda la producción pensada para las nuevas tecnologías de la información y comunicación, la convergencia digital y plantean la inclusión social. Incluyen la interactividad y movilidad posibilitadas por celulares, computadoras portátiles, *tablets*, entre otros dispositivos electrónicos.

Palabras clave: Producción didáctica; Edición universitaria; Industrias de contenidos; Costa Rica.

The case study

The Distance University of Costa Rica (UNED) was created in 1977 on the basis of the educational models of the UNED of Spain and the Open University of Great Britain, in order to serve geographically dispersed populations who labor under significant time constraints.

The distance education model of the UNED entails three variables: the students, the teacher and the contents of knowledge. The student is the actor and main component; the teacher unfolds the individual figure of the traditional teacher in a subset of functions performed by various persons, such as academic editors and authors of the modular didactic units; and the contents mediate the relationship between student and the knowledge, which is why it

emphasizes the way they get in touch with the student (*Modelo Pedagógico…*, 2007: 28).

The UNED has four faculties: Exact and Natural Sciences, Business Administration; Pedagogy, and Social Sciences and Humanities. It also has a postgraduate studies department and forty-five university centers distributed throughout the country that are in charge of teaching tasks. The university centers are the gathering point for students enrolled in the distance learning methodology, and where administrative tasks are performed and other student services provided.

The teaching practice in this institution is oriented to facilitating searches, and processing and assimilation of new concepts by the student. According to current trends in distance learning, the student-teacher interaction is characterized by the transformations described below:

a) A change from the "one professor to many students" scheme to a scheme of "one student to many professors"; in which the professors serve as diverse and dispersed sources of knowledge and orientation.

b) An intensification of interdisciplinary work and teamwork in the functions of the distance learning teacher, which entails academic planning, design and production of modular didactic units, facilitation of learning process, and evaluation and self-regulation of learning.

c) Effective coordination of the actors in charge of the diverse actions associated with the design and production of modular didactic units, supported by pedagogical experts and epistemological principles.

The Modular Didactics Units (MDU), defined as "the basic print materials that develop the fundamental concepts of each course and whose didactic elements are oriented to helping the student learn to learn" (Lobo Solera and Fallas Araya, 2008: 63. Italics are in the original), was the watershed for the creation in May 1977 of the first UNED Office of Publications and in 1979 of the Publishing Department of the National State Distance University of Costa Rica (EUNED), oriented toward the publication of institutional text books. For 35 years, the EUNED has managed the editorial line of the institution to which it belongs and also publishes its own brand of books. Moreover, it is one of four university publishing concerns in the country.

The production of didactic materials

The production of didactic materials in UNED can be traced to 1977, when text books were published for five basic courses. During this early phase (August 1977- February 1978) the first editorial regulatory documents were issued by the university. These regulations remained in place for the next two decades. These documents include the Didactic Units Drafting Contract, Regulations for Selecting Authors and the Methodological Instruction Manual, the first guide for authors in the institutions.

In August 1979 the Academic Production Office, later renamed the Didactic Materials Production Office, was created. This office belongs to the Academic Vice-Rector's Office, which is in charge of planning, implementing, articulating and evaluating the tasks associated with the processes of teaching and learning in the UNED.[1]

Currently, DPMD groups five programs: 1) The Written Didactic Material Production Program (PROMADE); 2) Audiovisual Didactic Material Production Program; 3) Electronic Multimedia Production Program; 4) Videoconference and Audiogram Program; and 5) Online Learning Program. These programs justify the actions of the 2011-2015 work program, which contemplates six lines of actions:

1) Creation of an Editorial Board of Didactic Materials;
2) Project Management System;
3) Reorganization;
4) About the PROMADE-Editorial Direction Office Relationship;
5) Integrated Platforms for Producing and Distribution of Online Contents, and
6) Educational Radio and Television (Muiños Gual, 2011: 1-10).

Of the five programs ascribed to the DPMD we will focus on Written Didactic Material Production Program (PROMADE), whose output bears the EUNED editorial seal, in addition to the works it publishes, and magazines and other publications which will not be discussed in this paper.

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1   Universidad Estatal a Distancia de Costa Rica, http://estatico.uned.ac.cr/academica/objeti-vos.shtml

The Written Didactic Material Production Program (PROMADE) has a coordinator and twenty professional academic editors. These professionals cover the academic offerings of the four UNED faculties and the National Distance Learning College (CONED) that offers high school studies. The academic editors[2] oversee the quality of the materials by means of an appropriate academic mediation that encourages autonomous, self-regulated and -directed learning. Since its foundation in UNED, PROMADE has been a hub for the production of those texts that are the main object of didactic consumption by the university students. Because of their quality, relevance and actuality, the didactic contents of the materials produced by PROMADE are in high demand in the public and private institutions of middle and higher learning in the country.

The work of PROMADE operates on the basis of:

> [T]he academic publishing, above all, fulfills the function of incubators and creators of work that ultimately shall reach the hands of students. The seed of all didactic units lies in the curricular design, the basic plan that guides the production of the material (whether a book, a manual, anthology or study guide) and which must be met in all aspects of content, methodology, quality and depth. The academic editors take this work plan as the starting point and accompany the author during the process of transforming the design of the academic work. ("Presentación del Programa…", 2012)

In contrast to the other materials for didactic purposes published by university publishing departments in Latin America and the rest of the world, the production process of the Modular Didactic Unit evidences a set of complex associations between the academy, evaluation diligences and editorial tasks. The process initiates with the creation of the academic major by the Office of the Academic Vice Rector. Then the curricular design is executed in the Curricular Support and Learning Evaluation Program (PACE), which works on

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2 The academic editors are the coordinators of the production teams and are in charge of ensuring compliance of the didactic mediation in every dimension of the editorial process.
  The academic editors are the first readers and critics of the work. They propose changes in terms of structure, expanding or narrowing the topics and contents, inclusion of complementary activities and self-evaluations, resources for calling the attention of students, reading breaks, and metaphors and visual iconography. The final objective is the creation of a didactic reading environment with tools to facilitate self-regulated learning of students who study in the distance learning program.
  Once the preliminary draft is ready, the editor takes it through the evaluation and validation process, which entails incorporation of corrections and winding up all materials to be included in the final version. Only when the work is ready to be placed on the book shelves of bookstores and/or distributed by the respective institutional office has the editor concluded his duties.

it with a specialist and the faculty.[3] When it is approved and delivered to the class professor, he or she goes to PROMADE with a Production Application.[4]

In PROMADE, the Coordination Office selects an academic editor, who brings together the work team to introduce the process and instructs the authors to draft the Global Plan (proposal of contents regarding the curricular design of a course, including the compliance program). On the basis of this review and approval of the Global Plan, the authors begins to draft the text. After they deliver every chapter, the academic editor asks the other team members to make observations of the draft in accord with their respective areas of expertise. This feedback is the pillar of the process, in that for each chapter the specialist, the titular professor, the program heads and academic editor deliver observations that the authors should contemplate and/or incorporate into subsequent drafts.

After this review, the entire team of authors and academic editors continue to perfect each chapter, resubmitting the improved drafts until the objectives traced out by the Global Plan are met. After this, the style correction is performed by a member of the PROMADE philology team. The Coordination gives its approval to this preliminary version[5] is distributed for validation to the academic and student community. Once the preliminary version is validated, the layout and design of the Modular Didactic Unit is executed. The process concludes with the official delivery of the new didactic unit to the university community. The Academic Production Process performed in PROMADE is done in accord with the following flowchart and the "Guidelines for Production of Didactic Materials" proposed in August 2011.[6]

3   PACE is the agency that provides systematic guidance in matters of curricula and evaluation of learning and extension programs in both undergrad and postgrad programs of UNED. Among its duties, we find: "evaluation of the use, management and relevance of the didactic means applied in the teaching and learning processes of the university" (Programa de Apoyo…, 2012).
4   The Production Application submitted to PROMADE is a format implemented 35 years ago, over which time it has been progressively polished. It now contains eight parts: data on the material requested; data of authors; data of specialists (only for didactic units); teaching data; general information of the programs that use the material; application authorization data; and data needed for internal uses of PROMADE. According to the Program Coordinator, the Production Application "is for a better organization of work and to see how our production behaves in general" (Gustavo Hernández Castro, interviewed by author, July 2012, San José de Costa Rica).
5   A preliminary version of a Modular Didactic Unit is a draft done in Word. This draft is subjected to the validation process. For this purpose only enough copies are made for use in the four-month course. It is sent to the Office of Distribution and Sales (OFIDIVE) of the university in PDF for printing. It is not for sale.
6   In 2011, the Coordinator of the Written Didactic Materials Program issued the: "Guidelines of Producing Didactic Materials," which gathers all of the recommendations established for producing written didactic materials. In order to facilitate the identification of the area of application, they were organized in accord with the type of didactic materials to which they refer.

GREEN LIGHT FROM THE COORDINATION
CP approves preliminary draft of the DU by signing off on the "OFIDIVE didactic materials control form.

PUBLICATION PROOF
AE delivers the printed first draft to AA and the digitized version of the DU to begin process of printing and distribution.

FINAL ADJUSTMENTS
AE incorporates final observations to the preliminary draft of the DU.

FINAL READING (COORDINATION)
PC reads the entire first draft of the DU.

REVISION AND ADJUSTMENTS
AE performs final reading and makes needed corrections before delivery for printing.

PAYMENT PROCESS
AE requests AA to process payments to Author, Philologist and Specialist.

APPROVAL
AE receives Green lights from PE, EC, ES, AE, Author and Philologist of the final version of the first chapter and issues memo stating satisfaction.

ADJUSTMENT
AE incorporate observations made by PC.

CONTRACT WITH AUTHOR
EA and the AA process the request to draft the contract with the author.

SPECIALIST APPLICATION
With AA, AE processes the specialist price quote application in order to complete the documentation required for payment.

ASSIGNATION
PC meets with assigned philologist and delivers first chapter for correction.

REVISION
Philologist revises draft of first chapter.

ANALYSIS AND ADJUSTMENT
AE analyzes and incorporates philological observations.

CONTROL
PC revises first chapter after philological correction included.

VERIFICATION
CE, SE, PE and AE revise the first chapter corrected by the author to ensure observations have been duly incorporated.

CORRECTION
Author incorporates observations to the first chapter.

ANALYSIS
AE meets with PE, CE, SE and Author to analyze observations made on first chapter.

AUTHOR'S GREEN LIGHT
PE, CE, SE and AE ensure continuation of recommended author on the basis of the first chapter report.

READING
PE, EC, ES and AE issue written report on first chapter draft.

DRAFTING
Author drafts first chapter.

ASSIGNATION
The academic editor (EA) reviews and analyzes the production assignation submitted by the administrative assistant (AA).

INDUCTION
The AE induction meeting held with PE and EC and SE to establish Global Plan application to the Author and terms of the contract with the Specialist.

PROPOSAL
Author drafts Global Plan.

READING
PE, EC, ES and AE issue criteria for Global Plan.

CORRECTION
Author incorporates changes to Global Plan on the basis of criteria issued by PE, EC, ES and AE.

APPROVAL
PE, EC, ES and AE issues approval of the Global Plan modified by Author.

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This instrument is complemented by the "Description of the Academic Production Process of PROMADE," which synthesizes the number and sequences of activities, steps, duties, business days, observations and documentations entailed in the process. Finally, it is emphasized that 96 is the average number of business days needed to publish the first chapter of a Modular Didactic Unit; 55 is the number of business days to produce each chapter after the second chapter; 24 is the number of steps that demand time in business days and 17 months, or 371 business days, is the estimated time of production for a Modular Didactic Unit of six chapters or 360 pages.

In Latin America there are very few university publishing departments or programs that have standardized editorial processes beyond the adoption of simply editorial policies. PROMADE is one of these few exceptions. During the last stage of establishment of the program coordination, the Didactic Units Production Systematization and Standardization Commission was established. Between mid-2011 and April 2012, this commission produced the following instruments regarding the reception of documents, author and specialists contracts, and payment paperwork, among others:[7]

- Hiring of authors and reception of associated documents.
- Document reception procedures and specialist payment processing.
- Data entry and registration of active production (RPA).

7   These documents were updated in April 2013, but continue to be modified.

- Delivery of Academic Materials to the Office of Distribution and Sales.[8]
- Drafting and update of the positions for PROMADE. Two are formats that sustain this practice: the functional questionnaires of the jobs in PROMADE and the descriptive systemization sheet of the job positions in PROMADE.
- Management of Classified Print Information. The preparation of this material is based on the *General Internal Control Act* (Law No. 8292*); the Manual of general standards for public sector auditing* (M-2-2006-CO-DFOE); *the Manual for the performance of audits in agencies and organs subject to oversight of the General Controller of the Republic (*approved by the UNED University Board on May 16, 1986*)* and the *Internal audit regulations* (approved by the UNED University Board on October 30, 1986).

Since the PROMADE is an office of the Didactic Materials Production Directorate (DPMD), it is also subject to the general dispositions of this dependency, which entails its coordinator serving on the Commission of Research of the Didactic Materials Production Directorate (COMI-DPMD). This commission, created in June 2011 is charged with generating research proposals associated with its functions as a Directorate and linked to the work of its five programs. These proposals must be situated in some of the lines of research defined by the Research Vice-Rectory of the University. The importance of the production of Modular Didactic Units (MDU) as instruments of dissemination of knowledge with the EUNED seal was highlighted in *2005-2011 Final Management Report* of the Publishing Directorate. From 2005 to 2010, the executive director reported that, 2,534 Modular Didactic Units (titles) were produced, which is equal to 1,166,431 printings and 592,790,717 million pages. The printing of this body of material was achieved at a cost of 2,102, 742, 028.18 colons, accounting for 69.35% of the total income of EUNED. The MDU accounted for 83.14 % of the total editorial output catalogued as "books" during this period.[9] The aforementioned report also stated that books were the most expensive productions at 9.66 colons per page, while

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8 In August 1977, UNED the Operations Directorate, which eventually became the Office of Distribution and Sales (OFIDIVE) of the university. This office pursues two general objects: 1) efficiently meet schedule of distribution to university centers over the entire year; 2) generate revenue through the sale of books and audiovisual material. The office distributes materials to the students enrolled in the university. Once students have paid the enrollment or reenrollment fee in the central office or university center nearest their home or work, they receive their course materials (didactic units, multimedia, audiovisuals, etc.)

9 The editorial production of UNED is comprised of: Books (Modular Didactic Units, catalogue books, other books) and other materials (student material, journals and other printed materials).

magazines cost of 8.03 colons per page. Meanwhile, Modular Didactic Units cost 3.55 per page (Muiños Gual, 2011: 4, 14).

Moreover, the *Report on the Work of the Didactic Materials Production Directorate* for the period of July 2011 to July 2012 and *Action Proposals* to 2015 (Román, 2012: 6) highlight the fact that PROMADE is still the center of attention of didactic production in UNED; since to June 2013, the number of productions requested through this program by schools in contrast to the remaining fours was that which is shown in *Table 1.*

Table 1. Number of productions requested by school to each of
the five didactic material production programs.

School	PROMADE	Online learning program	Audiovisual material production program (production hours)	Electronic multimedia production program	Videoconference and videography program	Total per school
Business Admin School	82	49	0.0	0	21	152. 0
Educational Science School	24	258	9.5	8	17	316. 5
School of Exact and Natural Science	130	439	124	14	27	734
School of Social Sciences And Humanities	79	354	14.8	11	42	500.8
Total per program	365 [*sic*]	1 100	148	33	107	1 753

Since 2009, the DPMD issues a statistical analysis of the supply of didactic materials supporting the Academic Program (PAC), allowing one to predict the demand for didactic materials in a given term or school year. The aspects taken into account are: 1) Academic offerings of the PAC in course; 2) Registry of Active Productions in the Registry of Active Productions Program (RPA) for the National Distance Education College (CONED), and 3) Registry of productions in the RPA for the Postgraduate Studies Systems.

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After 2012, a new tool was added to help more efficiently control the didactic materials ordered by the UNED School and the Faculty. This tool is the Didactic Materials Production Sheet. The Sheet analyzes the orders submitted by more than 90 heads of faculty offices of the institution using Excel spreadsheets. The program consists of two parts: the first shows graphs of each program of the DPMD, and the second shows a line that represents all of the services demanded by a specific course. The Faculty Directors, the DPMD Director, and the heads of the five programs of the Academic Vice-Rector's Office all have access to this tool. The Sheet, however, does not gather everything each program does, because they are not integrated into the SEP, CONED, the Extended Learning Directorate, Language Center, University Agenda and Youth Agenda, which are offices that also submit requests to the Directorate.

In the section of PROMADE of the July 2011-July 2012 *Report on the Work of the Didactic Materials Production Directorate and Action Proposals to 2015* mentions that as of June 2012 the Program was working to conclude the following works:

- *The Manual of Administrative Procedures* in accord with the requirements of Internal Control and International Quality Standards (ISO).
- *Module of the Publication Standards Manual (style manual) and Module on Typography and Ortho-typography*, the latter of which is currently in the validation and consultation stage in the university community (Román González, 2012: 6).

Methodology

University publishing can be thought of as a cultural industry, cultural field, creative industry and content industry. In this paper, we discuss university publishing as a content industry. The content industries comprise productions borne of new information and communications technologies and digital convergences, while asserting the values of social inclusion. That is, they entail new business models, such as multimedia conglomerates[10], new tech-

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10 Multimedia conglomerates are the result of mergers of and strategic alliances among companies headquartered in diverse countries and devoted to cultural products, information and entertainment. One of the fundamental features of these media groups is that they went from being instruments of the State and capitalist groups to imposing their own political and economic agenda. The interested reader can consult Guerra González (2009).

nological structures, new languages for these digital media, new ways of interacting with diverse audiences and new professionals called new cultural intermediaries, who trained to attend to these new demands.[11]

The content industries are planned and developed without regard to time, space or geographic location. They include interactivity and mobility made possible by mobile telephony, portable computers and tablets, etc. Said subset of actions occurs in the editorial field with the publication of texts in specialized websites, the concentration via email of copyright sales, diversified formats, such as eBook, ePub, and on demand printing and marketing in social networks. The communication and journalism expert Cosette Castro has stated: "that which marks the defense of this category is the possibility of citizen participation, and the immense amount of information that the inhabitants of the orb may receive on a daily basis (other than what they receive in print and audiovisual media)" (Castro, 2008: 15-18).

The content industry category is worked in detailed by specialists in Economy of Culture, a sector of the economy devoted to defining policies and strategies for products that have both economic potential and symbolic value (messages, identity and values). Economy of Culture studies the generation of intellectual property and copyright, which are fundamental elements in the business of books and subsidiary rights.[12] Worldwide, it is a core discipline in the Management and Development of Culture. It has been studied and applied in Latin America by Xavier Huamayave, Ernesto Piedras Feria,

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11 The new socio-economic conditions emerging in the last decade of the twentieth century compelled a shift in cultural processes such as publishing within the context of a market, requiring analysis of new concepts and explicative frameworks. At the end of the 1990s, American researcher Mike Featherstone reexamines Bourdain´s category of cultural intermediaries, using the prefix "neo," to describe the subset of new professions linked to symbolic production in the late capitalist era and the context of the social transformations associated with the crisis in the Welfare State, new political movements, and the idea of the market as the sole regulator of daily life, and the emergence of what authors such as Chilean Oscar McClure and the Spaniard Ludolfo call the new middle classes.
The cultural are agents that make information circulate rapidly between areas of culture that were once closed off (cultural fields). In a society with a propensity for consuming symbolic merchandise, where taste and discriminating preference are the order of the day, the capital of knowledge or culture enables groups of persons to understand and classify the new goods appropriately and show how they are used to wide array of audiences and consumers (Featherstone, 2002: 55-56). In the spectrum of commercial publishing, these new cultural intermediaries are individuals and institutions that condition and direct the supply of publications to be consumed. They are the emerging actors in the chain of book production, such as literary agents, translators, content digitization companies, digital libraries, graphic artists, institutional buyers, etc.
12 Subsidiary rights accrue from the sale of the contents and even the personages of cultural products to filmmakers, publishers of popular books, book clubs, foreign editions and manufacturer of such things as tee-shirts, posters, mugs and greeting cards (Cole, 2003: 113).

Néstor García Canclini and Ana Carla Fonseca. The analysis of the economic dimensions of culture entails two contradictory points of view. The first is linked to the market and holds that despite their particularities, they share many features with industries in other economic sectors and should be treated similarly. The second perspective, aligned with the defense of public management of art and culture, assumes that despite its economic dimensions this sector cannot be treated like any other, because it has social and human repercussions that should take precedence over pecuniary considerations.

The view that culture is the heritage of humanity resides in this conception and is in line with the tasks of the public university.[13] For content industries that exist in the digital convergence, cultural economists employ the following indicators: 1. Knowledge; 2. Immediacy; 3. Digitalization; 4. Virtualization; 5. Disintermediation; 6. Network interconnection; 7. Innovation and 8. New roles of actors.

By using this methodology, the following questions are answered:

a) What is the impact of the knowledge produced and/or disseminated in UNED in view of its originality, target audience, type (academic or scientific), nature (public or private), etc.?
b) Which editorial process in UNED offers the value of immediacy?
c) How is digitalization assumed in the case of selected study with regard to hardware, software, specialized human resources, types of digital publications, presence of retro/digitalization, diversification of contents and rights of use in diverse media?

The methodology employed is qualitative in nature and reveals the institutional dynamics of the editorial program that despite being educational in nature nonetheless is influenced by what occurs in the global publishing system. In this way, we shall describe the value to be qualified, and details of how it is assumed in PROMADE as follows:

Knowledge Indicator

According to María Alejandra Tejeda Gómez, some of the criteria used to quantify the impact of knowledge are:

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13 Data base of the Asociación de Gestores y Técnicos Culturales de la Comunidad de Madrid, http://www.agetec.org/ageteca/economia.htm

- Is the knowledge is produced or reproduced?
- For whom is the knowledge produced?
- Is the knowledge academic or scientific?
- Public or private?
- Local or national?
- Regional or global?
- Is the knowledge democratized (Open access) or restricted (copyright)? (Tejeda Gómez, 2009: 305)

According to these criteria it can be said that the knowledge generated in PROMADE under the EUNED seal is "original," since it is developed at the request of an academic department in accord with the needs to develop curriculum. Moreover, its validity and relevance for students enrolled in the State Distance University is corroborated institutionally by means of two assessment instruments. Using the first of these, PROMADE assesses students' use of the didactic print material in order to improve the didactic proposals in accord with the pedagogical model of the UNED. The second assessment has the tutor assess the written didactic materials. The information obtained is confidential and for the exclusive use of the institution.

Owing to copyright restrictions, less than 5% of the material produced by PROMADE is available free online through the platform of didactic resources (http://recdidacticos.uned. ac.cr/). The sale price to the public of the Modular Didactic Units, however, is only about 10,000 colons, or approximately 20 USD[14], which encourages readers to purchase them, thereby promoting the democratization of knowledge.

The sale price of the Modular Didactic Units is set on the basis of costs edition, printing, distribution and copyright. On the basis of these factors a multiple is established that provides a profit of 1.75%, which is practically negligible. The outlays made by UNED are covered by state subsidy.

Immediacy Indicator

In the traditional economy, a new invention can ensure a revenue stream for decades. In the new economy, immediacy is a fundamental property that

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14 The discount prices for a didactic text for higher education published by a commercial publishing house is about 17,000 colons, or 34 USD.

generates competence and supply of new services in all sectors, whether in the field of communication or medicine. As the internet has modified the relationships of persons and companies by facilitating the immediate exchange of knowledge and services, obsolescence is the variable to be avoided. In the field of book publishing for the educational market, such as the Modular Didactic Units of PROMADE, the drafting and constant updating of books is an ongoing effort to prevent obsolete materials from reaching students' hands. For this purpose, control tools have been designed such as the previously discussed Didactic Materials Production Sheet. These are used with statistical analytic software to manage academic editorial production.

In this line of thought, it is crucial to strengthen the Didactic Resources Portal in order to potentiate immediacy of the academic contents of the Program. It becomes indispensable to keep the contents of said online platform up to date so that they can be consulted easily by both students of the UNED and the public not affiliated with the university. The initiative has not yet begun to materialize, because the Program's publishing contract still does not provide for dissemination of partial or complete works in diverse supports. *The July 2011-July 2012 Report on the Work of the Didactic Materials Production Directorate and Action Proposals to 2015* sets the following objective:

> *The existing contractual paradigm with authors at UNED must be changed.* Currently there is a single contract format for commissioning work that limits PROMADE and the Academy from receiving contents written by authors in accord with work schedules and from using the contents written by authors. For example, an author who writes four chapters of a total of six and then decides not to finish the remaining two currently bars PROMADE from using the four existing chapters even though they are paid for in full. To address such problem, the following contract options should be employed in addition to the currently existing commission contracts: a) Content acquisition contracts, which currently exist; and b) Joint authorship contracts.

Digitalization Indicator

Previously, analogical, physically supported information required people to move to conference rooms. It required the use of cash and checks. Information was broadcast over analogue television and radio signals, and analogue telephone line. It also required the use of standard mail services to send letters and hard copies of files, etc. In the new economy, text, image and audio files are digital. Meetings are held virtually. Checks and cash have been substituted by credit cards and online payment services such as PayPal.

The field of publishing now has two types of digital publications: the first group entails reproduction of print material in image format. This is done using programs such as Adobe Acrobat (PDF files), which allow editors and booksellers to offer the buyers a product that is identical to the original hard copy book or magazine on an electronic support such as laptop screen or tablet.

This system offers the advantage of retro-digitalization, a process that uses an optical scanner to digitize the hard copy original and thereby preserve it partially or completely for subsequent commercial sale or dissemination through diverse digital channels.

The second group of publications arises from the new functions of emerging software and reading supports. This group includes materials that can be viewed on portable devices such as electronic books. The Didactic Materials Portal of the Didactic Materials Production Directorate exemplifies the effort to releases digitized materials under the UNED stamp. This system publishes texts in PDF, SWF and EPub formats. To march 2014, this portal hosts 129 documents dealing with topics of 13 disciplines. It also hosts one preliminary version of a Modular Didactic Unit and nine reference books, in addition to the production of the other four DPMD programs.

Digitization allows low demand printing of magazines, books and institutional paperwork, which reduces overhead. The *2005-2011 Final Management Report of the Publishing Directorate* (Muiños Gual, 2011: 27) highlights the comparative advantages of low-demand digital publishing over offset printing as follows:

a) This allows changes to be made in contents from one run to another without incurring costs of materials, thereby enhancing ongoing efforts to test didactic materials and keep them up to date.
b) This prevents the accumulation of inventory and lowers the risk of losses due to obsolescence.
c) Online digital printing technologies allow printing, pagination, folding and binding of books and pamphlets to be performed from a single workstation.
d) It is an environmentally clean, friendly technology.

During the period of 2005 to 2010, UNED invested 371, 133, 948.00 colons (approximately USD 743, 000.00) in the acquisition of digital printing technologies. After a period of two years of operation in which the efficiency

of the equipment acquired was analyzed, the following elements were put into place: 1) a sustainable didactic materials production strategy that takes into account five variables: print run, use of color, production capacity, number of pages and service life of the materials; and 2) institutional production policies (Muiños Gual, 2011: 30-31). This investment also allows UNED to commercialize the services of its print shop to outside parties.

For the period 2011-2014, EUNED proposed an investment plan in this area within the framework of the loan[15] extended by the Inter-American Development Bank (IDB) to the National Board of Rectors (CONARE) and the member universities. In accord with projections of its general director, the economic injection of the black and white printing, scanners for prepress and publishing, management and production software, and photographic camera would place the UNED and its print shop at the forefront of publishing in Costa Rica (Muiños Gual, 2011: 61).

For its part, DPMD made renewal of technological equipment a priority in its *July 2011-July 2012 Report on the Work of the Didactic Materials Production Directorate and Action Proposals to 2015.*

> In the last five years, PROMADE has been allocated second hand equipment from PEM and PAL. The donation application was filed on February 16, 2012 with the Academic and Executive Vice Rectories. With this change, the academy would be strengthened by: 1) online interaction with publishing programs that allow real/time communication with content authors; 2) upgrading of online didactic materials with0ut need of incurring overhead of hardcopy printing.
> The renewal of equipment has also allowed PROMADE, DPMD and the institution to launch a specialized digital magazine that serve as a meeting point and systemization of more than 30 years of experience in the production of didactic materials. Using these spaces for reflection, today universities around the world are strengthening their academic publishing initiatives. (Román González, 2012: 6)

The publishing of eBooks is still pending because the university has not resolved certain legal hurdles regarding copyright. Because the project was ap-

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15 In 2009 CONARE presented the Higher Education Improvement Project to members of the executive cabinet. The project contemplates and agreement with the World Bank to secure financing for 200 million USD to be distributed equally among four participating universities and to support the following areas: 1) expansion of student enrollment and classroom capacity in high-demand majors; 2) reinforcing the scientific-technological capacities and expanding physical infrastructure, equipment, grants to professors and expansion of student services, including residences. These goals are directly associated with the National State University Higher Education Plan for 2011-2015.

proved by the University Board in 2011; however, training of UNED, PROMADE and OFIDIVE personnel in this area was begun in August 2012 through the auspices of Latin American companies such as Versal headquartered in Mexico.

Virtualization Indicator

Virtualization allows the virtual extension of the institution for the purpose of dissemination, promotion and commercialization of its products and services. This facet is contemplated by PROMADE and the EUNED in the figure of the virtual book store which is designing the internet sales area of OFIDIVE. Originally scheduled to launch sales of hard copy books in the second half of 2013 and expand into sales of eBooks in 2015, by May 2014 the launch of both modalities was still pending because of unresolved legal and technological problems.

Disintermediation Indicator

Several intermediation functions in the digital network have disappeared. The main break is in the area of distribution, which was traditionally controlled by large companies (gatekeepers[16]) that for many sectors created a bottleneck between products and the market. With the development of the internet, new, smaller companies and institutions leap over traditional distribution channels. That which was at first a strategic sales advantage for large companies is now their main liability, because they are forced to keep up diverse, costly distribution channels that no longer provide control of the market. In contrast, new companies emerging in the internet age are able to distribute without fixed structures and at low cost (Casani, Rodríguez-Pomeda and Sánchez, 2012: 56).

The disintermediation of PROMADE materials is limited. It continues to distribute its materials through traditional channels such as physical libraries. In addition to the distribution among enrolled students, OFIDIVE distributes in its own bookstores run by the Library Supervision Office, and administration bookshops of the university centers and private commercial bookstores. This work is performed by the Sales Promoter.

OFIDIVE runs the following our bookstores: Mercedes de Montes de Oca, San José Centro, Heredia Centro and Cartago Centro. There is a fifth book-

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16 An analysis of university editors in the role of guardians of knowledge can be found in McGinty (1999).

store that operates under the terms of an agreement with the Ministry of Public Works and Transportation. This store sells the *Driver's Manual, the Public Transportation Manual,* and *the Driver's Manual in CD* and other books from the catalogue. These establishments are staffed by a manager and two employees. The manager reports directly to the supervisor of Bookstores by means of a billing system that is updated on a daily basis.

It is important to point out that the university bookstores not only sell books and magazines published by UNED, but also books and magazines published by other universities and publishers. Owing to the exponential growth of its collection,[17] the space devoted to exhibition of external materials has been reduced. Currently, these bookstores offer external books on a consignment basis, provided they have good turnover rates.

The second type, i.e., administration bookstores in university centers, consist of one in Cañas (Guanacaste) and another in Alajuela. These bookstore are equipped with administrative personnel and exhibition space of 20 x 25 m. They sell books exclusively on a consignment basis and receive management advice from OFDIVE through the Bookstore Management Office. In the medium term, this strategy aims to implement the regionalization plan of the university editorial collection.

One of the obstacles OFDIVE has encountered in the past with regard to commercialization of its materials is the legal apparatus of UNED, which does not allow credit to be extended to interested buyers. To attenuate this snag, bulk sales to and purchases from foreign parties are transacted through the State Distance University Foundation for Development and Promotion of Distance Learning (FUNDEPREDI), whose mission is to "facilitate the management and search for funding to promote the development of research, teaching, extended learning and supply of services associated with UNED activities."[18] The paperwork entailed in purchasing and sending packages abroad through the intermediation of the Foundation[19] requires about 15 business days. Packages are sent by the national postal service of

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17 The catalogue of EUNED bookstores contains active 1,180 titles.

18 Fundación de la Universidad Estatal a Distancia para el Desarrollo y Promoción de la Educación a Distancia, http://fundepredi.org/Quienes-Somos.html

19 In addition to UNED, three other Costa Rican State universities sell published materials through the auspices of their respective foundations. The National University operates the Foundation for Academic Development (FUNDANA); the UCR operates the Costa Rican Research Foundation (FUNDEVI) and the Costa Rican Technological Institute runs the Technological Foundation of Costa Rica (FUNDATEC).

Costa Rica or DHL. Individual purchases by foreign customers are handled immediately through the company Mall506,[20] a Costa Rican consortium that rents virtual spaces to third parties for commercial, promotional and other activities.

For wholesale transactions within Costa Rica, OFIDIVE works in conjunction with the University Treasury Office's Credit and Collection Unit, which is authorized to extend credit for and collect monies from the sale of books. The line of credit is adjusted to the needs of the client and can be authorized for terms of 8, 15 and 30 days. OFIDIVE uses three payment modalities: cash, credit and consignment. Despite this apparent flexibility, the Bookstore Supervisor points out that: "…the discount cap in accord with statute is 30%. Larger discounts can be made, but these must be requested at a level above OFIDIVE, such as the Vice Rector's Office."[21]

The rules in UNED governing the commercialization of internally and externally published materials are provided in the *Regulations for the Sale of Materials Produced or Acquired by UNED*, which was approved by the University Board on May 31, 2011. Article Ten of this regulation referring to discounts was modified on July 11, 2003. These regulation includes *the Procedures for Credit and Collection of Materials Produced or Acquired by UNED* (June 17, 2000), which is implemented by the Credit and Collections Unit of the University Treasury Office.

OFIDIVE works on the basis of a five-year plan and a budget allocated annually in accord with the needs detected in its diverse areas. It does not have a marketing department. It is tasked with the job of purchasing books requested by the Academy, which because of time or intellectual resource constraints cannot be produced by PROMADE.

Indicators appearing in the *2005-2011 Term Management Report of the Editorial Directorate* (Muiños Gual, 2011: 19) show that from 2007 to 2008 the purchase of books increased from 322 608 948.21 colones to 454 953 067.44 colons, respectively; while in 2009 forty external books and only eleven Modular Didactic Units were added to the catalogue. OFIDIVE observes that three quarters of EUNED's time and that of its functionaries are devoted to supplying the demand of the student population. The movement of cata-

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20   Mall506, http://www.mall506.com/uned/index.php
21   Author interview with Erick Escalante in August 2012, San José de Costa Rica.

logue text books in correlation with the Modular Didactic Units is exclusively 25%. The MDUs in Exact Sciences are the biggest sellers because they are required of students enrolled in the National University, the University of Costa Rica and other private universities in the country.

Network interconnection indicator

PROMADE does not have social networks. As such, the so called "integration interconnection," defined by the set of production and consumption function of the participants (Casani et al., 2012: 60), is still in diapers in this publishing program. One of the direct causes of this situation is the institutional control of information in diverse UNED dependencies, schools and programs, requiring all information to be disseminated through the network to be reviewed and approved by the Institutional Office of Marketing and Communication and the Directorate of Technology, Information and Communications.

Innovation Indicator

Innovation is the key work in all sectors of the economy for digital convergence. In terms of content industries, it is the duty of companies to develop innovative products for all kinds of media, because the creative potential of these industries is greater than that of the analogue media. Creativity --understood as the individual ability or talent for creating wealth and employment by means of generating and exploiting intellectual property (Piedras, 2008: 29)—is the main source of value in the new economy and the raw material of all innovation. As such, the publishing industry must innovate in the acquisition of rights, supports, sales approaches and distributions if it wishes to survive and remain competitive. An example of this is the "hunt for author" in social networks such as Facebook or Twitter carried out by publishing houses, such as Intangible and Sinerrata, or the Twitter Fiction Festival organized by Twitter in November 2012 ("Editoriales buscan…", 2012; Wolford, 2012).

The digital convergence confronts institutions and companies with the duty to conceive of innovative products and services. PROMADE has innovated with regard to distribution of didactic materials with the creation of the online Didactic Materials Portal with the scope and limitation already described.

Indicator of New Roles of Actors

In this new age, there is a strong tendency to individualization through personalized actions. In conjunction with the digital convergence and from the standpoint of social inclusion, this envisions the phenomenon of audiences making the transition from consumers to producers of contents. The transition from the traditional book industry to one of contents entails a chain or editorial ecosystem with less intermediation and greater specialization within the production steps. Thus, at UNED we speak of inclusion of their academic staff as editors of the Modular Didactic Units (PROMADE), while the participation of local and national intellectuals is concentrated in writing cultural works. The diminishing participation of independent creators and of the general public in functions associated with creation and dissemination of contents is noteworthy.

Among the goals for the period of 2013-2015, PROMADE seeks to:

- *Formalize the style correction area of PROMADE through the Human Resources Office.* The job of style corrector is a specialization that the institution must acknowledge. Currently, the functions of style corrector are done by the academic editor, who are not necessarily qualified to do the job. The philology team in PROMADE revises all of the didactic materials and helps with style correction in the remaining programs of the Directorate, the Postgraduate Studies System, the University Board, the Office of Communications and Marketing, and other areas of the university.
  As such, PROMADE will have the Human Resources Office perform a study in order to orient the new profile, competencies and function of the Style Correction position in PROMADE and DPMD. A similar process was carried out in the Publishing Department to establish the position of Philological Editor of the catalogue works.
- *The external editing team must be strengthened in order to increase the production of didactic materials such as study guides, laboratory manuals and other complementary materials,* in order to allow academic editors concentrate exclusively on Didactic Units (Román González, 2012: 6-7). (Italics added)

All of the dependencies and programs of UNED and the Costa Rican public administration are effectuating their respective annual plans by means of the

Annual Operative Plan (POA).[22] The EUNUD annual plan for period 2005-2011 had the stated objective of: "elaboration, production and distribution of print, audiovisual and computer assisted didactic materials required for university teaching programs, extended learning programs and the area of postgraduate studies." (POA, 2011: 6).

Likewise, it continued to pursue ten specific objectives that contain scheduled goals, measurement units, and progress in compliance and relevant observations on fulfillment of semester goals. Of the ten objectives, five showed 100% compliance or better.

1. Produce and reproduce the printed of educational materials for students of the UNED (184%).
2. Meet the demand for assorted minor print matter to support the proper operation of departments and meet the priorities of the institutions and their commitments (131%).
3. Promote the EUNED brand by means of print material (177%).
4. Planning and programming of production (160%).
5. Promote the EUNED brand by means of onsite presentation of new works (100%).

Another four have been fulfilled at a level above 90%:

1. Produce and reproduce material for student body of the diverse academic periods (96%).
2. Improvement of the procedures employed in the diverse activities of the EUNED (95%).
3. Development of the sale of services for securing income through the optimal exploitation of EUNED's low cost, high quality production capacity (95%).
4. Promote the EUNED brand in mass media (93%).

Failure to meet outstanding objectives was attributed by the Executive Editorial Director to causes outside of his control. Specifically, the tenth objective regarding the regularity of university journals over the period of 2005-

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22 With regard to the mission and vision of UNED, POA is a fundamental management guide for agencies, which in line with the 2011-2015 National State University Higher Education Plan and the 2011-2015 Institutional Development Plan (PDI), allows improvement of university administration.

2010 was not met. Journals such as *Innovaciones Educativas* and *Repertorio Científico* failed to be published for more than one year or more (Muiños Gual, 2011: 23, 58).

On October 26, 2012, UNED published the institutional bulletin *Acontecer* (Happenings), nine new initiatives that are part of *Institutional Improvement Plan* --derived from the *Higher Education Improvement Project*-- both of which seek to make institutional management more dynamic for the purpose of improving higher education distance learning across the country. Of the nine initiatives, those that are associated with PROMADE are as follows:

4. *Improve the equity of access of students to digital learning resources and Internet.* With an investment USD $600.000.00, the aim is to assign technological devices to economically marginalized students. The initiative will benefit between 2000 to 2500 students and shall those who do not have social support networks (single mothers, disabled and indigenous) shall have priority. Another 800 to 1000 devices shall be made available in the academic centers (libraries) of the university centers and educational areas of prisons. These devices will not have internet access but will provide access to multimedia materials resided in a storage unit. Students needing internet access will be given a 1 mb data card. Additionally, those who do not enjoy internet access or a data card shall receive a USB memory stick with their device containing all of the digital resources required in the coursework. This option shall also be made available to prisoners. […]

7. *Diversification and broadening the production of multimedia and internet content.* With an investment of USD $2.080.000.00 for upgrading of technical resources, the positive effects of the audiovisual language in cognitive process of the student in the learning process shall be guaranteed. […]

9. *The information system for supporting decision making and institutional management.* An investment of USD $2.599.500.00 allocated to strengthen, improve and modernize the institutional information systems and specifically those associated with the areas of Human Resources, Academic Administration, Student Administration and Finance and Accounting; and for the purpose of integrating them into and satisfying the needs of information and services required by students, academics, administrators and university authorities in a timely way.
Additionally, as part of this initiative, the quality of the data recorded in data bases shall be updated and improved, and modifications will be made to include new information relevant for making management decisions. ("Nueve iniciativas …", 2012)

Conclusions

[…] University publishing departments […], and especially those sponsored by the State, have a social function to intervene against the hyper-concentration of private capital and multinational corporations, which control most of the authors and titles, by promoting small independent authors who do not enjoy projection beyond local borders of their regions.

Carlos Gazzera, Editorial Director of the
National University of Villa Maria in Argentina

The Written Didactic Material Program of UNED is a pioneer in content generation, management models, technological incorporation and human resources training in Costa Rica and Central America. It guarantees quality academic content by means of planning and development performed by the academic editors who are specialists in diverse disciplines. From 2011 to date, UNED has gone through a process of unification and improvement of editorial criteria, including the creation of job profiles, scheduling of editorial production and printing of works, and research. The objectives that have not yet materialized have been encumbered by time constraints associated with the university's institutional bureaucracy, something that is quite common in public higher education institutions in Latin America. This contrasts with private publishers of academic material. One of the most relevant aspects of this program is the implementation of a methodology for presenting contents in the Modular Didactic Unit. This is understood as the subset of didactic materials and resources with the sole purpose of taking into account the type of student, which assumes that the MDUs should be based on the didactic communication model in accord with the following features:

- To have a clear, explicit structure in place.
- To allow the student understand and take ownership of learning goals, facilitating establishment of connections with previous experience, interests and expectations.
- To present contents with a didactic structure that the student can own.
- Stand on the basis of thematic nuclei of the professional reality and, if possible, that are associated with the context of the student and the world or professional practice, in such a way that the student can find meaning in the knowledge and project it functionally.
- To incorporate self-regulation, requiring students to take ownership of assessment criteria by assuming the self-observation and planning abilities entailed in the task of studying for a degree.

- A flexible structure that enables the conformation of a body of theoretical and practical knowledge that stands up over time.

Even though there are aspects of the content industry model that are deeply rooted in the daily work of PROMADE, such as specialized knowledge and digitalization, the values of immediacy and disintermediation must be pursued further in order to catapult the Program's products in the form of accessible materials in diverse digital and analogue formats as required by the didactic mediators. Nonetheless, values such as the role of actors shall be severely limited in this editorial system, because of compulsory quality and legitimacy standards governing the participation of authors, reviewers and editors upon which the learning-teaching process of the UNED educational model is founded.

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Year two of the Claraboya research project: changing faculty attitudes regarding academic library resources for improving academic performance in selected subjects and student satisfaction

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Abstract

The present research reports the results of the Claraboya project, focused on improving two variables: 1) student's satisfaction with resources available in the campus library through the implementation of attitudinal changes in their teachers regarding reading assignments, and 2) students' academic performance in the participant courses. Methods: Using a pre-experimental design, degrees of satisfaction a sample of 373 students for seven accessibility indicators were compared to those found in two random samples of participating students on the Service-Quality Survey from

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2013. Findings: For six of the seven variables analyzed, averages obtained for the students in the Claraboya Project Research Survey (CPRS) are higher than those reported in the in 2013 Sample 1 and 2013 Sample 2. Additionally, there is a statistically significant greater level of satisfaction in six and five variables against scores reported in the random samples. To check the second hypothesis, courses taught by the same teacher in 2012 and 2013 (Claraboya) were selected and their averages compared. Insofar as only four of the twenty-one showed statistically significant differences, this hypothesis was rejected. Finally, the scope and limitations of this study are discussed.

Keywords: Library Resources; Students Satisfaction; Subject Performance

Resumen

Segundo año del proyecto de investigación Claraboya: el cambio de actitud del profesorado con respecto a los recursos bibliotecarios encaminado a mejorar el rendimiento académico en materias selectas y niveles de satisfacción entre los alumnos
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La presente investigación informa los resultados del proyecto Claraboya, el cual estuvo centrado en mejorar dos variables: 1) satisfacción del estudiante con los recursos disponibles en la biblioteca del campus, a través de la implementación de cambios actitudinales en los académicos acerca de las sugerencias de texto, y 2) el rendimiento académico de los estudiantes de los cursos participantes. Mediante un diseño preexperimental, se compararon los grados de satisfacción en siete indicadores entre una muestra por accesibilidad de 373 alumnos y dos muestras aleatorias de estudiantes participantes en la encuesta de calidad de servicio 2013. Los promedios obtenidos por los alumnos en la Encuesta de Investigación Proyecto Claraboya (CPRS) son superiores a los promedios 2013 para las muestras 1 y 2 en seis de las siete variables analizadas. Además,

hay un nivel de satisfacción estadísticamente superior en seis y cinco variables respectivamente, en comparación con las muestras aleatorias. Para verificar la segunda hipótesis, se extrajeron los cursos impartidos por el mismo profesor en 2012 y 2013 (Claraboya) y se compararon en sus promedios. Esta hipótesis fue rechazada, en la medida en que sólo cuatro de los 21 cursos mostraron diferencias estadísticamente significativas. Finalmente, se discuten los alcances y las limitaciones de este estudio.

Palabras clave: Recursos de Biblioteca; Satisfacción de los Estudiantes; Desempeño en Asignaturas.

Introduction

San Sebastian University (USS) has implemented several initiatives to enhance student learning. The investment in bibliography and data bases in the year 2013 came to US$ 638.000, bringing the collection up to more than 144.000 books, of which 56% are basic bibliographies for course subjects.

These improvements, however, have not resulted in commensurate progress in student competency in the use of lbrary resources. In this context and in recognition that efficient and effective use of the resources available in the library is as an essential element of teaching and learning processes, the Quality Assurance Vice Chancellorship (VRAC), in conjunction with the Academic Vice Chancellorship (VRA), has implemented a two-year pilot project to increase students' use of library resources and their satisfaction with said resources.

There is not enough evidence about the effects of efficient management of library resources on teaching of a particular subject or students' thoughts regarding their satisfaction with the bibliographic resources available to support their studies in such a course. This connection stands at the intersection of quality management in higher education, the use of information technologies, and the sociology of education, administration, and library science.

The processes of teaching and learning are strengthened to the extent that library resources are effectively used in classrooms, where course content is matched with the materials actually available. For teachers to fully utilize their materials and match course content to material available, however, they

must go to the campus library regularly with an awareness of expected learning experiences.. This will facilitate the teaching and learning processes, making them more efficient.

On the basis of enrollment numbers each year, Chilean universities acquire basic textbooks and the university libraries acquire complementary bibliographies. At the USS, there is a permanent and increasing effort to acquire texts used to prepare students for professional careers. Additionally, the educational project of the USS and the learning environment "Vive la Experiencia USS," have been established to enrich the classroom teaching and learning processes with cultural content, while providing students greater autonomy in the search for information, the possibility of learning and applying bibliographic standards, and evaluating the appropriateness of fonts used in academic tasks (De la Vega and Fukushi, 2011). This initiative is termed: "information culture in the classroom."

While one might suppose that the growing existence of texts in the library and aforementioned initiative described would result in greater student satisfaction with the texts available; however, this has not happened. In two consecutive studies of service-quality, rating on a scale from 1 to 7, the availability of texts in the library for courses in Universidad San Sebastián has been rated by students as deficient. In 2010, the score came in at 4.8, and in 2011 it dipped slightly to 4.7. (Universidad San Sebastián, 2010, 2011.)

Review of Literature

Though most research has focused on the use of library resources by students (Simisaye, 2012), there are several studies showing faculty assistance to the institutional library is often inconstant and insufficient (Popoola and Haliso, 2009; Münster, 2003).

Other studies have shown a decrease of 35% in printed books over a 10 year period (Camacho and Spackman, 2011), and ebrary (2007) reports that approximately 50% of respondents prefer to use online resources for research, class preparation and instruction, versus 18% who prefer print materials.

Although Popoola (2008) says that just a small percentage of social scientists regularly use formal databases as information resources, Münster (2003) has reported that 79% of the researchers visit the library weekly and 47%

use the catalog at the same rate, though there were some differences across the diverse disciplines. For a sample of 987 graduate students, Kayongo and Helm (2010) indicate that 53.3% visit the library while 65.5% use library resources from home. Of those who visit on a weekly or daily basis, 34.8% come to sign out or return a book.

The numbers of uses seeking assistance could be driven by several causes, including insufficient technical support and access to collections, the presence of modern technology in contemporary libraries, or the huge volume of information, etc. (Jiao, Onwuegbuzie and Daley, 1997). All of this is very important to consider to the extent that there is evidence that effective use of library resources has an effect on the quality of teaching and of learning (Popoola and Haliso, 2009).

For example, Gaona and Villuendas (2011) report statistically significant correlations between academic performance and attitudes toward reading (ρ=.413, p <.001), and to frequency of strategies used to find information in libraries (ρ =.239, p <0.001).

Soria, Fransen and Nakerud (2013) analyzed use of libraries at the University of Minnesota during the Fall 2011 by first-year undergraduate students and found statistically significant differences in cumulative GPA (cumulative grade point average) between those who used at least one library service compared to students who did not use any.

These data are in line with research by Han, Wong and Webb (2011) that found a correlation between the use of libraries and graduation GPA of students graduating between 2007 and 2009 at the Hong Kong Baptist University (HKBU). This positive correlation was also found by Stone & Ramsden (2013), who successfully demonstrated a statistically significant correlation between student achievement and e-resources use and book borrowing statistics. Similar findings are reported by Goodall and Pattern (2011). This pattern has also been found in high school students, where libraries visits combined with proper study habits were significantly correlated to achievement in science subjects (Aanu and Olatoye, 2011). The key mechanisms behind these correlations, apparently, are not only cognitive or associated with the development of critical judgment, but they are also motivational (Ilogho, 2011).

The fact that teachers do not adequately stimulate the use of institutional resources can occur for many reasons. For example, many of the faculties are

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part-time professors, with varying approaches to the use of resources and effective, valid management of bibliographies. Moreover, these approaches are distinct from those exhibited by tenure-track teachers in these areas (Washington-Hoagland and Clougherty, 2002). On the other hand, within universities, there are dissimilar expectations about the proper use of and interaction with libraries, and the fullest use of available resources (Stebelman *et al.,* 1999).

In this way, faculty could assign certain readings for assessment that are not found in library, simply by providing copies to students. By doing so, they transmit the implicit message to students that the library's collection is not useful for educational purposes in that subject; and students might complete the course and later report dissatisfaction with resources available in the library. This dissatisfaction is not a product of an inconsistency between the course program and the available library resources, but between the professors' readings and those available in library. In light of the research of Lau (2001) and Pierce (2009), who suggests that a basic goal should be to encourage students to include library materials in their learning strategies, this disconnection is potentially very serious.

In sum, an attitudinal change must take place in faculties (Dierking and Fox, 2013; Khan and Pred, 2002; Kaplan, Cook and Steiger, 2006); and not only where the connections between course content and the library's resources are widely known. Faculty must also model efficient library use through an ongoing effort to assign readings that are available at the university.

THE CLARABOYA DESIGN: THE FIRST EXPERIENCE OF THE 2012 PILOT

A preliminary version the program aimed at increasing student satisfaction with the available library resources through the implementation of an attitudinal change in the professors regarding assignment of readings was designed and assessed. The central activity of this stage was a seminar attended by 18 faculty members (González *et al.*, 2014).

In that first year, the overall structure of the seminar and the mechanisms to assess student satisfaction with the resources of the library were designed. Finally, satisfaction levels for seven indicators of and accessibility sample of 175 students of 18 pilot courses were compared to random sample of students participating in the Service-Quality Survey of 2010 and 2011. A greater

level of satisfaction in all indicators was found for 2012. Five of these differences were statistically significant against 2010 survey data and as well as versus to 2011 data (González *et al.*, 2014).

Due to the success of this initial experience, a program with greater coverage was designed for the year 2013. This program was offered to all accredited majors and those in the process of securing accreditation process at the City of Concepción Campus of USS.

Aims

To purpose of this study is to assess the the second year of the Claraboya project, which aims to: 1) increase student satisfaction with resources available in the campus library through the implementation of attitudinal changes in teachers regarding assigned reading, and 2) improve academic performance of students in participating courses.

Method

Hypotheses

1) Students and teachers participating in the Claraboya 2013 program have a statistically higher level of satisfaction with the resources available in USS library than students participating in the 2013 Service-Quality Survey.
2) The mean scores obtained from Claraboya 2013 courses are statistically higher than the mean scores obtained in 2012 in the same courses.

Design

The research design entails intact groups, and pre-experimental, experimental intervention, and post-test stages. The 36 subject professors participating in the project attended the Claraboya seminar in order to train to make optimal use of library resources in connection with their respective course contents. After this intervention, students of those subjects were evaluated in two variables: 1) student satisfaction with resources available in the campus library for the course and 2) academic performance in the participant courses, which was done by comparing academic achievement of students enrolled with the same professor the year before.

Intervention

The intervention seminar titled the "Claraboya Workshop: optimizing use of bibliographies and electronic databases available in library by implementing digital indexing in subjects," was targeted at part-time teachers for the central purpose of helping teachers through attitudinal change to develop strategies for optimizing the use of academic library resources for pedagogical purposes (Steintert *et al.*, 2006).

The seminar attended by 36 teachers lasted 15 hours, five of which were face-to-face class time (July 25, 2013). Participant courses were required to meet the following acceptance components:

1) A group project presenting a disciplinary theme in Microsoft Power-point which considered: a) connection between course content and virtual and physical bibliographies available in USS libraries system, b) connections with subject planning, subject programs and suggested texts, c) modeling behaviors aimed at effective use of library resources, and d) modeling of the incorporation of library resources into the classroom

2) Personalized follow-up throughout the semester, in which teachers receive assistance with questions and difficulties they encounter when implementing courses contents. This monitoring program was implemented using both telephone and email communication.

Sample

For the first hypothesis, an accessibility sample was used, consisting of 373 students from 17 of the 19 participant major fields: Law (5.1%), Preschool Education (0.8%), Nursing (7.5%), Phonoaudiology (8.6%), Business Administration (4.6%), Kinesiology (8.9%), Medicine (5.9%), Veterinary Medicine (3.8%), Nutrition and Dietetics (3.8%), Dentistry (14%), Pedagogy of Secondary Education in English (2.7%), Pedagogy of Secondary Education in Language and Communication (1.3%), Pedagogy in Primary Education (7.3%), Psychology (12.1%), Chemistry and Pharmacy (3%), Medical Technology (9.4%) and Social Work (1.3%). These students (35.6% males, 64.4% females) were enrolled in courses in Claraboya in 2013.

Of the 36 original subjects (courses) participating in the seminar, students of 34 of them answered the survey. To obtain the two 2013 Service-Quality

Survey samples, 746 persons were randomly selected from the corresponding databases to achieve 343 persons in each sample. This procedure provides two databases needed to test the first research hypothesis, consisting of 746 students who responded to the Service-Quality Survey of 2013 (in two separate random samples of 343 each) and 373 students for the experimental measurement of the 2013 Claraboya group.

To test the second hypothesis, courses taught by the same teacher in 2012 and 2013 with 20 or more students enrolled in both years were selected. The averages of the resulting 21 unit of analysis were compared using the non-parametric Mann-Whitney U test. All the samples showed a non-normal distribution.

Instruments

CPRS scale. To assess the effectiveness of the intervention, an adaptation of the Service-Quality Survey (which USS has been performed since 2009) was made. The 2013 version consists of 99 thematic questions, that cover the following dimensions: Library; Food and Canteen; Administrative Staff and Faculty Attention; Infrastructure, Furniture and Equipment; Technologies and Computer Science; Security; Photocopies; Communications; Green and Recreation Areas; Sanitary facilities and toilets; Student Assistance Services/ Scholarships and State benefits; USS University Life; Clinical Fields/Practice Centers and finally General Satisfaction. The entire survey achieved internal consistency of 0.991 (Cronbach Alpha) in 2013.

The library assessment section of the instrument contains between 7 and 9 items - depending of the year - with which students assess each service on a scale from 1 to 7. For the purposes of this study, an instrument was created called the Claraboya Project Research Survey (CPRS) that was applied in an online version using Surveymonkey. This instrument consists of seven statements that were reformulations of the items created for the Service-Quality Survey, but in this case focused on the specific participant courses in which students were enrolled (González *et al.*, 2014). (*Table 1*)

Table 1. Service-Quality Survey Items and associated CPRS items

Service-Quality Survey Items	CPRS
Text availability in library	Text availability in library for the selected course
Library hours of operation	Library hours of operation when you need material required for the course

Laptop loan service	Laptop loan service in library for this course
Digital library databases availability	Digital library databases available in library that you have used in this course
Search catalog	Material search catalog for the selected course
study room availability in library	Quiet study classroom availability in library (for the purposes of this course)
Library study room comfort	Library study room comfort (when required for the selected course)

Upon final measurement, the CPRS survey attained internal consistency of 0.851 (Cronbach's Alpha). Both the pilot study and this main research used the Surveymonkey online survey system, while the CPRS was applied by email between January 10 and January 23, 2014.

Variables

The variables considered in this research are library resources satisfaction for specific courses (as measured by the CPRS), the library service dimension (extracted from the 2013 Service-Quality Survey) and the global average in the 21 courses selected for 2012 and 2013.

Data analysis

To assess the differences between the scores of students participating in the study and the general population, two random samples of the 2013 Service-Quality Survey were extracted. Each samlple contains the same number of students as the experimental group. Once this was done, the means of these three groups—experimental group, Sample 1 2013 Service-Quality (2013 S1) and Sample 2 Service-Quality 2013 (2013 S2)—were compared using Mann-Whitney U test to assess the effectiveness of the program.

Moreover, the Mann-Whitney U test was used to compare the averages of the 2012 and 2013 courses.

Findings

Table 2 shows the descriptive scores for the variables under study , namely satisfaction with library service (Service-Quality 2013 samples 1 and 2) and satisfaction with library resources for the selected course (by CPRS).

Table 2. Satisfaction with library resources

	Sample	Mean	SD	Lowest Score Value	Highest Score Value
Text availability in library	2013 S 1	4.81	1.735	1	7
	2013 S 2	5.06	1.627	1	7
	CPRS	5.47	1.614	1	7
Library hours of operation	2013 S 1	5.73	1.483	1	7
	2013 S 2	5.82	1.486	1	7
	CPRS	6.20	1.238	1	7
Laptop loan service	2013 S 1	5.05	1.673	1	7
	2013 S 2	5.20	1.666	1	7
	CPRS	5.64	1.433	1	7
Availability of digital databases of library resources	2013 S 1	5.32	1.513	1	7
	2013 S 2	5.46	1.502	1	7
	CPRS	5.75	1.445	1	7
Search catalog	2013 S 1	5.47	1.410	1	7
	2013 S 2	5.57	1.457	1	7
	CPRS	5.74	1.466	1	7
Availability of library study rooms	2013 S 1	4.47	1.799	1	7
	2013 S 2	4.70	1.829	1	7
	CPRS	4.39	1.885	1	7
Comfort of library study rooms	2013 S 1	5.12	1.789	1	7
	2013 S 2	5.13	1.769	1	7
	CPRS	5.48	1.640	1	7
2013 S1: Random Sample 1 of Year 2013 2013 S2: Random Sample 2 of Year 2013					

The averages obtained in the CPRS are superior to the averages for 2013 S1 and 2013 S2 for six of the seven variables analyzed: Text availability in library (2013 S1= 4.81; 2013 S2= 5.06; CPRS= 5.47), Library hours of operation (2013 S1= 5.73; 2013 S2= 5.82; CPRS= 6.2), Laptop loan service (2013 S1= 5.05; 2013 S2= 5.2; CPRS= 5.64), Availability of digital databases of library resources (2013 S1= 5.32; 2013 S2= 5.46; CPRS= 5.75), Search catalog (2013 S1= 5.47; 2013 S2= 5.57; CPRS= 5.74), availability of library study rooms (2013 S1= 4.47; 2013 S2= 4.7; CPRS= 4.39), Comfort of library study rooms (2013 S1= 5.12; 2013 S2= 5.13 CPRS= 5.48).

To ascertain statistical significance of these differences, the Mann-Whitney U test for independent variables was conducted. The *Table 3* shows these results:

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Table 3. Results of Mann-Whitney U test for the independent samples

	Samples	N	Ranks	Mann-Whitney U	Asymp. Sig. (2-tailed)
Text Availability in library	2013 S-1	365	313.25	47540	*0.000
	CPRS	340	395.68		
	2013 S-2	357	321.17	50756	*0.000
	CPRS	340	378.22		
Library hours of operation	2013 S-1	361	315.77	48652	*0.000
	CPRS	342	390.24		
	2013 S-2	357	324.61	51981	*0.000
	CPRS	342	376.51		
Laptop loan service	2013 S-1	326	300.94	43099	*0.000
	CPRS	317	343.65		
	2013 S-2	324	301.45	45018.5	*0.001
	CPRS	325	348.48		
Availability of digital databases of library resources	2013 S-1	332	296.53	43170	*0.000
	CPRS	319	356.67		
	2013 S-2	336	307.98	46865	*0.004
	CPRS	319	349.09		
Search catalog	2013 S-1	346	314.28	48711	*0.001
	CPRS	327	361.04		
	2013 S-2	343	321.97	51438	0.054
	CPRS	327	349.7		
Availability of library study rooms	2013 S-1	362	353.11	59507.5	0.618
	CPRS	336	345.61		
	2013 S-2	357	326.51	54439	*0.033
	CPRS	336	330.52		
Library study room comfort	2013 S-1	350	311.12	52994	*0.007
	CPRS	340	380.89		
	2013 S-2	358	326.96	52789	*0.008
	CPRS	333	366.47		
2013 S1: Random Sample 1 of Year 2013 2013 S2: Random Sample 2 of Year 2013 *p<0.05					

In the 2013 S1/ CPRS comparison, statistically significant differences were found in six of the seven variables studied. These difference all favored CPRS as follows: Text availability in library (p=0.00), Library hours of operation (p=0.00), Laptop loan service (p=0.00), Availability of digital databases of library resources (p=0.00), Search catalog (p=0.001) and Library study room comfort (p=0.007). Availability of library study rooms showed no significant differences (p=0.618).

In the same way (see table above), the 2013 S2/ CPRS comparison produced statistically significant differences favoring the following five CPRS variables: Text availability in library (p = 0.000), Library hours of operation (p=0.000), Laptop loan service (p = 0.001), Digital library databases availability (p=0.004)

and Library study rooms comfort (p=0.008). Search catalog (p=0.054) produced no significant differences, while Availability of library study rooms showed significant differences (p=0.033), but in the opposite direction.

To check the second hypothesis, courses taught by the same teacher in 2012 and 2013 with 20 students or more enrolled in both terms were selected. The averages of the resulting 21 subjects (courses) were compared using the non-parametric Mann-Whitney U test. The results are shown in *Table 4*. To safeguard faculty privacy, acronyms for their names are used.

Table 4. Mann-Whitney U results for the 21 selected subjects

Subject	Year	Means	Ranks	Mann-Whitney U	Asymp. Sig. (2-tailed)
EK	2012	4.78	79.97	2110.5	0.29
	2013	4.62	68.48		
AN	2012	4.53	50.23	342	0.000*
	2013	3.79	28.77		
FVV	2012	3.83	21.33	212	0.086
	2013	4.09	24.9		
FCQ	2012	4.09	29.53	351	0.170
	2013	4	27.13		
EP	2012	3.68	117.06	6601	0.123
	2013	3.76	126.09		
NK	2012	3.94	82.23	1890.5	0.000*
	2013	3.66	62.17		
FPP	2012	4.21	64.99	1665.5	0.387
	2013	4.18	63.33		
FF	2012	3.49	81.24	3127.5	0.000*
	2013	4.03	122.64		
FT	2012	3.63	58.17	849.5	0.014*
	2013	3.95	77.07		
HPB	2012	3.62	30.89	440	0.164
	2013	3.74	34.7		
PM	2012	5.14	60.55	528	0.000*
	2013	4.48	33.21		
PIF	2012	3.96	34.13	204	0.000*
	2013	3.29	21		
QOE	2012	3.18	45.82	989.5	0.000*
	2013	3.69	62.33		
PCI	2012	3.41	51.64	1090.5	0.236
	2013	3.16	47.83		
BT	2012	3.62	41.84	853.5	0.2
	2013	3.78	45.84		
MPB	2012	4.04	30.84	425.5	0.14
	2013	4.22	35.54		
PAP	2012	3.39	66.61	1923.5	0.069
	2013	3.58	76.03		
PGV	2012	4	29.5	360	0.065
	2013	3.92	27.35		
FOO	2012	4.21	96.13	3798	0.063
	2013	4.09	87.89		
IGT	2012	3.88	48.38	1127.5	0.000*
	2013	4.34	66.54		
PIFII	2012	4.05	44.41	683	0.080
	2013	3.87	38.53		

P<0.005

As shown in *Table 4*, statistically significant differences in favor of the 2013 intervention were found in 4 of the 21 subjects evaluated, corresponding to 19% overall.

DISCUSSION AND CONCLUSION

This paper reports on the research is the middle stage of a pioneer project in Chile for optimizing of the use of library resources for academic purposes. A higher level of satisfaction was found in six of the indicators measured by the CPRS scale. The study found that six of these indicators showed significant differences against 2013 S1 and five (5) indicators against 2013 S2. These results serve to provide substantial support for the validity of the first research hypothesis.

An analysis of this variation reveals that the most important indicator for the purposes of this research, i.e., "text availability," shows statistically significant differences in both comparisons. Since the S1 and S2 samples were selected randomly, these results corroborate the data found in the preliminary approach by the researchers (González *et al.*, 2014) and they underscore the importance of implementing this program at the national level.

As mentioned before, these results come in addition to the other five and four indicators with significant differences found respectively in the two comparisons. Of these, the increased levels of satisfaction with library hours of operation may indicate a positive feedback: as students visit the library more frequently, they become increasingly familiar with and better adapted to the library schedule.

In the view of the authors of this study, the fact that satisfaction with the search catalog did not improve after intervention is due to the fact that students in the experimental courses were required to use the library by faculty. Moreover, participating faculty often provided catalogue codes needed to find required reading.

The second research hypothesis must be rejected because no effect on academic performance of students enrolled in the selected courses was found against the either the 2012 or 2013 grade average, a finding that is not consistent with the findings reported by Gaona and Villuendas (2011), Soria, Fransen and Nakerud (2013), Han, Wong and Webb, (2011) and Stone and Ramsden (2013).

It is important to highlight, however, that the aforementioned research studied the correlation between the students' academic performance and the use of library resources, but not the impact of an intervention on the course's overall performance in two different years.

This is important, to the extent that the development of skills for the use of existing library resources benefits students over the course of their entire academic life. On the other hand, there are many factors that affect the overall performance of a course, including the number of students enrolled and the individual characteristics of the students.

In fact, of the courses participating in the comparison, five (5) are offered in the first year of the respective majors, and there is evidence in the USS that the overall performance of students admitted in 2013 was lower than those admitted on 2012 (Programa CREAR, 2013).

Finally, it should be pointed out that, in terms of faculty satisfaction and teaching quality, the effectiveness of programs aimed at behavioral changes through attitudinal changes has been sufficiently documented (Dierking and Fox, 2013; Khan and Pred, 2002; Kaplan, Cook and Steiger, 2006), but student satisfaction and organizational development has not been documented to nearly the same extent (Steintert *et al.*, 2006).

An analysis by major or by student within a full-fledged experimental design or an analysis of the effectiveness of the intervention, comparing participating students vs. unexposed students in a given year, are potential areas for further research. In the same vein, the limitations of this research were related to the generalizability of the results and the nature of the research design. The pre-experimental design utilized to assess this program does not allow the researchers to draw conclusion or assert causal connections between the variables. These issues should be considered limitations of this research and areas for futures study.

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Digital preservation of
sound recordings

Perla Olivia Rodríguez Reséndiz

Abstract

Because thousands of sounds documents are lost every day as a result of the fragility and deterioration of recording supports, and the obsolescence of analogue recording and playback equipment, the preservation of the sound archives is at a critical point in its history. Currently, the transfer of analogue content to digital platforms is the only way to guarantee the survival of sound heritage. Therefore, the preservation of digital audio files constitutes a long-term safeguard that will eventually replace analogue backup methods used to preserve the world's audio heritage.

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Keywords: Sound Archives; Preservation; Digital Preservation; Digital Sound Preservation; Digitizing; Sound Documents.

Resumen

La preservación digital sonora
Perla Olivia Rodríguez-Reséndiz

La preservación de los archivos sonoros está en un punto crítico de su historia debido a que día a día desaparecen miles de documentos sonoros como consecuencia del deterioro y la fragilidad de los soportes en que han sido grabados, así como por la obsolescencia de los equipos de grabación y reproducción analógica. Hasta ahora, la transferencia de contenidos analógicos a plataformas digitales (digitalización) es la única forma de garantizar la existencia del patrimonio sonoro; por ello la preservación digital de archivos sonoros constituye una forma de salvaguarda a largo plazo que ha modificado los métodos de preservación de documentos sonoros en soportes analógicos.

Palabras clave: Archivos sonoros; Preservación; Preservación digital; Preservación digital sonora; Digitalización; Documentos sonoros.

Introduction

For many years sound recordings have been a province separate from text documents. Such recordings were defined as non-library documents. This is understandable in light of the fact that sound recording is much newer than the print technology that underpins the collections of museums and libraries. Libraries only began to collect and classify audio documents in the twentieth century (Wright, 2012). In the opinion of Jean Weihs (2001), audio documents began to become ever more visible in the 1950s and 1960s in the United States and Canada. With the advent of sound recording technology, special catalogues of audio documents were implemented in libraries. Dayli (1967) showed that audio recordings require new approaches in terms of pro-

cessing, storage and cataloging. To this end, he developed a criticism of the Anglo-American Cataloging Rules. He opined that these rules were insufficient for cataloguing sound documents. Dayli's initial analysis published in 1967, established the idea that sound recordings were a distinct medium and therefore required special treatment, distinct from that afforded books.

Rousseau and Couture (1994) assert that the 1960s and 1970s constitute the period when archivists took a genuine interest in non-textual documents. According to Ávila Araujo (2013), during the 1970s the archive began to broaden in scope to include, for example, administrative, business and private files, and documents arising from new fields, such as sound recordings and microfilm. The development of archival science and the interest in sound documents coincided with the founding of the International Association of Sound and Audiovisual Archives (ISAA) in Amsterdam in 1969. The ISAA's stated purpose is to provide a forum for encouraging cooperation among archivists and librarians whose job it is to safeguard sound documents.

The interest lent to sound files in the documental field coincides with the progressive incorporation of information and communications technologies that Castells (2004) has called the "knowledge revolution," a term suggesting that information is the foundation of the information economy.

This process occurs in the context of what Vivas Moreno (2013) calls "integrated archival science in the information society," and can be understood as the period in which the discipline underwent important growth in terms of conceptual principles and implementation. These changes can be seen in the broadening and expansion of the general field of activity of archival science, which views the archive, library and documentation center and their associated processes as residing under the umbrella of information and documentation science, with the incorporation of information and communication technologies intrinsic to its practice. In the view of Vieira (2013), archival science arose at the end of the twentieth century and was characterized by the unfolding and dissemination of information and communication technologies, which led archival specialists to rethink the objects, methods, theories and concepts of the field. Consequently, the body of sound archives spurring academic, social, political and cultural reflection appears to coincide with the incorporation of information and communications technology.

Origin and development
of sound recordings

With the invention by French inventor Édouard-Léon Scott of the phonau-
tograph over 150 years ago, it was understood that sound could be recorded.
Scott recorded himself singing some lyrics from *Au clare de lune* (Giovanno-
ni, 2008). Sometime later, in 1877, Thomas Alva Edison invented the phono-
graph (Hill, 2012) making it possible both to record and play back recorded
sound. This was the beginning of the era of audio archives and the documen-
tation of human history by means of sound recordings.

This new audio technology captured the interest of society and drove explo-
ration of its possibilities within the fields of science, art and entertainment.
Sarmiento (2010) cites one of the earliest articles by Edison on the phono-
graph written in 1878, in which Edison envisions the uses of his invention,
including its usage in education, recording music, creating family albums,
recording and playing back books and speech, as well as its potential in the
field of advertising or simply being used as a sort of music box.

Schüller (2008) points out that in the early twentieth century scientific re-
search in the fields of dialectology, ethnomusicology and anthropology relied
on sound recording technology. This led to the establishment of the first au-
dio libraries. Founded in 1889, the first audio archive was the *Phonogram-
marchiv* of the Academy of Arts and Sciences of Vienna (Miranda Regojo,
1990; Schüller, 2008). Two years later in 1900, the *Phonogrammarchiv* of
Berlin was founded. This was followed by the founding of the Phonogram-
marchiv of Saint Petersburg and that of Zurich in 1908 and 1908, respec-
tively (Schüller, 2008).

The invention of portable, battery-powered recording devices supported
field work and allowed researchers to record language, music and rituals all
over the world. Much of our current knowledge about linguistic and cultur-
al diversity comes from sound documents recorded over the last 50 years.
(Schüller, 2008). Sarmiento (2010) has found that in the milieu of the *avant
garde* in the early twentieth century, the phonogram was a key instrument for
dissemination of art and prevailing ideas. Moreover, it was used in the cre-
ation of works of art.

The systematic gathering of sound documents began from 1920 to 1930. In
this period, we find the first national sound archives devoted to safeguard-

ing phonographic recordings made in the early twentieth century. One of these was the *Discoteca dil Stato d´Italia* created in 1928. By the decade of the 1930s, radio broadcasts were regularly recorded (Rooks, 2010). Radio programs in the first years radio, of course, have been lost to history, since most were not recorded, largely because their value as historical documents was not widely appreciated (Rodríguez, 2012).

By 1932, the term audio library had come into use. Gabriel Timmory used the term to describe the National Audio Library of France (Bellveser, 1999; Miranda 1990). By the end of that decade, early sound collections had begun to make up part of library collections (Schüller, 2012). For example, in 1938, the National Audio Library of France became a part of the National Library of France.

The consolidation of sound and audiovisual archives began in earnest in the decade of the 1940s, with the introduction of the vinyl disc (Schüller, 2012). Klijn and Lusenet (2008) have pointed out that by the middle of the twentieth century, several national audio and film institutions had been founded.

After 1956, radio stations began to use magnetic tape to record sound. In the International Expo of Brussels in 1957, Radio France presented recording of writers' voices as a complement to the visual exhibits on display (Miranda Regojo, 1990).

Scientific research, the recording industry, radio and artistic exploration were the main tributaries feeding into the collections of the first sound archives. Of these sources, recordings of decades of radio programs are by far the largest contributors (Rodríguez, 2012).

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The beginnings of analogue recording

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Recordings have been made of radio broadcasts, the world's languages, the voices of important historical figures; the testimony of artists, scientists, athletes and politicians; musical genres, the audio landscape and countless other things, all of which are preserved in audio libraries that arose as the new institutions of memory based on the conceptual and philosophical principles of libraries, archives and museums, which for centuries have been the depositories of human heritage (Edmondson, 2004).

Sound recordings document or preserve material for a deliberate intellectual purpose (UNESCO, 2002) and consist of the informative content and the recording support media. The contents of a sound document are recorded to support media made from diverse materials, including wax, vinyl, plastics, acetate, paper and Bakelite. Each of these supports corresponds to a particular recording and play back technology, which has included the phonograph, gramophone, magnetic wire recorder, record player, reel to reel tape recorder, cassette tapes and the compact disc player. Recorded content and the support media had been closely associated and equally important in grooved analogue supports (cylinders, thick and narrow groove record discs, transcription, lacquered, etc.); magnetic analogue media (magnetic wire and reel to reel tape, cassette tapes), and in the first digital storage systems (compact disc, DAT, DVD and Blu-Ray) (Edmondson, 2004; Rodríguez, 2012).

It is well known that none of these supports can provide indefinite storage. As such, these supports must be safeguarded in optimal conditions in order to allow users to enjoy access and use for as long as possible (IASA, 2005). The first document processes applied to sound archives occurred in libraries, which over time began to develop specific processes for handling their collections of sound recordings.

Since the basic purpose of a sound recording is to preserve sound documents, we should be wary when terms such as conservation, preservation and restoration seems to be used interchangeably as if they were synonyms. Voutssas Márquez (2009:9) distinguishes between these concepts as follows: "…to preserve is to safeguard the long-term permanence of the document. To do this, we must conserve, i.e., use foresight to adequately and permanently protect and safeguard the document. When such documents are damaged, we must restore them." For the purposes of this paper, we shall take up the definition of preservation of sound and audiovisual archives provided by Edmondson (2004:20): "all of the media required to ensure continuous access –for all time-- of a sound or audiovisual document with the best possible fidelity." The main international sound and audiovisual archive associations, such as the International Federation of Television Archives (FIAT-IFTA), the International Association of Sound and Audio visual Archives (IASA), the Association of Archivists of Moving Pictures (AMIA), the United Nations Organization for Education, Science and Culture (UNESCO) and the Coordinating Council of Audiovisual Archive Associations (CCAAA), agree with this definition (Wright, 2012).

The preservation of analogue sound documents is associated with the physical and chemical stability of the support media. Consequently, there is an incentive to limit the public's access to such these sound archive, which is to say that conservation becomes the chief preservation measure. In this vein, ISSA (TC03-2005) states that conservation implies storing the supports in suitable environments. To this end and whenever possible or necessary, the primary information must be separated from the secondary information; and maintenance and cleaning should be performed routinely. Conservation entails shaving copies of the documents while minimizing the use of the originals or archive copies. One of the major tasks of the archive operation for conserving its collection of original material is to produce copies and make these available to the user public.

In concert with this outlook, Edmondson (2004) has stated that conservation is the set of elements needed to ensure the indefinite availability of an audiovisual document in optimal conditions. He adds that without cataloging, sound documents cannot be identified or consulted. It is well known that cataloging of sound documents is a specialized task that has its origins in the cataloging of books. Print and sound media are distinct in terms of the variety of supports, content diversity, timeliness of the information they contain and depth of analysis, and ambiguity of the document (RTVE, 1991). To these features, we can add the diverse audio playback equipment.

The antecedents of sound document cataloguing dates to 1942, when the Music Library Association issued its *Code for Cataloging Phonograph Records.* In 1995, the International Association of Sound and Audio Visual Archives (IASA) issued its cataloguing rules based on the work and experience of a team of professional sound and audiovisual archivists. This means that for a period five decades, many professionals in the field have reflected on and analyzed the features and nature of the sound documents in order to establish cataloging guidelines for such documents. Cataloging sound documents is a key process that allows retrieval of contents and permit access to them.

If there is no access to the document, the document is meaningless. Conservation and access are the two sides of the same coin (Edmondson, 2004). Access may be deemed an integral part of conservation. Access is defined as all of the uses, exhibitions or physical deliveries, which is to say that all uses (Edmondson, 2004) of archive contents, whether media or metadata, provided through information services, print media, multimedia, audio or any other production type. The latter definition of access can include all of the

activities associated with dissemination, educational, and cultural or commercial exploitation of an audio archive. All told, access can be understood as the right of all persons to consult and come to share in our sound heritage.

It is important to remember that for many years access to audio documents was dependent on the availability of playback equipment and copies for users to hear in audio booths and other set ups for listening to discs, cassettes and CDs. As spaces for consulting sound documents, the audio library was quite a rare animal.

INCORPORATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN AUDIO LIBRARIES

The appearance of the compact disc in 1980 as a sound recording support coincided with UNESCO's recommendation on safeguarding and conserving motion pictures, acknowledging the importance of the cultural and historical heritage of audiovisual documents. At that time, the first reflections on digital preservation of sound documents arose (Wright, 2012).

Brylaswky (2003) asserts that for years sound archivists had been talking about a digital future, but now there is no such talk, because the digital future is here. Between 1989 and 1990, audio archivists accepted that the intention of the classic paradigm of conservation of original material was a futile enterprise because of the instability of the supports and the presumption that required playback equipment would not be available forever. (Schüller, 2008). Moreover, many thinkers in such matters believed that analogue preservation had come to an end or, at the very least, was out of options (Brylaswky, 2003).

All of the audiovisual documents, i.e., video graphics, filmographies, and phonographies, and other audio documents were the first to be transferred from the analogue platform to the digital platform. This was done for the first time in Germany in 1992 at the Arbeitsgemeinschaft der öffentlich-rechtlichen Rundfunkanstalten der Bundesrepublik Deutschland, a consortium of public radio broadcasters in Germany (Haefner, 2001). Seven years later, in 1997, the Institute del Audiovisuel dé Francia launched its archive digitization plan (Teruggi, 2004).

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The first collections to be digitized were radio programs, because it had become imperative to organize, conserve and archive the massive amount of radio and television material that had accumulated (Teruggi, 2004). At the 2000 Annual International Sound and Audiovisual Archives Association Conference, Albrecht Haefner was one of the first to signal the new theoretical and technological trend that had begun to gain ground in the area of radio and television, i.e., technology for mass storage of digitized contents. (Rodríguez, 2012).

These events notwithstanding, in 1997, five years after the first digitization of materials, experts of the Audio Engineering Society (AES), the National Academy of Recording Arts and Sciences (NARAS) and the Association for Record Sound Collection (ARSC) all agreed that analogue documents should be saved, because the digital formats were in fact unstable (CLIRLC, 2006). This cautionary recommendation came at a time when digital preservation platforms were about to be rolled out.

For more than two decades, the issues surrounding the use of technology to preserve sound documents has driven research and reflection, and has dominated the stage of conferences, forums and seminars of the International Association of Sound and Audiovisual Archives (IASA), the Audio Engineering Society (AES), and other international gatherings of specialists, researchers, archivists, engineers and audiovisual document professionals.

In addition to studies on the reliability of digital preservation platforms, it has been shown that the first digital storage efforts were very expensive, highlighting the need to make digital preservation platforms more broadly available. This concern was address at the 2003 conference on Bridging the Digital Divide by Providing Support to Content Professionals, organized by UNESCO, where the widening audiovisual digital technology gap between first and third world countries was highlighted. (UNESCO, 2003). One year later at the Fifth Program in Technologies for the Information Society, the European Commission created the PRESTO Project for the purpose of finding solutions to the problems of digital preservation. This project focused on new, long-term (20 years or more) opportunities for storage and access (Wright, 2004). The British Broadcasting Corporation (BBC) led the project in partnership with the Institut National del Audiovisuel de France (INA) and Radio, Televisione Italiana (RAI).

In addition to the research developed in the PRESTO Project, one of the most significant contributions to the development of digital preservation technol-

ogy was made by Kevin Bradley, Who published a paper *Toward an open code storage and preservation system: recommendations regarding the implementation of digital audiovisual preservation system and matters of software development,* a proposal for creating open code storage and preservation systems, with the idea making these systems affordable to smaller organizations with urgent sound document preservation imperatives.

The project methodology attempted to describe (something like construct) a small-scale, autonomous, digital mass-storage system using open code software. The system was conceived to assume all of the functions of a standard archive within a digital storage system, such as task management and intake, management and extraction of metadata, and preservation and storage of backups (Bradley, 2007b).

Since Bradley understood that there is no such thing as permanent digital storage, he envisioned a simple, sustainable open code-based system that provides digital preservation management strategy options (Bradley, 2007b). Currently, open code systems are a viable alternative for digital preservation of sound documents.

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Digitization and
digital preservation

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Digitization and digital preservation are closely related concepts. Voutssas Márquez (2009) defines digital preservation as the specific actions and the technologies, whose underlying, long-term purpose is to ensure permanence of and access to the contents of digital documents, regardless of support, format or system. To achieve this, maintenance is required, which is the same as preemptively and permanently protecting and safeguarding such materials. When such materials undergo deterioration or are damaged, we must try to restore them.

In the view of Térmens (2013), digital preservation ensures access to and future use of digital documents created in the present or the past, on the basis of information conservation and security that ensure long-term maintenance and use. Romero (2006) holds that digital preservation is developed as a global task that is ongoing and complex, taking into account physical and logical factors of the information, as well as implementation of proper, adequate and formal descriptions of the documents. Consequently, digital preservation of sound documents is a sustainable method through which sound

documents are conserved, administered and handled, while providing permanent access to the audio digital contents (also called essence or media), their dissemination and reuse, including associated metadata.

On the other hand, digitization is the transfer of the contents held in analogue supports to digital supports, i.e., the process by which the analogue signal is replaced by a digital signal (IASA, 2005). Digitization serves to protect valuable documents from manipulation and deterioration. It is the only way to ensure the survival of audiovisual material (UNESCO-UBS, 2012).

Beyond being an analogue to digital platform transfer and conversion process, digitization is a file management strategy (Green, 2006). Through the digitization process, a certain content is converted; for example, an audio recording is converted into a series of numerical values. According to recommendations of experts and researchers (IASA, 2005; ARSC-Technical Committe, 2011), digitization is based on the following recommendations:

1. Digitization should be performed without compressing data, on the basis of agreed upon digital signal quantification and samples.
2. The analogue signal of the document should be retrieved with high fidelity using proper recording and reproduction equipment.
3. Digitization must be performed without altering the source material.
4. An alpha-numeric coded link between the media and metadata must be provided to identify the material.

Digitization is a measure that serves to preserve documents recorded on analogue supports, and is implemented on the basis of digital preservation. Once the terms digitization and digital preservation have been defined, it is important to keep in mind that there are thousands of documents being produced every day on digital supports. This is why the question of digital preservation is so complex, in that it must deal with both digitized materials and those materials originally recorded using digital technologies. Digital preservation includes intervention and conservation actions. Migration from an obsolete support to new support is another preservation task. Prevention or delay of deterioration or damage are conservation actions that do not prevent obsolescence (Wright, 2012). According to the definition offered by Wright, migration is a part of preservation, and conservation of digital documents is the ongoing work of digital preservation.

The effect of digital preservation of sound files

More than a decade ago, Chen (2001), observed that conservation and preservation would be changed by digital preservation. This change has been so great that it has modified the safeguarding of sound archives through the advent of new professional profiles and flows, the generation of digital copies without losses and the incorporation of media and metadata as basic components of digital preservation. This change also entails the creation of digital mass storage and management systems, and the extension of access, dissemination and reuse of sound documents. Moreover, this change faces a series of challenges derived from digital preservation of sound documents.

New professional flows and profiles

Digitization was the first new process to be incorporated in the tasks of a traditional sound file.

In the view of Westerhof (2011), digitization lies at the root of the organizational changes and generation of problems in files. This process also exerts effects on the way in which we think about archival collections. With digitization, new work flows regarding file identification and intake of digital documents have gradually been incorporated. These works flows also include validation and verification of both cataloging and digitization, and matters involving on-site and remote access, ongoing verification of integrity and consistency of audio signals and metadata, and the periodic production of copies of media and metadata in accord with the policies of the archive. Therefore, employees doing such tasks must have an array of associated professional competencies. When deploying its digitization processes, the National Image and Sound Archive of Holland ran into problems associated with personnel and the changes this brought at diverse levels. The main problem was the change in the work team. Competencies had changed. The approach taken by new personnel jarred with the tools and mindset of the traditional archivists, in a sort of clash of cultures that is not always easy for archivists to understand (Westerhof, 2011).

Archives must face the twin unknowns entailed in digital preservation. On one hand, the continuity of conservation in traditional formats and, on the other, the demands placed on their use (Edmondson 2004). This means that while digital preservation platforms are used, archivists must also continue preforming traditional documental processes, including conservation

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of phonograms in vaults. The coexistence of these preservation methods of preservation of analogue and digital collections seems to be the direction of things to come.

Digital copies without losses

We have stated that conserving the contents, rather than the supports, lies at the heart of the change in digital conservation. For many years, production of copies on analogue supports entailed losses of signal fidelity. With the advent of digitization, copies on analogues supports are no longer made. Now the only way there is to have copies and ensure the long-term preservation of archives is to transfer them to a digital platform. The digital document is separated from the support. This separation is the principle of the preservation copy. It is much like an identical clone of the original (Wright, 2012). The concept of lossless copying is only possible within the digital domain (Schüller, 2006, 2012). Consequently, the priority for digital preservation is the conservation of digital contents.

Media and metadata, basic components

As explained before, the two basic components to consider in digital preservation are the digital sound, also called the essence or media, and the metadata. For preservation of sound, it is indispensable to have formats, levels of resolution, supports and technological systems that meet international standards. Version lying outside of such standards are not safe in the long term for migration and exchange of information, or with regard to emerging formats (IASA, 2006).

Metadata constitute the fundamental information for the use and management of sound collections once they have been digitalized. Metadata serve not only to identify and structure information, but also to allow for its retrieval (De Jong, 2001). The metadata of a digital sound file are created on the basis of the information issuing from cataloguing, digitization and management of the sound file (De Jong, 2001). A well planned digital archive will automatically create its metadata and include information regarding the original recording support, the format and state of conservation, the equipment and playback standards, digital resolution, all of the equipment employed, operators and participants and any other process or procedure involved (IASA, 2006).

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The metadata of a sound file are key tools for the communication that occurs between current systems and emerging technological systems. Without metadata, the exchange of digital information would be impossible (De Jong, 2001). A sound file needs to document all of the changes undergone by the metadata. The metadata registries, when properly created and maintained, may be made secure against any relevant change or storage applied in the appropriate field (Rodríguez, 2012).

Mass digital management and storage

Over the years and as collections grew, sound and audiovisual archives have faced the main challenge of negotiating for storage space (Wright, 2011). Digital preservation modified the conception of mass storage in vaults before the appearance of the Mass Digital Management and Storage System.

The IASA Technical Committee (2006) defines this system as "An understandable, completely automated and designed for storing, managing, maintaining, distributing and preserving a complex subset of inherited digital objects and their associated metadata, a backup system and simple storage."

The mass digital management and storage system integrate and automate the processes of controlling, digitizing, storing, cataloguing, administering and distributing digital objects and metadata of a sound file for the purpose of ensuring preservation and access. Mass Digital Management and Storage Systems establish the groundwork for operation of a digital file that can adopt open archive models such as Open Archival Information System (OAIS) and metadata management such as PREMIS. Mass Digital Management and Storage Systems are the technological platforms for the digital preservation of a sound file.

Access, dissemination and reuse of a sound file

Access to, and visibility and reuse of a sound file comprise the most relevant changes arising from digital preservation. Thibodeau (2010) has stated that the value of digital preservation exists insofar as the information is used. The final purpose of conservation, therefore, is to optimize the possibilities of use.

Use of the digital sound file is potentiated by the internet and social networks, and new specialized services are created on the basis of sound cata-

logues of a file, which serves to imbue the documents held in each archive with value. Likewise, digital preservation constitutes a fundamental change in the area of promoting a culture of listeners. From this perspective, activities such as the basic selection of an audio library for preschoolers, the creation of a sound map or development of educational or cultural content maps constitute only a few examples of the variety of options that the reuse of sound file presents. A sound file is imbued with vitality and the collected phonographic recordings become a living heritage and fundamental component of contemporary society.

Challenges of digital preservation

Challenges should be understood as the trials that digital preservation of sound files entails in order to guarantee long-term digital preservation. Of these challenges, the following are the most prominent.

Obsolescence and migration

Thibodeau (2010) has established that the only prediction that can be made regarding information technology is that it will constantly change. Consequently, digital preservation conceived as a permanent solution for safeguarding the audio archive, resolving the problems of fragility and obsolescence of recording supports produced more than a century and a half ago, may well be inoperative within a relatively short period of time. As technology matures and density of storage increases, hardware often becomes obsolete; and as computer processors and many software applications fall out of use, users will no longer be able to access many files that depend on these components. Therefore, any decision regarding digital preservation should include technological flexibility. In this regard, Bradley (2007a) has said a long-term, sustainable vision of digital preservation of sound files is necessary.

Consequently, migration is something that will be performed on an ongoing basis. Schüller (2006) and Teruggi (2004) also stress that migration of information to new storage systems as a result of impending obsolescence of the earlier storage system is a key part of digital preservation. According to Schüller migration is a cyclical process that should not be delayed beyond a ten-year horizon.

Technological breakdowns and human errors

Digital preservation is fragile because of the inherent risks of using technology and human error. Van Malssen (2011) has stated that some of the common risks to digital media, which can be applied to digital preservation of sound files, involve operational errors in the use of software and hardware, file transfer glitches, and internal and external attacks.

Moreover, human errors in the operation of mass digital management and storage system arise from lack of specialized qualification and training in the associated technology (Van Malssen, 2011). Since preservation is a new area of knowledge, many institutions do not have the qualified personnel to handle the technology. Sometimes, technical personnel is hired, who do not have the requisite knowledge, leading to human errors affecting the operation of the digital archive. What is more, the capacity to respond to internal and external attacks is related directly with the ability to have professionally qualified personnel on staff.

Social, economic and political continuity

Social, economic and political continuity is perhaps the greatest threat. If the institution decides not to support the maintenance of digital preservation, digital resources may well disappear. In this regard, the Vancouver Declaration, (UNESCO-UBC, 2012:1) states that "large amounts of information are continuously lost because its importance is unknown, the lack of legal and institutional frameworks for ensuring its conservation and better training and funding are needed."

In this sense, Wright (2012:15) states:

> In the physical (analogue) world, the environment of storage spaces, including such things as temperature and humidity control and fire prevention systems, are fundamental. In the world of digital preservation, the topics to consider are the social, political and economic contexts, and the management of an unseen archive.

The continuity in digital preservation of an audio archive is associated with long-term sustainability

Natural disasters

Natural disasters such as floods, earthquakes and fires pose risks to both analogue and digital archives. In order to safeguard such archives, institutions will have a least two copies held in alternate sites in conjunction with a disaster recovery plan (Van Malssen, 2011; UNESCO-UBC, 2012).

Lack of metadata

The lack of metadata represents a threat in the management in large collections of digital documents (Van Malssen, 2011). In analogue archives, the lack of identifying metadata is serious, but in digital archives it is even more damaging, because the support is not available. Before beginning the digitization of sound collections, an inventory of the collection including the basic metadata for identifying the digital document is a prerequisite

Conclusions

Over a century and a half ago it became possible to record sound to a support medium. After this achievement, millions of sound documents reflecting the history of artistic, cultural, scientific and political heritage of humanity have been created. As such, the preservation of analogue collections was a major task of archives, libraries, audio libraries and other depositories of sound memory.

The root of a fundamental change in audio archives began by acknowledging that conservation of original material was a vain effort because of the instability of supports, and the problem of the availability of playback equipment in the future.

With the advent of digital preservation, the priority was to preserve the content rather than the support. Consequently, the sound archives undergo a transformation that can be observed through the incorporation of new work flows and professional profiles defined by the coexistence of both analogue and digital preservation methods, the production of lossless digital copies (which has changed the notion of the original), the incorporation of media and metadata as basic components of the digital files, the use of Mass Digital Storage and Management Systems, as well as an expanded capacity for access, dissemination and reuse of the sound document.

Digital preservation of produces a change in the audio archive that entails a series of challenges, including technological obsolescence, ongoing migration, technological breakdowns, human error, and social, economic and political continuity, natural disasters and lack of metadata.

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✎

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