Development of a Digital Repository Prototype applied to Faculty of Pharmacy, University of Lisbon

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Abstract

University libraries have played a key role in scientific research as well as in the support of education-related activities. Their main goal is to provide its users with immediate access to relevant information through updated information sources. Science evolves rapidly and so the daily information needs on health matters are large and require rapid access to the sources. One of the problems that currently stand at university libraries is the access and processing of information in digital format. Digital objects are technologically diverse and there is not enough technical information about its proper handling.

In this paper we present the tools and methodologies that should be used to provide, in an organized and validated way, the wide range of existing information in digital format. This work was done in the context of the Master of Science thesis in Information Studies and Digital Libraries.

This research's aim is to find practical solutions for the processing and offer of information in digital format in the context of pharmaceutical sciences. For this, a prototype of a digital repository on Pharmaceutical Sciences, applied to the reality of the "Faculdade de Farmácia da Universidade de Lisboa" was created. Firstly, research work was developed on the reality of digital libraries and digital repositories in an university context and on the advantages, the problems and the main challenges that information professionals and institutions have to overcome. Secondly, issues about the quality of the information sources available on the Web were analyzed and a study on the quality of university digital libraries and digital repositories at a national and international level was made. Finally, having in mind the work that was developed and after the analysis of different platforms available in open source for the creation and implementation of digital repositories, the choice of a platform and the building of the prototype of a digital repository was made. This construction involved the installation and configuration of adequate software and the setting of parameters of the system, according to the previously identified needs.

Furthermore, the paper presents reliable benchmarking of best practices to implement and evaluate a prototype applied to the Pharmaceutical Sciences, in order to satisfy the user's needs.

Introduction

One of the problems that currently stand at university libraries is the access and processing of information in digital format because it is information that is technologically diverse and there is still much to tackle on the technical knowledge

about its proper handling. We intend to find out how libraries should act and what kind of tools and methodologies should be used in order to provide, in an organized and validated way, the wide range of information available in digital format.
As science evolves rapidly, the daily information needs in healthcare, which is the subject of interest in this work, are large and require rapid access to information.
The credibility of institutions devoted to research is given by publication and availability of its scientific production. As services to support research, Libraries should create and develop mechanisms that answer positively to these issues. These services should look at users as customers seeking a service - in this case, information - and for whom all the efforts will be made to respond at all information needs. Also, it's important to create services increasingly user friendly. To do that, it's necessary to adjust their services to new needs and new kinds of users, more and more dependent on the use of information technology but not always prepared for the overwhelming information that is discovered on the Web. Thus, it is proposed the development of a prototype of a digital repository, especially applied to the Pharmaceutical Sciences, but which can be implemented in any library or university.

Digital Technologies in University Context
University libraries have played a key role in scientific development and research, as well as supporting activities related to education. They have as main objectives to provide its users quick access to relevant information through updated information resources. With the advent of new technologies it is very important to try to realize which changes the "digital" environment actually adds to the libraries.
Arms (1) believes that digital libraries will allow a better provision of information and bring several benefits as, for example, the approach of the user's library, the ease of information search, the sharing and updating information, the 24 daily hours of available services and the appearance of other formats besides printed formats (1).

Scientific Production and Digital Repositories
In the late twentieth century, the publishing model of scientific production goes into crisis (2-5). That crisis brought great problems to the accessibility and dissemination of science. The time between submission, acceptance and actual publication is very large and libraries are no longer keeping up with the high costs of journals, compromising either access or scientific development. Thus, at the beginning of the 21th century, there has been a "revolution" in the communication model of scientific production, with the reorganization of the processes and initiatives of the researchers themselves, via the Web, allowing free access to its production, promoting communication between researchers and the integration of geographically dispersed scientific communities and knowledge sharing (2, 3, 6, 7). The digital repositories emerge, based on the OAI - Open Archive Initiative philosophy, to ensure a model of scientific publication to allow access, credibility, dissemination and scientific development.
Universities as generators of scientific information, that is likely to be used either internally or externally, give greater credibility to both researchers and universities themselves, and lead to the emergence of repositories in higher education institutions (8).
Crow and Rodrigues consider institutional repositories as "digital collections that preserve and provide access to the intellectual output of an institutional community" (9, 10). However Lynch defines a university institutional repository as a set of services that the university provides to its community, and to managing and disseminating digital documents created by the institution and the members of that community (11) and Crow

adds that institutional repositories, in addition to allowing free access to information and reduce the monopoly of scientific journals, can also serve as indicators of the quality of the university and “demonstrate the scientific, societal, and economic relevance of its research activities, thus increasing the institution’s visibility, status, and public value" (12-14).

With regard to content, repositories can store various types of documents that can be archived in different formats of text, image, audio, video, and can co-exist in more than one kind of document type (8, 15, 16). To ensure the long-term reliability of the contents, it is necessary to adopt management policies and selection of content with scientific value.

Thus, the creation of a digital repository, that centralizes the materials produced in the institution, which organizes and allows their search and information retrieval and that enables the authors themselves to feed the database of the digital repository, is an asset in the academic and scientific context because it promotes, preserves and disseminates the scientific production of an university.

Institutional Repositories: Benefits and Problems

One of the most important issues in the process of building an institutional repository, as well as all the technical issues related to software implementation and support of various informatics applications, is the stakeholders’ issue. Thus, it becomes essential to create a multidisciplinary team with librarians, computer programmers, researchers, institution director and people involved with the institution management policy. Simultaneously, the support and participation of the entire community is essential so that the repository is widely recognized as an asset for the institution and, in particular, for its members (8, 11, 17). The development of internal policies about self-archiving, copyright, access to information, preserving and use of the digital repository by the entire community (researchers, directors and institutional repository users, be they individuals or centers and departments) is very important to the building, implementation and development of the repository (2, 3, 7).

The authors-researchers themselves identify several advantages in the existence of institutional repositories such as a wider audience, accessibility and impact of scientific production (18). The repositories also positively affect the institutions, since they may be the way the institution is shown in the academic and scientific world and have more credibility, to deploy its scientific output in open access (19).

Another advantage identified is that the repository could become an important tool in the evaluation of research units and researchers to provide access to statistical data, generate activity reports, statistics of access to their documents (number of hits, queries and downloads) (20).

Despite the many benefits of creating an institutional repository, some concerns are pointed up, such as how the diversity of users types can be a barrier to information retrieval (9). Other recent studies show concern for the peer review in the repositories (18). However Viana, et al. argue that repositories can create conditions for discussion among peers and exchange ideas (6). Lynch points out to the possibility of the repository failing due to adopted policies, management fault and/or technical problems. In this case we may experience problems in accessing information or, worse, there might be total and permanent loss of documents stored in the repository (11).

Besides the technical issues related to creation of digital content, as the integrity and authenticity of digital objects, metadata, digital preservation, interoperability standards, copyright and intellectual preservation, there are also issues related to quality and usability of electronic resources, including digital libraries and digital repositories.

Evaluation of University Digital Libraries and Repositories

The main goals of this study are understand how the libraries and digital repositories are built, which platforms are used, what features were available and, finally, how we should develop a digital library or repository that responds to the increasing demands of its users.

In order to understand this reality an analysis of the national and international panorama was done, performing a comparative study on the university digital libraries, especially in the area of pharmaceutical sciences and/or health sciences.

This study was conducted in several phases. Initially, it was necessary to define our sample. At national level, research was done at the website of the Ministry of Science, Technology and Higher Education, at http://www.mctes.pt, where we searched for all Higher Education Institutions, regardless the study area. We analyzed all the Web pages of the institutions in order to detect which provided digital library or repository services. Please note that, in Portugal earlier to this study, only the University of Minho had already implemented this service and operated it in a more advanced way. Other institutions, like the University of Porto and ISCTE, were implementing similar services.

At the international level, the analysis was made from the webpage “Virtual Library: Pharmacy Page: Schools, Colleges, Faculties, and Departments” (21) which gives access to all schools of pharmacy in the world.

Earlier, this evaluation study considered 362 universities and tried to search directly on schools or colleges of pharmacy and their libraries. However, in general, in the pages of the schools and colleges of pharmacy that exist throughout the world, there is no access to libraries and therefore to their digital libraries. Given this difficulty, the research was conducted at the university level.

At the end of the first phase of the analyses research, the Webpages that had no access to digital libraries were not considered for study. The digital libraries not allowing access to general users were also not considered since it was not possible to analyze their organization and content. After this filtering, 300 libraries remained to be studied. Given the large number of digital libraries to analyze, it became necessary to filter and examine its qualities and characteristics. A new criterion was created classifying by "True Digital Library" or "False Digital Library". In this context, “True Digital Library” means using a structured and organized technology platform enabling basic and advanced searching functionalities in opposition to “False Digital Library” meaning a simple list of resources or digital collections. Please note that throughout this exhaustive analysis of Web pages of universities, colleges, libraries and digital libraries our concern was also to search for digital repositories. At the final stage of selection, the sample for study considered 45 platforms of digital libraries and repositories.

The evaluation grid was developed based on the literature on evaluating websites, portals and digital libraries. We used the grid adopted to Portals studies (16) and made the adjustments that were considered relevant for the evaluation of digital libraries and repositories.

It was considered important to examine both the institution and the library homepages, especially with regard to the information provided and the access points to the digital library and/or digital repository.

For the digital library or repository, the analysis fell into two distinct parts which complement each other: the homepage and the structure of the platform. It was considered relevant to study the following components: general and specific information, authority, updating and accessibility on the homepage and, regarding to the

structure of the platforms, analyzing their characteristics concerning the tasks and available functionalities, including types and search fields, information about the metadata schemas, the collections and its organization, available document types and display. We also analyzed some human-computer interaction (22).

Evaluation Results

The 45 digital libraries and repositories analyzed are distributed by the five continents, from the following countries: USA, UK, Spain, Netherlands, South Africa, Australia, Portugal, Austria, Canada, South Korea, Norway, Peru, Sweden, Switzerland and Turkey.

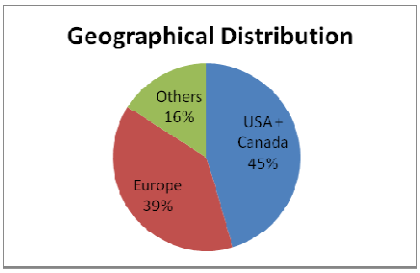

Figure 1 - Geographical distribution of the analyzed digital libraries

This study allowed us to understand the reality of university digital libraries and repositories around the world and to plan a more structured way to develop the prototype. It was possible, first, to draw some inferences about the best practices adopted. The parameters were analyzed in four different phases:

- Available information at the institution homepage,
- Available information at the library homepage,
- Available information at the digital library or Repository homepage and
- Characteristics about the digital library or repository.

With regard to the first stage of analysis, it is noted that none of these institutions homepages provide all indicators considered in the evaluation grid. But some of them provided the majority of the indicators (Figure 2). In this case, we found the sites of the University of South Carolina, University of California, Idaho State University, University of Kentucky, University of Southern California (USA) and University of Sydney (Australia), Ankara University (Turkey), Uppsala Universitet (Sweden) and University of Minho (Portugal).

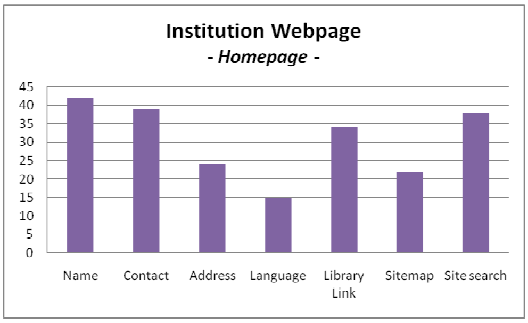

Figure 2 – Available information at the analyzed Institutions Homepage

Next we searched for the information present at the libraries homepage, such as page name, contact info, address and other parameters (exhaustive list present at Figure 3). In

some cases this information was only accessible beyond the homepage, after browsing thru not very well structured access points. Libraries providing the majority of the information at the homepage were ETH Zurich - Swiss Federal Institute of Technology Zurich (Switzerland), University of Florida (USA), Seoul National University (South Korea), Freie Universität - Berlin (Germany), University of Pretoria (Africa South) and University of Minho (Portugal) (Figure 3).

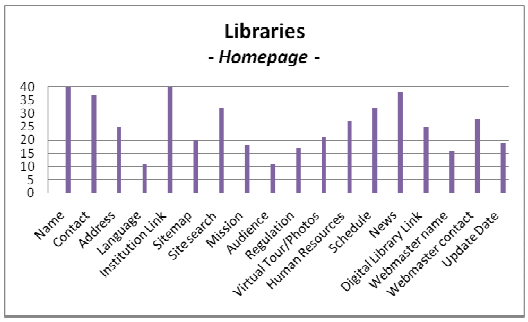

Figure 3 – Available information at the Libraries homepage

Analyzing the digital library homepage, we highlight some issues as the difficulty of the libraries to integrate in one place all the digital resources available in the institution. We found the University of Minho (Portugal), ETH Zurich - Swiss Federal Institute of Technology Zurich (Switzerland), Rhodes University (South Africa), University of South Carolina and University of Wisconsin - Madison (USA) and University of Sydney (Australia), as being the digital libraries that best integrate at their homepages the analyzed parameters (Figure 4).

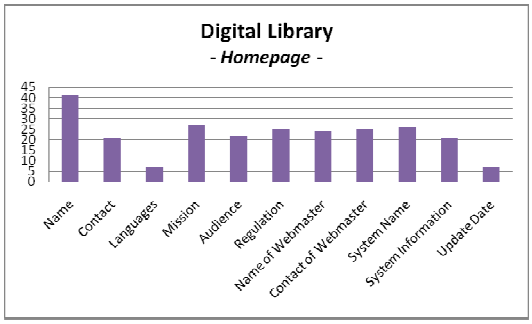

Figure 4 – Available information at Digital Library homepage

Furthermore, the digital libraries and repositories tools depend largely on the platform used. Thus, we highlight the platforms Dspace, Eprints, and CONTENTdm, but Dspace has been the most identified and used in the study, by the tools it provides (Figure 5). It is noted also that this may be due to the fact that it is an open source platform and allows the use of other free programs allowing the implementation of services that with a licensed platform would have to be paid. Thus, in the analyzed group, the highlights were the libraries and digital repositories at the University of Sydney (Australia), University of Manitoba (Canada), Universitat de Barcelona (Spain), University of Pretoria (South Africa), University of Cansas, Edinburgh University (Scotland) using the Dspace platform.

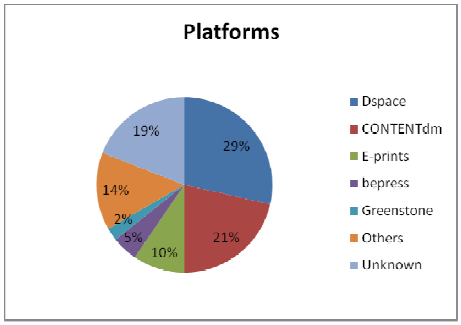

Figure 5 – Platforms used in Digital Libraries and Repositories

Another important issue in accessibility is the easy access to handicap people with special needs. To this indicator, only ten digital libraries and repositories provide information on accessibility or add the W3C logo identifying concerns about accessibility issues. We also find some weaknesses when analyzing the toolbar and their connections, missing links either to the library webpage either to the institution webpage, on the digital libraries webpage.
The type of information provided is another feature included in this evaluation. Therefore, we analyzed the type of bibliographic records available, the identification of document formats, access to full text and/or abstract, and the availability to download the documents. The bibliographic record format more adopted is the abbreviated format and, although many of the digital libraries provide the access to full text, the download of the entire document is not always allowed. Here it is noteworthy that many digital libraries provide access to full text in an image format, where each image corresponds to a document page, making it difficult or impossible any search, editing or printing (Figure 6).

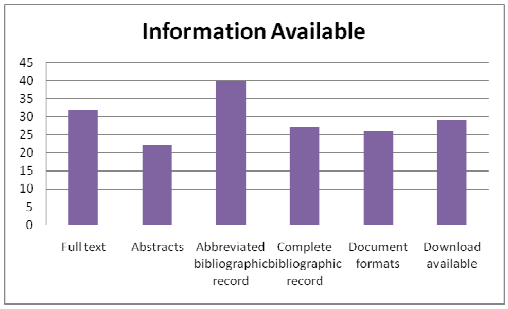

Figure 6 – Information Available

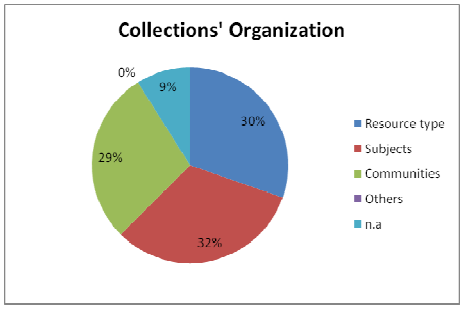

Figure 7 – Collections' Organization

The interaction with the user is very important to satisfy the audience. Related to the support services (which allow communication between the library and the user), the "Help" service is the most used and it is included in 30 out of 45 of the digital libraries evaluated. The possibility of contacting the libraries, tutorials and FAQ's are other possibilities, but this is available only in 10 digital libraries. Regarding the forms (which allow the user to communicate with digital libraries), these are not much used. Another parameter analyzed is the organization of the collection. It is possible to understand the purpose of the creation of some digital libraries and it is also possible to correlate this with the software adopted.
The organization of the collections in digital libraries is given in subject areas, resource type or by communities. In general, when collections were organized in communities, they were also organized, in a secondary level, by type of resource (Figure 7).

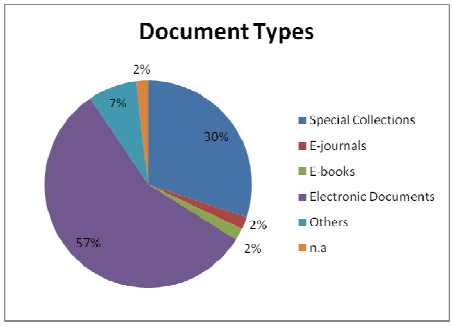

Figure 8 – Document types

Regarding the types of documents, 57% of the digital libraries analyzed are composed of "Electronic Documents" (such as work reports, masters dissertations, doctoral thesis, scientific papers, conference papers, among others) and 30% are "Special Collections" (such as photographs, maps, plans, documents, audio – oral history, among others, relating to the history of the institution). It is noted also that only a minority have the e-books and electronic journals in the set of resources that integrate the digital library. Through the analysis of these digital libraries, we also found out the platforms best suited for the different type of documents that was intended to provide. CONTENTdm is more used to "Special Collections" while Dspace and Eprints are best used for "Electronic Documents".

Prototype of Digital Repository for the Faculty of Pharmacy, University of Lisbon

Characterization of the Institution
The Faculty of Pharmacy has a curriculum composed by three scientific disciplines: Life Sciences, Pharmaceutical Sciences and Chemical Sciences and each one of the subject areas is divided into several subgroups (23).
Alongside to the educational activity, the School of Pharmacy develops research activities. These activities are distributed by the following research centers:

- Molecular Pathogenesis Center
- Studies in Pharmaceutical Sciences Center
- Chemical and Pharmaceutical Biotechnology Center
- Pharmaceutical Sciences and Technology Unit
- Molecular Biology Unit: Genetic and Environmental Pharmacogenetics
- Research Institute for Medicines and Pharmaceutical Sciences

Each center is composed by several groups associated with research projects that produce scientific articles, papers at conferences, contributions from researchers in the scientific literature including chapters in books, some working papers, reports and patents.

Methodology
The methodology for the development of the Digital Repository of Pharmaceutical Sciences encompasses several phases. In the first phase, the selection of the platform to be adopted for the digital repository, it was necessary to know the characteristics of the existing software. To this, it was necessary to do a review of the existing literature on the platforms and software. It was also important to analyze the case studies of use of such platforms.

Platforms for Digital Repositories

Dspace and Eprints are open source platforms which allow creating institutional repositories. By analysis of Dspace and Eprints tools and functionalities we could identify some differences between both of them. They use different programming languages, Java and Perl, respectively. Regarding configuration, through comparative studies conducted by the University of Glasgow, Eprints needs to be worked in terms of configurations. These configuration changes must be made at the encoding and involve changes in several files *. Xml (24).

Dspace does not require major changes to its configuration. However, at administrator level, you can make changes on the page of communities and collections, with text or image, such as adding information about copyright.

Regarding to submission/deposit, it can be concluded that both platforms are designed to allow the authors and researchers to upload their materials to the repository. However, Eprints is geared more towards self-archiving of peer-reviewed scientific papers produced by universities and Dspace is intended for a variety of institutional uses, which also include the management of digital content, digital preservation and electronic publications (25).

According to the University of Glasgow comparative study, the submission process is very similar. But Eprints is based on document type and Dspace focuses on the collection where the document should be added (24).

Both platforms allow the user access to a personal area. To do this, users must register with their access credentials. Once registered, users can submit their work and view the submission stage. In Dspace, users are responsible for some admission or verification tasks of previously submitted content and can be notified by email if any task is pending.

For the administration area, to administer a range of services such as management of registered users, the admission of items and the creation of communities and collections, the University of Glasgow study finds that Dspace has an administration interface very well achieved (24).

The model of communities and collections in Dspace allows access to the content of the various collections and it can be very granular.

Dspace provides detailed statistical reports about registered users actions, about the research carried out on the platform and the number of times a particular item was accessed (20, 24).

Into Eprints you can apply access controls to a particular item and create different workflow processes and policies for access to specific collections. This is possible by creating groups and access policies for each collection and its contents (24).

Thus, the platform chosen to develop a prototype of digital repository was Dspace due to the fact that it can be used for different types of documents within an institution and not just for peer-reviewed scientific papers such as Eprints. Dspace enables the management of digital content and digital preservation and is more easily configurable without the need of major changes in the coding.

Building the Prototype of Digital Repository

The building of the prototype includes the installation and configuration of software, selection of colors and choice of the logo, the type of persistent identifiers and metadata schema adopted, and the form of information organization that was considered in the case of a digital repository of Pharmaceutical Sciences applied to the Faculty of Pharmacy, University of Lisbon. One aspect initially considered was the implementation of a prototype server. However, this deployment, initially planned, did

not materialize since the acquisition of the Linux server by the Faculty of Pharmacy, University of Lisbon, did not occur as expected due to budget constraints.
In failure of the Linux approach, the Windows environment was adopted in which we installed Java SDK 1.5, PostgreSQL 8.2 for Windows, Apache Ant 2.0. and Jakarta Tomcat 5.5, applications needed to run Dspace and available for download at the Dspace homepage (26). After that, we made the Dspace software installation with the most stable version – the 1.4.2 version (as of December 2007). When installation was complete, we started the Tomcat service and opening the browser with the link http://localhost:8080/dspace we can view the Dspace default page. Then, we setup Dspace according to customer needs.

Figure 9 – Dspace default page

Colors and Logo. Colors play an important role in the development of websites and must be compatible with all systems that are properly viewed by all users (27). It is therefore advisable to use a palette of 216 colors, usually referred to as web-safe color palette (28). The colors are the way the brain interprets the electromagnetic radiation whose wavelength ranges between 350 (violet) and 750 (red) nanometers. At each wavelength a different color is viewed (29). Simultaneously, the colors also have a symbolism which conveys a certain meaning to the user. The choice of colors used on the website led to conduct a review of the best colors to be take into account that the website conveys credibility and seriousness. Another issue considered was the existence of a color associated with the pharmaceutical sciences (purple), which also corresponds to the color adopted by the Faculty of Pharmacy, University of Lisbon.
Thus, the selected colors were white, purple and gray. White symbolizes simplicity and harmony, purple means prosperity, nobility and respect, and gray is a color that conveys stability, success and quality (30).
For the logo, we considered three aspects: the name to assign to the prototype, the subject area and the color adopted. As the prototype is a digital repository of pharmaceutical sciences applied to the Faculty of Pharmacy, University of Lisbon, commonly known as FFUL, the name given was "FFUL digital - Digital Repository of the Faculty of Pharmacy, University of Lisbon." Moreover, the pharmaceutical sciences are usually represented by a mortar or bowl of Hygeia (goddess of health in Greek mythology) and the serpent of Epidaurus (ancient Greek city, located near the Aegean Sea and famous for the shrine of Aesculapius, the god of medicine) (31). The use of the serpent as a physician-pharmacist symbol comes from a legend: the hero Gilgamesh dives into the depths of the sea to harvest the plant of eternal youth; when he returns, a serpent swallows it and rejuvenates (31).
However, in France, the Société Libre de Pharmaciens de Paris, founded in 1796, used a symbol consisting of a serpent coiled around a palm tree and it is believed that Portugal

used it also into as a form of homage, though never openly admitted, to the French Revolution.
The symbol of FFUL, composed by the serpent coiled around the palm tree, is adapted from the original symbol of the Pharmaceutical Society Lusitana, created in 1835.
The elements that make up this symbol have a more specific meaning: the palm tree represents the plant kingdom, the serpent represents the animal kingdom and the rocks at the base of the palm tree represent the mineral kingdom (32).
Thus, it was considered important to maintain the identity of the Pharmacy School, combining the symbol used by the college with the name of the prototype.

Figure 10 – Digital Repository Logo

Identifiers. Dspace uses the CNRI Handle System for creating persistent identifiers that allow references to digital resources to remain available in long term. However, we can use another type of identifier, as PURL. Until the entry into production of the repository, Dspace provides a test server that generates the fictitious type handles http://hdl.handle.net/123456789/n where *n* ranges from [1, + ∞ [and corresponds to the order number of a particular object created in Dspace. These handles are generated for testing (they are equal in each existent Dspace test facilities and the Handle System does not recognize them).
To use the handle system it is necessary to install the handle server that Dspace provides. Since, during the development of this work, we could not have a specific server to implement this project, in the test phase a test server provided by Dspace was used. In the future, as soon as the handle server installation process and CNRI registration is carried out, we will get a unique prefix and our identifier becomes the type http://hdl.handle.net/xxxx/n, identifying the digital objects uniquely.

Metadata Schema. Dspace incorporates the Dublin Core as the default metadata schema. However, it allows us to set other metadata schemas if necessary. In the particular case of the digital repository of Pharmaceutical Sciences, and according to the characteristics and types of the digital objects that were considered, the metadata schema adopted was the Dublin Core. It was also considered very important to develop templates for the different types of documents used in the repository.
The existence of templates has as main advantages the identification of key fields to be completed in a situation of self-archiving by users. Moreover, the existence of templates for each document type lets you keep both the quality and completeness of bibliographic records, or facilitate the retrieval of information in the repository and/or bibliographic catalog. So, for the main types of resources, we set up templates with the respective entry fields.
An important aspect is the integration of resources with the bibliographic catalog or, at least, the existence of a connection between the objects of the digital repository and bibliographic record of the library catalog. This connection is possible by placing the persistent identifier (assigned to each document in the repository), in the bibliographic records from the Library catalog. Thus, any user who carries out search in the bibliographic catalog of the Library of the Faculty of Pharmacy will be able to access the document in digital format. The integration of the digital repository with the bibliographic catalog can also be considered in the initial feeding of the digital

repository. Another possibility is the bibliographic catalog to be fed from the digital repository. Thus, it would avoid duplication of tasks.

Information Organization. In the process of organizing information, as observed in the study of digital libraries and repositories, it's possible to structure the information in three ways: by communities, by type of resource and by subject area. Analyzing Dspace capabilities and tools, according to database structure and information retrieval, the thematic organization was excluded. This decision is based on several factors: first, the Dspace lets you search and browse the entire database by subject, on the other hand, it would be more difficult for the user to make the ingest of documents according to subject area, since documents can address several issues, which could confuse the user. It is noted that, with regard to indexing and assignment of descriptors or keywords, the role of information professionals is considered extremely important.
Thus, there remains under consideration the communities and type of resource organization. Analyzing the two situations, and considering what has been observed previously in other libraries and digital repositories, it was chosen, at first level, to organize the information into communities and sub-communities, and at second level, to organize it by type of resources. Communities correspond to the various sectors or departments existing in the institution and the types of resources will correspond to collections, which include journal articles, books, periodicals, doctoral dissertations and master's degrees, among others.

Communities	*Sub-communities*	*Collections*
Library	---	Book Chapters Journals Articles Electronic Articles Special Collections Conference Papers FFUL Events Conference Abstracts Learning Materials Serials Doctoral Thesis Master's Dissertations Academic Works Tutorials
Research Centers	iMED.UL - Chemical Biology and Toxicology - Medicinal Chemistry - Metabolism and Genetics - Molecular and Cell Biology of Eukaryotic Systems - Nanomedicine and Drug Delivery Systems - Neuron Glia Biology in Health and Disease - Pharmacological Sciences	Articles Conference Papers Working Papers Patents Reports

Figure 11 – Example of Communities, Sub-communities and Collections

Two initial communities were created: Library and Research Centers. It is possible to create sub-communities within each community, and so, some sub-communities were created in the community "Research Centers". Regardless of being able to be reorganized in another way, the information was organized according to the example of Figure 11.

After building the prototype it was important to analyze and interact with the system through the introduction of documents according to their templates, create records for new users, make an analysis of the metadata schema and identifiers and the system responses to the several steps of the workflow. We then analyzed the functionality of the system and made the appropriate adjustments to optimize the prototype.

Features of the Prototype

The homepage was set up in order to provide a set of essential tools, according to the digital libraries and repositories evaluation, as the link to the institution and library homepages and the ability to view the page in Portuguese or English at the top of the page. In the navigation bar, on the left, there were available the search area, the user registration area and associated services, and also the "user help" area.

Figure 12 – FFULdigital repository homepage

On the right hand side, some links were added to information considered useful, including the ability to subscribe to RSS feeds from the repository. At the center, you can find three distinct areas with the information about the repository (goals, target audience and type of documents available), the ability to make several searches and an alphabetized list with the communities that constitute the repository. At the bottom, users have access to information about Dspace and also they can contact those who are responsible for the repository, through the "Comments"/"Feedback ".

One essential requirement in a digital repository is the possibility to do several searches. The repository can perform simple or advanced searches. A simple search is performed on the full range of existing documents in the repository while the advanced search allows selection of the search field, the community, sub-community and collection intended. It's possible to browse the entire database by title, author, subject and date.

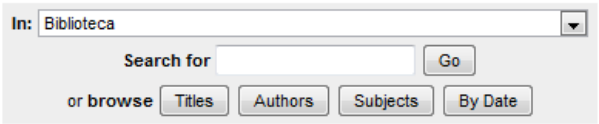

Figure 13 – Example of search type

The access to the administration tools is done through "My Dspace". Here the administrator introduces its credentials and, in addition to access its personal area, the system recognizes him as an administrator. The administrator sets up and manages the communities and collections, users and groups, records and metadata schemas, global

permissions and access policies, among others, according to community, collections and institution needs.

Figure 14 – Toolbar before and after administrator sign in

To keep the consistency and organization of communities, the system was parameterized so that only the system administrator can create communities and collections. The process of creating communities and collections is initiated through the site administrator with the creation of a top community. It's possible to customize the community with specific information about it, as a community logo, and to set policies and permissions for the community. At anytime it's possible to make changes, to add or delete communities and collections.
User Registration is provided from the homepage of the repository. If the users are already duly registered, they just have to fill in their credentials (e-mail address and password).

Figure 15 – User Login

In case of a new user, the "New User? Click here to register" link should be selected. After creating the new record, the user can access his personal area in the repository. However, to be able to make deposits, the system administrator will have to give him such permissions. Dspace admits authentication through the LDAP system. This system allows all users that are registered in the institution (e-mail address) to sign in without having to register again. So, the credentials are the same usually used to access the institution's network.
The self-archive process is only possible for authorized users and permissions are given by the system administrator or by the community or collection administrator. Templates

were defined for specific collections. For each collection, there is a form with specific fields for each type of document, that should be filled in. The self-archive process consists of several steps as in the workflow below:

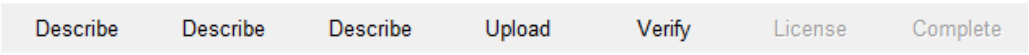

Figure 16 – Workflow Process

The first three phases refer to the description of the registration by completing the fields with the author, title, subject, etc. Then the system asks to load the files. Before concluding the deposit, it is also necessary to verify the information and that the author grants permission and licenses of copyright. If the author does not grant permission, the process is interrupted.
The statistical information provided by Dspace involves the use of PERL. For PERL to run on Windows Vista, it was necessary to install a compatible compiler. After that, it became possible to run PERL. However, as a separate tool, it was necessary to make some changes to the HTML file, including the full translation of the information provided and the set up of several parameters for the various counters. It's possible to get statistics of use of the repository, including statistics on documents submitted to the repository, items viewed, users who registered, information processing, actions in the repository, surveys and search word, among other possibilities.
During the testing phase, this prototype was used by users from areas such as university professors, researchers, students, librarians and general users. Their reactions and feedback were very positive, considering the prototype easy to use and very usefull.

Conclusions
The final goal of this work was the development of a prototype digital repository of pharmaceutical sciences. There was an analysis framework for understanding the contexts involved. The university's digital library must evolve in order to allow that the entire work of the university community is an asset for the whole community and to the institution. Thus, we conclude that it is very important, in the university context, a tool that allows, in addition to access to digital contents, the preservation and archiving of all academic and scientific results produced in the institution.
The answer to this tool is to build a digital repository and understand how their own libraries and academic institutions should act to meet their own needs. In terms of international experience, it is noticed that libraries should develop a very friendly service and prepare briefings and training sessions to users about how to work with repositories, to ensure that the community sees it as an added value. Similarly, there must be an institutional policy setting out guidelines and directives necessary to ensure the success of projects that universities wish to develop.
During the development of the digital repository prototype, we analyzed several open source platforms and chose Dspace because it can be used for different types of documents within an institution, enabling the digital content management and digital preservation. Furthermore, it is easily configurable without the need for major changes in the coding. It was necessary to explore it in order to enable the configuration and parameterization according to the outlined objectives and the needs identified according to the reality of the institution and the organization of information. One of the main difficulties encountered in building the digital repository prototype was the need to deepen the knowledge of computer programming.
We developed the tools considered basics to the proper functioning of the digital repository taking into account good practices to be used in the Web environment,

creating a page using CSS (Cascading Style Sheet), subtitling of icons and images, the choice of colors and logo. On the other hand, we considered the aspects that have to do with the metadata schema and the identifiers to be used. As Dspace is an open source software, it allows the parameterization and configuration using the underlying technologies or the adoption of other (eg, in the case of identifiers, the use of PURL or Handle System) which are available and deemed most appropriate by facilitating the achievement of predefined goals.
Regarding the organization of information, Dspace allows information to be organized according to the needs of the institution itself. In this case, we tried to approach the organization of information in the digital repository to the reality of the institution. Some aspects should be improved, for instance the statistical information that should be adapted according to university needs. Another important aspect is the user support: the prototype functionalities should be even better and also some tutorials should be prepared to help users in the more complex tasks.
The aims of this study and prototype presentation is to demonstrate that the implementation of digital repositories in the university context is now of undeniable importance for greater transparency of scholarly communication, for the institutional value, for the treatment of information in digital format, by the university libraries and documentation services, and for improving access and retrieval of scientific information.

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