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Discovery Tools for Open Access Repositories: A Literature Mapping

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ABSTRACT

This paper describes the development of a systematic literature mapping approach that was used to identify and categorize current global studies wherein librarians utilized updated methodologies to select and implement Discovery Tools within Online Public Access Catalogs (OPAC) and Open Access Repositories (OAR). In line with systematic mapping protocols, this paper seeks to address the following questions: 1) What are the processes involved in the implementation of Discovery Tools (DT) within the OPAC and OAR of the libraries of universities and global research institutions? 2) How many studies have presented results concerning the methodologies used during efforts to evaluate the efficiency of DT functionalities? 3) What are the criteria used to measure the degree of satisfaction with regard to awaited expectations? Ultimately, the collected information will be used to document the state of a PhD thesis that aims to create a prototype for the usability evaluation of OAR that will lend visibility to the results of a project entitled "A Binational Laboratory for the Intelligent Management of Energy Sustainability and Technological Formation."

CCS Concepts

CCS → **Information systems** → **World Wide Web** → **Web services** → **Service discovery and interfaces**

Keywords

Discovery Tools, Open Access Repository, evaluation usability and open educational resources.

1. INTRODUCTION

The objective of the systematic literature mapping approach utilized in this study is to guide the state of the art in order to answer the following research questions: 1) What are the processes involved in the implementation of Discovery Tools (DT) within the Online Public Access Catalogs (OPAC) and Open Access Repositories (OAR) of university libraries and global research institutions? 2) How many studies have presented results regarding the methodologies used during efforts to evaluate the efficiency of DT functionalities? 3) What are the criteria used to measure the degree of satisfaction with regard to awaited expectations? This

study uses a systematic literature review to categorize and summarize existing information concerning these research questions; as such, it can be viewed as a method of investigation that is very similar to a survey. It is important to note, however, that a survey includes people while a systematic review involves literature. Various authors [17] [20] describe a process of systematic literature review that is combined with a synthesis of the research evidence; such a combination results in a "meta-analysis" and provides quantitative results that have been gathered from multiple perspectives.

Along these lines, this study is based on the three stages associated with a systematic review of the literature and is developed according to Kitchenham's proposal [17]. During Stage 1, the review is planned and researchers must develop a strategy that focuses on a systematization of the information related to the research questions. Furthermore, the strategy must also be considered in light of the review protocols. During Stage 2, the review is conducted; the main goals of this stage are to locate primary resources that address the research questions and to extract relevant information from their summaries. This will ensure relevance and quality and will allow for a synthesis of data that can be used to classify information according to its ability to answer the research questions. In Stage 3, the review is reported. The objectives of this stage are to present the valuable information that has been gleaned from the various studies, to systematize the results according to their respective research questions, and to uncover any gaps in knowledge as they relate to these contexts.

2. RESEARCH METHOD

Since 2004, the systematic literature review (SLR) has gained significant relevance in the field of software engineering. The SLR is used to identify, evaluate, and interpret all available data gathered during a research study, particularly data that is relevant to the question's subject area or phenomenon of interest. It is important to note that with a systematic literature review, it is expected that the selected studies will describe key points that may point to relevant information and that may be used to answer the research questions. During this process, the information can be systematized according to various criteria depending on the experience of the

researcher and the categorization of the information obtained (search chains, sources with factors of impact, research limitations, the precision of the hypothesis, etc.) [4].

The most important activity that is conducted during the planning stage is the formulation of research questions. These questions will, eventually, require a response and thus all aspects of a study will depend on the formulation of these questions [17]. To this end, the following steps are considered, wherein researchers must:

- Identify keywords and search terms that suit the research question(s).
- Conduct traditional research to procure articles in order to identify the terms that are most appropriate for an SLR search; this determination should be validated by at least two researchers who are experts in the field.
- Establish electronic databases to be used during the research study, including filters that can be used to specify the year, par evaluation, etc.
- Conduct a search using database keywords and export the files in an Excel-friendly format with such specific fields as "Abstract" and "Title."
- Read each of the titles and abstracts to determine whether they apply to the research context.

The stages of an SLR are presented in Table 1.

Table 1. Stages of an SLR [17]

Stages	Description
1. Planning	Researchers must identify a need for revision and establish the protocols to be followed during the study's execution.
1.1 Identifying the need for a systematic literature review	Researchers are required to carefully and impartially summarize the information that has been collected in order to answer research questions.
1.2 Developing the review protocols	Researchers must specify the methods that will be used during the performance of a particular systematic review. It is necessary to establish a predefined protocol in order to reduce researcher bias.
2. Leading	This stage marks the starting point of a systematic review process.
2.1. Identifying the research	The goal of a systematic review is to locate as many primary studies as possible that are relevant to the research question using an impartial research strategy. During this stage, this strategy is defined and documented in the research.
2.2. Selecting the primary studies	During this phase, potential relevant studies should be obtained. In order to determine their relevance to the study, an evaluation must be made. This assessment should be based on the selection criteria put forth in the study's protocols.
2.3. Evaluating the quality of	It is important to assess the "quality" of the gathered primary studies, to supply a detailed explanation of the

the selected studies	inclusion/exclusion criteria, and to provide recommendations for future research.
2.4. Removing the design data	Data extraction forms exactly record the information obtained from primary studies. To reduce bias, data extraction forms should be established during the definition of the study's protocols.
2.5. Summarizing the data	Researchers must summarize the results of the included primary studies. This summation can be descriptive (not quantitative) in nature. However, it is also possible to provide a descriptive synopsis within a quantitative summary.
3. Reporting the findings	Findings are usually reported via an article and are typically presented in a magazine, at a conference, in a technical report, or within a doctoral thesis.

To add to this study of quantitative data, we adopted the technique of meta-analysis, which was simultaneously implemented within the stages of our SLR.

According to Miller [20], a traditional meta-analysis begins with an exhaustive search of the available literature, to include every article that can be used to describe empirical evaluations of the concept under investigation. The unit of examination in a meta-analysis should be the impact of Variable X on Variable Y. It should be mentioned that this form of research is appropriate to a tightly focused investigation and that the concept of exploring multi-variables and their inter-relationships via a single meta-analysis is a topic of considerable debate in many experimental disciplines.

3. PLANING STAGE

In this stage, the following activities are performed:

- a) The research question is established. Researchers must identify the need for revision and define the protocols to be followed during the study's execution.
- b) The need for a systematic review is identified. Researchers are required to carefully and impartially summarize the gathered information in order to answer the research questions.

3.1 Establishing the research questions

The objective of this study's systematic review is to orientate the state of the art in an effort to respond to the following research questions:

- 1) What are the processes involved in the implementation of Discovery Tools (DT) within the Online Public Access Catalogs (OPAC) and Open Access Repositories (OAR) of the libraries of universities and global research institutions?
- 2) How many studies have presented results related to the methodologies used during efforts to evaluate the efficiency of DT functionalities?
- 3) What are the criteria used to measure the degree of satisfaction with regard to awaited expectations?

3.2 Identifying the need for a systematic review

Public science portal websites with open access articles must improve the user experience by providing searchers with a single starting point; users must be able to identify each item in the sites' holdings via a simple, intuitive, and fast mechanism that can be used to search for everything at once. It must be noted that these elements are expected by modern users. Libraries are dealing with the integration of diverse search systems and are developing more adaptable tools; however, it is also necessary to locate studies that contribute orientation research that may be used to supplement the most significant criteria for a discovery service. This effort is in line with open movement paradigms that have adopted a premise of sharing information and innovations not only with those communities that experience difficulties, but also with academic, governmental, and institutional bodies who have the will to use, produce, and disseminate OAR via the Internet according to freedom of use principles.

An approximation of the studies that have been conducted thus far inspired us to implement DT in an OAR; this decision was made based on an analysis of various studies of libraries and portals that have begun to integrate DT into their platforms.

3.3 Develop the review protocol

3.4 Developing the review protocols

The methods described above are oriented toward research and the differentiation of information. For this study, the following protocols were developed.

1. Researchers must specify the questions to be answered. Although systematic reviews often aim to uncover answers to individual questions or to test a single hypothesis, the field can be expanded. During this phase, it is necessary to identify the question or key questions that must be answered.
2. Researchers must define the methods to be used during the systematic literature review.
3. Researchers must define the inclusion and exclusion criteria that will be used to vet collected studies. For instance, studies that are relevant to the topics proposed in the research questions or that indicate the state of the question should be included. Researchers must decide whether to include results and conclusions that, in some cases, address the most specific questions through an analysis process or those that are based in knowledge areas that utilize different types of studies. Researchers must apply these criteria to various articles, books, book chapters, theses, dissertations, congresses, conferences, reviews, bibliographies, and work documents that were published during an appropriate time period as it relates to the topic of study.
4. To craft a comprehensive literature review, researchers must locate relevant studies using approved databases (WoS, SCOPUS, DOAJ, Google Scholar, ProQuest) and other available resources (for example, reports found in gray literature).
5. To facilitate the formulation of terminology to be used during the search process, an effective search method should be defined. Such a method may utilize qualifiers, descriptors, and keywords; these terms may be combined using appropriate Boolean operators (OR) (AND)

(NOT). Table 2 (presented below) describes the method used in this study.

6. Researchers must evaluate the results. Researchers are advised to make initial selections by examining the titles and abstracts of the retrieved resources.
7. Researchers must manage the results obtained from the various databases; it is recommended that researchers use a reference manager such as EndNote, Mendeley, etc.

Table 2. Keywords of the main concepts

Concepts	Keywords
Discovery Tool	DT
AND Repositories AND EVALUATION	OAR AND EV
AND LIBRARIES AND EVALUATION	LB AND EV

4. LEADING STAGE

During this stage, the systematic review process begins. Each study is retrieved via an automated search or a previously conducted manual search; the studies are evaluated by at least three authors, who together decide whether they should be included in the review. Decisions are made by considering the titles, abstracts, and keywords of the studies.

A systematic search is initiated by examining the search terms as they relate to the research question and by identifying keywords in the ACM Computing Classification System.

4.1 Identifying the research strategy

The Google Scholar, SCOPUS, and PROQUEST databases are often used to locate relevant resources. Searches are limited by dates, references, papers, sources, and countries with higher-level studies and products [4]. The objective of a systematic review is to locate as many primary studies as possible that are related to the research question using an impartial research strategy. During this stage, the research strategy is defined and documents are located [17].

4.2 Selecting the primary studies

Once the potential studies are obtained, a further evaluation should be conducted to determine their relevance to the study topic. This assessment should be based on the selection criteria defined in the protocol section.

A traditional search of the concepts should be made in Google Scholar using both English and Spanish terms; this process will allow researchers to identify various sources of open access articles and magazines. Researchers can then pinpoint the most relevant studies by examining the keywords that were defined during the previous stage. This will allow for a proper database search of SCOPUS and PROQUEST.

The results of a search of the selected databases are presented in Table 3.

Table 3. Total studies of search of selected database

Keywords	Google Scholar	SCOPUS	PROQUEST
DT AND LB OR OAR AND EV	38,036	93	19,996

4.3 Assessing quality

Researchers must select studies that contain quality information in order to develop detailed inclusion/exclusion criteria and to retain other studies for further research.

Using a comparative table to provide a quality assessment of the most promising studies, three main points were reviewed and identified as follows.

Inclusion/exclusion criteria:

1. The study was conducted after 2010.
2. Peer review journal
3. A sufficient number of citations were referenced.

Criteria for keywords linked to the “AND” operator:

- a) The study’s abstract offers a detailed description of the context (in this case, libraries and OAR).
- b) The study’s abstract provides guidelines regarding how the evaluation may be applied.
- c) The study’s abstract presents clear results that were obtained following an application of the context.

4.4 Developing a data extraction strategy

A study’s data extraction strategy is developed in an effort to provide a set of possible answers for each previously defined research question. An analysis of the study area’s keywords and a search of databases using the “AND” operator will allow researchers to quantify the related studies and uncover answers to the research questions.

Results should be exported to End Note to facilitate the accurate selection and evaluation of data and to develop statistics according to the inclusion/exclusion criteria.

4.5 Synthesizing, analyzing and presenting data

During this stage, researchers must summarize the results obtained from the included primary studies. This summation can be descriptive (non-quantitative) in nature, though it is also possible to provide a descriptive synopsis within a quantitative summary.

With regard to this study, the following results were found upon completion of this summary.

To quantify the information gathered from the three databases, researchers sought to identify those countries with the highest number of studies on the integration of DT. To this end, reports made in the last six years as well as the reports of scientists who have published the greatest number of articles in the field of library services were taken into consideration.

Table 4. Total selected studies according to the extraction strategy

Keywords	Google Scholar	PROQUEST	SCOPUS	Total
DT AND OAR AND EV	26	42	21	89

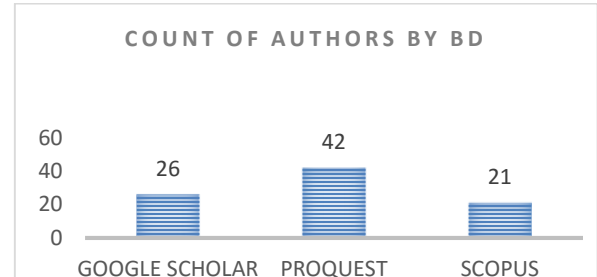


Figure 1. Average articles by each DB according to the extraction strategy

To quantify the information gathered by the three databases, the countries with highest number of studies that conducted research using integration of DT, the reports from the last six years and published reports of literature scientist who have published the greater number of articles in the field of the library services, were taken in consideration.



Figure 2. World Map of countries with the highest number of DT’s studies in libraries and OAR.

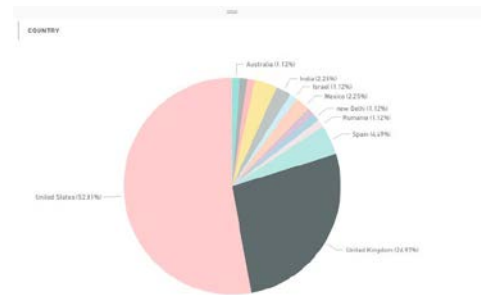


Figure 3. Average of country studies

Country	%GT Count of Country	Count of Country
Australia	1.12%	1
Bangladesh	1.12%	1
Brasil	1.12%	1
Cuba	3.37%	1
India	2.25%	1
Israel	1.12%	1
Mexico	2.25%	1
Netherlands	1.12%	1
new Delhi	1.12%	1
Rumania	1.12%	1
Spain	4.49%	1
United Kingdom	26.97%	1
United States	52.81%	1
Total	100.00%	14

Figure 4. Count of country with DT's studies

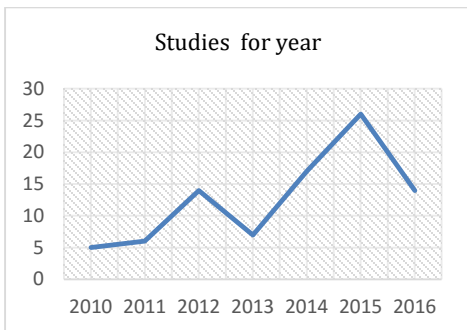


Figure 5. Graph of studies per year

5. REPORTING STAGE

Possible answers to the research questions must be explained in greater detail as they relate to the similar data extraction criteria of the selected papers.

1. Studies about the context
 - b. DT in LB
 - a. DT in OAR
2. Studies about the evaluation or comparison methods used to measure the efficiency of products
 - a. EV DT in LB
 - b. EV DT in OAR
3. Studies about the types of criteria used to measure results or characteristics

5.1 Studies about the context

The selected studies indicate that Discovery Tools have been well received in libraries; this is due to the fact that they provide access to various databases via a centralized search. DT have the ability to search a wide range of information resources, including OAR. Librarians can provide this functionality through DT; this method has been accepted by users, who compare DT to such search systems as Google [21].

To validate the increased use of library resources following the implementation of DT, comparisons must be conducted in order to uncover possible variations. In fact, some studies [1] reveal that WorldCat Local is recommended at McGill University for e-book services.

The use of DT promises to deliver a quick, efficient, and comprehensive search experience by offering users a single entry point [2]. In addition to DT, a customized search of pre-selected databases allows users to locate a set of smaller and highly relevant search results [8]. Librarians today are currently reviewing the next

generation of catalogs and DT in an effort to determine which tool is most appropriate. This is an important consideration, as each tool differs from the other and is able to locate different sources [3]. See Table 5.

Table 5. Results studies about the context

LB	OAR	Total
24	10	34 de 89
26.96%	11.23%	38.20% de 100%

5.2 Studies about the evaluation or comparison methods used to measure the efficiency of products

Many gray literature sources (published on library websites) have questioned the user experience. This experience should be both rich and intuitive; to this end, new interfaces should be integrated into traditional web-based catalogues. Evaluation tests of next-generation library catalogue interfaces should be formally conducted in order to determine whether users can, unassisted, accomplish common library tasks using these interfaces [18]. The selected studies highlight the development of task-based usability tests to measure various vendor-provided next-generation catalogue interfaces and web-scale Discovery Tools (Encore Synergy, Summon, WorldCat Local, Primo Central, EBSCO Discovery Service, etc.) [5][7] [14] [26] [27]. See Table 6.

The main goal of some studies is to provide a working framework that can be used to identify concrete evidence to support the purchase and implementation of an effective system that adequately addresses issues relating to catalogue searches [9].

Seven studies (7.86%) describe the implementation of a discovery layer in academic libraries; such implementation was based on usability testing and online surveys. To evaluate OAR, alternatives are presented from a different perspective and are based on the use of technology; only 3.31% of the selected studies discussed usability methodologies. See Table 7 and Table 8.

Table 6. Results studies about the evaluation or comparison for measure to test products efficiency of the products

LB	OAR	Total
25	7	32 de 89
28.08%	7.86%	35.95% de 100%

Table 7. Results for kind of measure for libraries

Exploratory Study	Count	%
Exploratory Study	1	1.12%
Methods and Technics	4	4.49%
Usability	7	7.86%
Comparative Criteria	13	14.60%

Table 8. Results for kind of measure for OAR

Methods and Technics	Count	%
Methods and Technics	3	3.31%
Usability	3	3.31%
Heuristic Evaluation	1	1.12%

5.3 Studies about the criteria used to measure DT evaluation results

Several studies have addressed the need for undergraduate students to be able to assess and compare the quality of sources when conducting research using Google and library (federated) search tools. These studies have examined the information-seeking behavior of undergraduate students within a research context and have established frameworks for teaching and assessing information literacy in response to advancements in online discovery methods [12] [6] [13].

Some studies have provided a conceptual framework for the creation of an institutional research-data management support system and have supported academic system development; these studies advocate data management, knowledge management, academic scholarships, and practice-based perspectives of knowledge. They conceptually explore the system elements necessary to the development of an institutional RDM service and compare that vision to the actual situations of universities. Ultimately, these studies provide recommendations for the adaptation and (re)design of institutional RDM infrastructure and promote knowledge discovery services [22] [19]. See Table 9.

Usability is a critical but often overlooked factor in the design and development of healthcare information technology systems and the testing of such portals using low-cost usability inspection methods such as heuristic evaluation and the identification of usability errors. Creating a user-friendly environment that follows the accepted heuristics of good interface design is essential in order to ensure the accessibility and usability of extracted data [25].

A study that included a ranking system was located and was determined to be a solid reference that supported the addition of criteria. For example, this study assessed the practice of webometrics and the heuristic evaluation of OER usability methods such as navigation, design, content, ease-of-use, and communication. [15].

Table 9. Characteristics and criteria for measuring the DT’s results of evaluation

How can we learn to students are looking in Discovery Tool?	11	12.35%
Knowledge Management Framework	2	2.24%
Usability Heuristics methodology	9	10.11%
Ranking systems to predict usability	1	1.12%
Total	23	25.84%

A study based in a ranking system was found, as a good reference to add criteria, for example, the practice of webometrics, to heuristics evaluation for OER under usability methods, such as navigation, design, content, and ease of use and communication. [15].

6. DISCUSSION

Studies regarding the evaluation of various DT have allowed researchers to identify the features that must be considered during an assessment. However, within the context of the user experience, features and considerations should be added to the interactive architecture of information designers and developers; this will allow them to evaluate usability during the user experience from their own perspective.

According to [11], creating or improving a product, service, or system by adopting principles of user experience design offers a clear and simple method that is based on decision-making, appearance, function, capability, information architecture, and interactive design.

Furthermore, various conducted surveys, which cover topics such as perception, reveal differences in the behavior of graduate and undergraduate survey respondents, as well as between library staff and non-library staff respondents.

The study described in [10] highlighted the need to integrate scientific activities within the web-based tools used in the social sciences; such integration would allow people to share information, resources, and documents with others. Therefore, it is not enough to ensure usability; we must also increase the use of technology to facilitate the dissemination of science knowledge [23].

The selected OER papers discuss various methods that may be used to develop a vision of how academic libraries can assume major roles in a future wherein open access (OA) publishing has become the predominant model for the dissemination of scholarly research articles. In April of 2015, there were approximately 2,850 academic OA repositories (Green OA) of various kinds listed on the Open DOAR (<http://www.openoer.org>). Scholarly OA repositories contain massive amounts of information, including rare or unpublished materials and articles from scholars’ self-archives, which are often included in their institution’s mandate. It can be difficult to locate this information if users do not know exactly where to look. The study described in [24] suggested that Ex-Libris efforts could improve the visibility and discoverability of OA materials included in the “Institutional Repositories”. This research access/impact problem is caused by a lack of access to journal articles; as such, potential research impacts could be lost. The solution, therefore, is to create open access articles [15].

Regarding OER, it is essential to consult research that covers the study’s evaluation criteria and that describes features of usability as they relate to OAR implementation and the integration of DT within the interfaces and architecture of information systems. Such studies should be conducted in accordance with the principles of user-centered design and with the goal of providing better possibilities of use in an effort to integrate design interfaces as potential tools for researchers.

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