

Digital repositories' Discovery services: between opportunities and challenges

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Abstract:

In recent years, many tools and platforms have been developed to improve and optimize discoverability and accessibility and enhance the search process to enrich the search results. The web searching process has undergone important changes such as the OPACS and Digital Repositories being adopted as discovery tools to develop the user's perspectives in finding the resources they need.

This study is carried out to evaluate the electronic information services mainly, discovery tools and their importance in the digital repositories. It also identifies the ways institutional repositories use to improve the discovery of resources in different location of those resources, to be discovered and retrieved by users to meet their information needs.

Keywords: discovery tools; institutional repositories; resources discovery; web-based searching ; Algerian repositories.

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1. Introduction:

Nowadays, Digital environment is undergoing changes to make it easy for the users to access, find and retrieve the information they are looking for. The way people search and look up scientific information has changed in behaviors and expectations, beyond the way to acquire research skills and obtain knowledge in that environment. Students are offered many opportunities to gain experience, create and share knowledge, discovery tools have emerged as important aids creating new information seeking patterns, so they can extend their experience and skills in dealing with the searching interfaces of institutional repositories and OPACs, and adapting their behavior to keep up with the current searching systems.

This study is set forth to analyze the electronic information services using a sample of 9 digital repositories in the Algerian universities. It also relies on the documented literature to provide a theoretical framework based on such analysis.

Besides, this study adopted content analysis of the Algerian digital repositories as an evaluation tool of the existence of the discovery services and to evaluate electronic information services of the repositories under investigation. The approach sought to analyze the electronic information services and mainly, discovery services tools used to increase the effectiveness and the diversity of information retrieval options available to users of the repositories. The observation method also was used, to observe each repository services

if they provide discovery tools used to increase the findability and retrievability of each repository's content these are listed as follows: The first subtitle opens with an introduction that presents the specific problem under study and describes the research strategy. The first subtitle opens with an introduction that presents the specific problem under study and describes the research strategy.

Link of the repository	Name of the repository
/http://dspace.univ-tlemcen.dz	DSpace à Université Aboubaker Belkaid Tlemcen
/ http://thesis.univ-biskra.dz	University of Biskra Theses Repository
http://dspace.univ-biskra.dz:8080/jspui	University of Biskra repository
/http://biblio.univ-alger.dz/jspui	Bibliothèque Virtuelle de l'université d'Alger
http://bibliotheque.univ-batna.dz/	Bibliothèque Centrale
http://dspace.univ-	Bouira

bouira.dz:8080/jspui/	University Digital Space
http://dspace.univ- /msila.dz:8080/xmlui	Mohamed Boudiaf University of M'Sila Repository
http://dspace.univ- /setif.dz:8888/jspui	University Ferhat Abbas Sétif 1 Repository
http://www.univ- soukahrass.dz/en/publication	Center of Academic Publications

**Table. 1 : the sample of the digital repositories under investigation
(Mettai and Boumarafi , 2022)**

2. Literature review

Previous studies that will be presented here to trace back the roots of discovery tools and the search behavior as well as the evaluation of discovery tools as an essential part of the library and repositories systems. The literature cites two ways of studying Discovery tools these are:

- A) The Usability of discovery tools in the OPACs of academic libraries and the capabilities of being used effectively by the users.

- B) The integration of discovery tools in digital repositories and moving from OPACs to implementing discovery tools to increase the findability and richness of relevant resources.

(**Heather et al, 2015**) conducted a study entitled “Searching in the Wild: Observing Information-Seeking Behavior in a Discovery Tool”. The researchers tried to investigate the users’ information-seeking behavior in a discovery tool by using an ethnographic analysis of the data with experienced research students to find out how appropriate discovery tools are for students and novice researchers. The study concluded that:

- The lack of understanding and constructing search queries and employing advanced searching techniques.
- A strong inclination for favoring full-text articles and native-full text.
- Several participants have demonstrated a strong familiarity with the author’s names when choosing topics in the field.
- The depth of familiarity with certain page layouts seems to prevent some students from absorbing the full contents of a search results from the discovery tool.
- Issues of access were an important reason caused unwillingness to follow links due to past failures.

(**York, 2005**) concluded that most of the library users are not comfortable with using discovery tools, most library users have already made the radical shift long before libraries. When Google

Scholar became available, users took to it immediately because it offered a search experience that was more appealing than library-provided interfaces. This was alarming to librarians that cautioned people away from using something not as powerful as library-provided tools. This demonstrates the experience of users with familiar search tools offered by Google and not ready to fully engage with the use of discovery tools when searching for the information resources, however, a 2015 Summon's study by **(Lundergan, Manuel, and Yan, 2015)** found that overall users were satisfied with the tool, and graduate students reported that they preferred specialized databases for their work, or Google Scholar for general searching. **(Tammera, 2012)** stated that the role of resources discovery tools in supporting serendipity, claimed that the resources discovery tools have an undeniable role in exploring the information resources, and cultivating serendipity and the accidental discovery of resources that has relevancy with the users' information needs. As library collections become increasingly digital, faculty lament the loss of serendipity of browsing library stacks. Resource discovery tools may have features that support serendipity as part of information seeking. **(MARÍA et al , 2014)** investigated the usability of discovery tools choices according to a desired checklist of criteria, and as a result they purchased the EBSCO's Discovery Service, and tested its usability among diverse users, they also evaluated its treatment of all types of resources. The researchers made a comparison of full text usages before and after the EDS soft-launch and the results users' feedback

were very positive during the launching the EDS. (**Guthrie and McCoy, 2012**) assessed discovery tool acquisition, library instruction, challenges, and librarian attitudes related to Web-scale discovery tools in HBCU (the Historically Black College or University) libraries in the United States, the results of this study showed That 50% of the respondents indicated that they have, indeed, supplemented their ILS with a discovery tool application. Five out of eight respondents cited EBSCO as their discovery tool as their choice. The others listed WorldCat Local, ProQuest, Primo and Summon. All the HBCU Libraries with discovery tools indicated that their product of choice primarily aggregates e-journals. Concerning the discovery tool acquisition, 84.8% of respondents selected speed, 69.2% cited efficiency, and 58.3% chose promoting resources and similar percentage indicated self-sufficiency. HBCU librarian attitudes toward discovery tools varied; when asked to check all the attitudes that apply, 70% of them believed that discovery tools help users turn to the library for scholastic research needs. 40% replied that discovery tools help users become familiar with individual databases, while 30% thought that discovery tools cause students to become less knowledgeable with individual databases. A similar number believed that discovery tools encourage students to be critical thinkers, while 10% stated that the tools inhibit students from engaging in critical thinking. For those libraries without discovery tools, respondents cited cost as the primary barrier for not having a discovery tool. All respondents indicated reasons such as lack of awareness, training, and

IT maintenance

2. Discovery tools evolution: a brief history

The effective searching for information on the World Wide Web represents a matter of great importance for the stakeholders and the research community members. Findability represents what can be done for locating digital objects and increasing the chances of finding more relevant resources to meet the users' information needs in a networked environment; the findability of Documents through OPACs and institutional Repositories. However, due to the complex search environment on the internet, sophisticated tools to satisfy the users have generated such worldwide interest of the research community, as the discovery tools aiming to enhance the ability of users to explore and find relevant items that match their information needs. **(Caplan, 2011)** mentioned that the first appearance of the term "Discovery tool" is the literature goes back to 2009, when ProQuest proposed "**Summon**" as "Unified Discovery Service ". Shortly after, the "EBSCO Discovery Service" (EDS) was launched. In 2011 a new feature named single centralized point was added as a single access point for all materials. **(Heller and Hong MA, 2016)** reported that the first commercial web-scale discovery (**WSD**) products came to the market in 2009, though the concept goes back farther to earlier federated search systems, according to **(Heppner, 2012)** WSD can be defined as a pre-harvested central index coupled with a richly featured discovery layer providing a single search across a library's local, open access, and subscriptions. The WSD contains two major components:

a central index and a discovery layer. Major WSD products are World Cat Discovery Service, Summon, Primo, and EBSCO Discovery Service (EDS).

2.1 What is Discovery tool?

(Teats, 2009) defines web-scale discovery as a system which is highly available, reliable, transparent, high performance, scalable, accessible, secure, usable, and inexpensive discovery tool aiming to enhance the search hits richness.

Discovery tools as a device which quickly searches through a large amount of data, regardless of being purchased, licensed or free of charge (Open Access content). Generally, discovery tools consist of two components namely: a unified index and a discovery layer which provides different features such as relevance ranking, an intuitive interface, and facets for searching. (Kutscher, 2013). Discovery tools can be defined as computer programs working as a comprehensive search tool to enhance resources findability and collecting all the metadata from the different location in one box from the broadest possible reach.

3. Digital repositories and Discovery tools: new opportunities to improve and facilitate content discoverability.

Due the nature of the fast-increased complexity of information on the web environment, many initiatives have been launched to increase the efficiency of information retrieval systems in

developing tools, and improving the ways that facilitate the fast discovery of information resources in a landscape changing rapidly in the way search systems work and support linking resources and the ability to discover resources metadata and interoperability between different systems with different metadata schemas to be discovered, and search options to be found and retrieved by end users, even in case of not implementing discovery tools.

Algerian digital repositories have been undergoing many changes, generally speaking, repositories' managers focused on simple technical issues to launch the platform rather than striving to improve the whole infrastructure that proved better services for the academic community. Accordingly, they have poor and medium electronic information services, and the technical issues are the most concerning issues that prevent or make it difficult to set some positive changes in the service packages the repositories provide for their users.

Discovery services represent a significant mechanism to collect many relevant information resources that implies different options to choose from, which they compiled from many locations in the unified box to search for and they can be found, accessed, and meet the expectations of the users. However, the nature of Discovery services requires of repository users to learn how it is used to meet his/her information needs, this is a real important factor in the success of search and information resources retrieval quality.

In relation to this, there are steps ahead and efforts to be made, and the repository platforms needs prerequisites, so that the

digital repositories can built-in more services in line with what they already have in common and as a result , the discovery tools can be a significance service that is going to boost findability and discoverability in a search environment that is getting complicated over time, the repositories in such a case must be effective, usable, and more responsive to the research needs of the community they serve.

3.1 Discovery tool service: a new trend in digital repositories

In a world that is becoming increasingly digital in an era where the linked data is a central part of the current web, the availability of digital information and where it can be found became a challenge for the digital consumers. (**Anglada , 2012**) claimed that the discovery tools aim to offer a better environment not just to search for resources, but to find them easily and retrieved them from different locations. The author gave a brief history of these discovery layers which were born out of an aspiration to offer a more enriched search experience than did library catalogs. In this networked environment, the implementation of discovery tools in libraries is growing and they are being integrated in the traditional libraries systems. (**Hofmann and Yang, 2012**) provided many up-to-date facts about discovery tools used in academic libraries. In addition to the increased number of implementations, they also found that among libraries that used discovery tools, 96% also used their traditional catalog system at the same time and 92% featured their discovery tools first on their home

pages, and the top three popular discovery tools were WorldCat Local by OCLC, Summon by Serials Solutions, and VuFind. About 66% of institutions with a discovery tool provided some degree of article search. Very few libraries were using more than one discovery tools in conjunction with their traditional catalog systems. This highlights the important role of discovery tools in enhancing the findability that lack the current systems of OPACs and providing a unified search interface for the users to choose between the search hits that can be retrieved from the institutional repositories or library catalogs or OPACs. The most widely recognized WSD services in the library market include Ebsco's Discovery Service, Ex Libris' Primo Central Index, Serial Solutions' Summon Service, and OCLC's WorldCat Discovery Service. **(Shi, and Levy, 2015)** mentioned that Ebsco's Discovery Services (EDS) is one of the discovery tools highly recommended by librarians, as such Ebsco has won many academic contracts for its use in libraries. The State University of New York (SUNY), for example, signed a multi-year contract with EDS in 2013. This reassures the importance of investing in Discovery services which are going to be an essential part of the whole services that institutional repositories offer to users by boosting the effectiveness and aiming to reduce, aggregate all the content, improve the fast discoverability, and findability with less efforts and time needed to get more search hits meeting the needs of information seekers.

4. How discovery tools can boost discoverability of content in digital repositories and OPACs

Discovery tools cannot work effectively in isolation, but rather, as a part of libraries and institutional repositories systems in a set of operations that need many factors interacting together. The integration of discovery tools has achieved some progress for academic libraries by moving from OPACs to discovery tools due to the complex systems that the web-services based on the emerging need to transfer the information between systems became key solution to the linkability of resources, OAI-PMH allow to discover the Metadata .The National International Information Standard Organization (**NISO , 2004**) defines interoperability as the ability of different systems, using different hardware and software platforms, data structures, and interfaces to exchange and share data.

The protocol for metadata harvesting (OAI-PMH), enables different digital libraries to expose their metadata for the purpose of automatic metadata extraction from all participating digital libraries. It also allows building various services, including a central metadata index and search system. Such a metadata index enables users to quickly identify and select appropriate research material held in all participating institutions and download specific publications online from the specific institutional repositories. The OAI-PMH has been used widely to harvest metadata across disparate digital repositories; this can be proved by the interoperable systems that are essential to make the discoverability of resources more possible and make the whole process successful, according to

(Edmund, 2013) Metadata serves three purposes in the Digital Library :

- **Descriptive metadata:** Descriptive metadata standards commonly used in Digital Libraries are Dublin Core Metadata Initiative (DCMI), Metadata Object Description Schema (MODS), and Metadata Encoding & Transmission Standard (METS). While DCMI is probably more widely used by Digital Libraries, MODS and METS provide a fuller descriptive framework as a successor to MARC. DSpace and Greenstone use DCMI as their descriptive metadata framework.
- **Semantic metadata:** semantic metadata description goes beyond the name/value descriptive pair to describe metadata in a series of “statements” in a subject, object and predicate statement.
- **Harvesting Metadata:** The most widely implemented harvesting system is Open Archives Initiative Protocol for Metadata Harvesting (OAI/PMH). This scheme supports metadata “harvesting” between digital libraries to allow discovery of digital resources between systems.

4.1 From search to discovery: searching, discovering, delivering

Searching information on the Internet has undergone so many radical changes since the creation of World Wide Web in 1990 by Tim Berners lee; the ways that users can navigate and find resources in the web also changed dramatically. As a result of ongoing web

developments, the browsing and navigation can be a challenging task. (Spiteri, 2016, p.13) mentioned that historically, the catalog has provided access to materials that are bought and processed within the library's system workflow, and the different materials have different processing and discovery systems associated with them, and institutional Repositories expanded the scope to include physical and digital collections, digital news feeds, course materials and syllabi, images, audio files, and so forth (Balnaves, 2013). The searching process has expanded in scope to include more resources to be retrieved from separate indexes and different locations and one can find all search results in its varying formats available in one place. Filtering and choosing from large, linked items that can match his information needs, and the tool provides broader access and coverage to most resources across disciplines for the users with discovery system search results.

4.2 Sharing metadata for better Discovery

Metadata is essential in the current web environment, and the path to where the information resources are well-described is stored in databases that contain those records, the more the item has a high rate of comprehensive coverage, the more probable of being discovered by the system. Metadata assists users in identifying, authenticating and contextualizing data, data sets and other digital resources as well as to describe the structural relationships within and between these materials. Metadata are used to define permission access rights,

sharing, re-use and re-distribution policies as well as the technical requirements for viewing, accessing or preserving digital and/or digitized objects. In order for these objects to be discovered and retrieved, the metadata needs to be harvested by the Primo discovery layer software (**Corrado and Jaffe, 2014**), which is one of the most used discovery tools for academic libraries and institutional repositories.

4.3 Facilitating findability and serendipity

The value of digital discovery tool and its implementation in the library OPACs and the institutional repositories is to make the search process more flexible and easier to retrieve more results at one click. (**Yckoson, 2015, p, 122**) posited that Former concerns of serendipitous information retrieval and collection's browsability still resonate loudly reporting that discovery tools allow users to not only discover "hidden" collections and uncover, serendipitously new information relevant to the overall need, but also to facilitate navigation through library collections that became increasingly complex and diverse in format. Such tools, which contemporarily have morphed from federated search capabilities; a single query search across multiple resources or databases, the results of which are aggregated and displayed to the user, and typically referred to as meta searching to discovery layers, web-scale discovery services, and beyond. The collecting of Resources from different locations via interoperable systems in one place to support serendipitous discovery, according to (**Tammera, 2012**) browsing physical collections is just

one of the possible manifestations of serendipitous interaction offered by information resources. Resource discovery tools can offer other possibilities.

4.4 Facilitating findability and serendipity

Although discovery tools have achieved some popularity as finding aids to the user's community, as they are tools easy to use. **(Johns-Smith, 2012)** claimed that the depth of the discovery product lies in its content, the ability to combine multiple sources of metadata into a single one such as, Google-like search box. The combination of MARC records, OAI compliant external repositories, databases, images, multi-media, and other online sources in a single search can lead to powerful, albeit overwhelming results. However, while the tools are easy to use and cover a lot of disciplines, their subject coverage is not always clear and relevancy rankings are proprietary algorithms, leading to information overload and dissatisfaction with known item searching **(Thompsett-Scott and Reese, 2012)**. According to **(Toby Burrows et al, 2007)** the advantages of these tools are:

- Results are often more focused because the content set across which the user is searching is related to a specific subject area, collection, or format of material.
- They offer advanced search options which give the user more flexibility in their searching. These include extensive field

searching, search histories, truncation, controlled vocabularies, and the ability to limit to peer reviewed items.

- Search results can often be manipulated through sorting or exporting.
- All the above means that searching can be done in a more precise manner which eliminates a lot of irrelevant search results from the process.

Although discovery tools can provide many features that create more options for users by extending the possibilities of collecting many resources from different locations to be searched for in one box, which can give diversified and rich search results for users, some of them may encounter a lot of difficulties because the nature of using the discovery tool per se. However, the same study reported that discovery tools do have their disadvantages

- For the novice user, it can be difficult to identify the right tool to use.
- Many of the advanced search options are not well understood and require instruction
- To be comprehensive in a search, users may need to search using multiple Tools.

5. The next generation of Discovery tools

The discovery tools of the next generation can solve and make the search process more precise, meaningful, and extendable to reach more useful results through the options they can provide for an effective information retrieval of rich search results that meet the

information needs of users in terms of precise and relevancy when looking for information in the repository system that is integrated with a discovery service tool, which is different from the traditional search systems that it can reach beyond the system searched in other contents with subscription from other locations which are affiliated to the OPACs or digital repositories. According to **(Breeding, a 2010)** One of the most powerful capabilities of these services involves providing access to individual journal articles, a task that has long been relegated to external indexing services. Indeed, the launch of discovery services seems to be a significant priority for repository's managers as this step will extend the scope of finding and discovering unexpected information resources from an unexpected source.

The next generation of discovery tools are developing to be more focused on finding information based on queries, **(Breeding, b 2010)** also clarified that the earlier versions of discovery tools were focusing on content managed locally within the ILS and repositories. This round of development takes on the ambitious task of bringing in the vast realm of remote content accessed through subscriptions, this means that the extend of search in the traditional contents in OPACs and repositories became an old mechanism to find, discover, and retrieve data or information effectively, tough, they have been developed towards next generation of discovery tools that meet the community needs.

The future of discovery tools/ web-discovery tools is much more related to the features they can offer to the users' community and giving alternatives to the ways that the users can search about resources and the ability to find it and retrieve them easily. However, there are more advantages for open-source discovery tools than those offered by vendors or commercial/proprietary systems. (**Yang and Wagner, 2010**) have developed a checklist of 12 features by comparing seven open source and ten proprietary discovery tools to determine if those features were present or absent in those tools, the two areas missed in both are Federated searching and relevancy based on circulation statistics. The results of that comparison are as listed below:

- 1- Single point of entry for all library information.
- 2- State-of-the-art web interface.
- 3- Enriched content.
- 4- Faceted navigation.
- 5- Simple keyword search box on every page.
- 6- Relevancy.
- 7- Did you mean...? / A spell-checking mechanism.
- 8- Recommendations/related materials.
- 9- User contribution.
- 10-RSS feeds.
- 11-Integration with social network sites.
- 12-Persistent links.

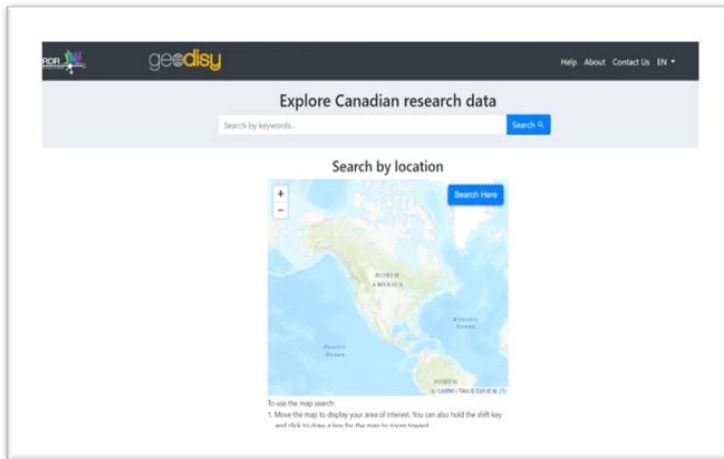
In sum, the repositories and libraries can evaluate their discovery tools by using different criteria which can be issued by experts, researchers, or even institutions. In addition to that, discovery tools support the research lifecycle and allow users to find more resources , beyond sometimes their expectations because of the way they collect items from many sources and the options they give for users to find, identify, select, obtain resources, and choosing between them to meet their needs and answer their questions. The benefit of this check list is spending less efforts and time with duplicate resources that can be found. However, the effective use of discovery tools by users poses a significant issue as systems work differently because some of the systems are non-generalized search systems and indexing data and the extent of linking resources on the web. Such factors might reduce the chances of search process success and make them unable to achieve the purpose of information search for information-seekers .

5.1 Geodisy Discovery Project

Geodisy is an open-source discovery tool that allows users to find data using an interactive map, which provides a map search FRDR's map search, this map search only includes datasets for repositories indexed by Federated Data Research Repository" (FRDR). with Geodisy, Data can be discoverable based on its location as it is shown in Graph 1, it includes geospatial files which they can

be downloaded directly when ISO19139 Metadata is set for all records.(FRDR, 2022).

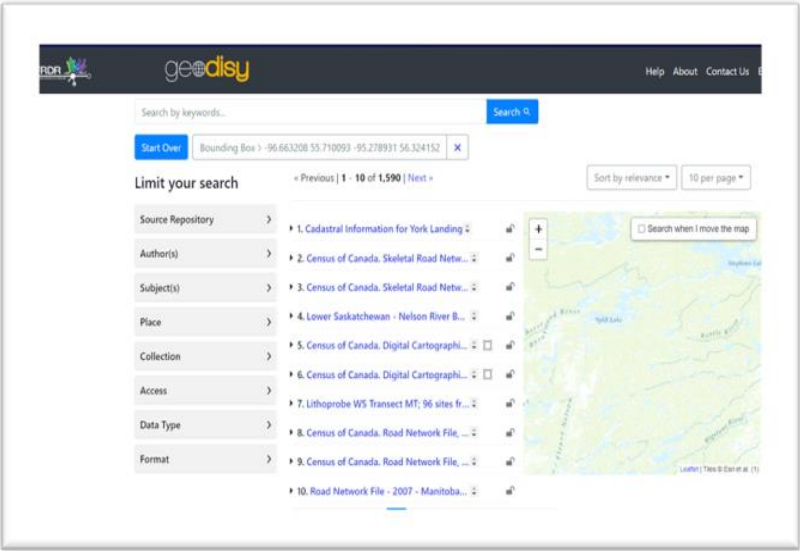
Fig.1. Geodisy Discovery service Search home page



Source: FRDR, 2022

As can be seen from the graph above, different criteria are provided to access information more precisely than in general search boxes which offer common search criteria to retrieve accurate results. Next generation of Discovery tools characteristics have been improving since decades, where some repositories can integrate Discovery services with the repository itself, other repositories built it in another link related to the repository link, so that users can search in one box for all the content in the repository with different search operators, in the case of research data, location search is a newly service that can be useful which is separated from the home page of the Federated Data Research Repository.

Fig.2. Results retrieved when searched by location



Source : FRDR, 2022

By searching the geographical map by the user towards specific geographical places of his/her own choice, many results could be retrieved by one click, as well as the institutions responsible for those resources. Users can also extend their research or limit it by different search options as it can be seen from the Graph 2 , which are on the left of the graph, they contain, in addition of the name of the repository that have the resource, the author, subject, place, collection, access, data type, and format.

Geodisy discovery service is an ambitious example of next generation of discovery tools which aims to change the traditional

search mindset and open the doors for more dynamic search in different systems in one place and retrieve diversified results that the users can choose, analyze, and find the most suitable resources with their exact location in the landscape that discovery services are working in as the information-seeking process in the age of digital linked data that became complicated and learning the basics of using them and supporting information literacy programs to teach the mechanisms of how discovery services are working in the digital web and their role in the findability and retrievability of content is decisive for making the search activities more meaningful and successful for repository users and digital information seekers alike.

6. CONCLUSION

This paper has been set to analyze and identify the importance of discovery tools and the scope of which they are part of the electronic information services of the Algerian repositories under investigation as new means to enhance effective information searching and the discoverability and retrievability of the digital content in the age of linked data. For years ongoing developments of search tools from traditional library catalogs to OPACs to discovery tools have been undergoing changes. These tools and systems have impacted users' information seeking behaviors and attitudes. They emerged as new systems of information retrieval and delivery for the potential value of making the search process more flexible and the ability to retrieve more results at one click.

The documented literature highlights several advantages that users and libraries can gain from implementing discovery tools to search library collections and institutional repositories.

Our analysis of Algerian digital repositories under investigation found that none of them use any type of discovery tool. The technical repositories' infrastructure is not focusing on improving the different services that repositories' software can offer to their research communities rather than just launching the simple basics of setting up repositories without being committed to working extensively to make it work for the whole research community they serve.

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