Utilizing Open-Source and Commercial Software to Establish Digital Repositories in Academic Institutions in Underdeveloped Nations.

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Abstract
Building digital libraries is not a complex or difficult process. The availability of specialized software for creating digital libraries has greatly facilitated the process, providing many advanced options for searching and browsing, as well as downloading, uploading, saving, archiving, and many other features. Greenstone is an open-source system that supports digital library building systems, while IQ CMS is a commercial system. This study presents a review of the experiences of several universities in four economically developing countries—Zimbabwe, Pakistan, Jordan, and Iraq—in using these software. The descriptive approach was used to complete this study, highlighting the negative aspects that emerged during the process of building digital libraries and repositories. The study demonstrated that the use of free and open-source software is a useful tool for creating effective and low-cost digital libraries and repositories, especially when the budget for such a project is very limited and expensive specialized software is not available.
Keywords: Greenstone, open source software, commercial softwear, digital repository, digital library.

1.Introduction

Technological development over time has made it possible for researchers and library patrons to acquire knowledge and science in easier ways. The availability of the Internet has made it easy for the reader and researcher to obtain the information they want while in their place without the need to move from one place to another or pay a lot of costs. Information sources have become distributed electronically, and it has succeeded. Information technology is used to convert collections from their paper form to electronic form. Libraries have become dependent on the availability of collections and information receptacles that have digital media, and this does not prevent them from having collections that are available on traditional media. The digital library is distinguished by its by using automated media and databases in the process of saving and storing information, and then being able to browse and obtain them over the network, Although building digital libraries is not a complex and difficult process, the presence of specific software for creating digital libraries has greatly helped to facilitate the construction processes and has provided many advanced options for searching, browsing, and browsing. Documents are stored electronically, in addition to the capabilities of downloading, uploading, saving, archiving, and many other features. This software also varied between commercial software, software available through a specific provider, and open source or freely available software. This open-source software, which is often available for free, has begun to attract the attention of libraries and small institutions as innovative solutions and appropriate tools for establishing digital libraries due to the advanced and diverse services they provide. One of these programs is Greenstone, which is the largest open program. The source is used to create digital libraries, which we will try in this study and learn about its characteristics, the most important services it provides, and the challenges that we will face when applying the software. The Greenstone system is considered one of the open source systems that supports digital library building systems. That is, software is available to all users. People can modify it, share it, and add to it according to their needs (Al-Salami, 2015). There is a close connection between open source software and the library community, as they both represent a free culture. In this context, the use of open source software in libraries has become an inherent phenomenon in light of the presence of many programs that can manage all operations. This prompted many libraries to upload the library database to the Internet and to ensure that all units are web-based and network-centric, enabling members to view the library's contents from home or from locations far from the physical entity of the library. Likewise, library staff can enter data from different, remote locations. If libraries continue to maintain their databases and websites on a local network or one device, they will lag behind others. When we talk about libraries working to develop themselves to survive over generations, they will be Programs with open source software are those ideal

programs for libraries that will continue to develop over generations, so that the matter is not limited to the survival of individuals but rather to the continuity of developing the program with new requirements and according to the best technologies available in the world (Haik, 2017).

2.Literature review

The existing system of scientific publishing is experiencing pressure for change under the influence of the exponential growth of information production, the dramatic increase in subscription fees, the increasing storage cost of printed documents, and the increasing power and availability of digital technology. To conduct their research more effectively, scientists need modern resources of digital information, which would support their endeavor. A digital repository is one such type of information resource. A digital repository is an institutional digital archive of the intellectual product created by the faculty, research staff , and students of an institution and accessible to end users both within and outside of the institution (Vrana. 2011)**.** Modern technological advancements have greatly simplified the processes of archiving, retrieving, and disseminating theses and dissertations (TDs). Originally bound, they are now available in digital form. Because of this change, student-generated research findings are now more widely disseminated and easier to access, and information is being shared across borders more effectively. Since their creation, electronic theses and dissertations (ETD) programs have been integrated into the Information Resources (IR) platforms of numerous universities. According to Yiotis (2008), this can contribute to the advancement of electronic theses and dissertations. Master's and doctoral students adore writing TDs because they are a certain kind of academic writing. To succeed, ETD projects require a diverse group of individuals with skills in management, teamwork, and preservation. Researchers, faculty, and the graduate or research office should work together more closely with the library (Mc Cutcheon, 2011). Institutional Repository Sustainability (IRS) is a comprehensive concept centered on the ongoing viability of an institutional repository. Institutional repositories are designed to safeguard the intellectual assets of universities, whereas sustainability pertains to the ongoing functionality of an organization. Consequently, the IRS manages the ongoing functionality of institutional repositories.(Esse, & Haliso, 2023). Allison (2006) presented a study, which is an experimental study. In this study, the researcher evaluated and tested both commercial systems and open-source software and did not find any system that met all his needs. There was no system that provided full support for the life cycle of a digital object, along with the flexibility and extensibility it needed to build and publish digital collections, so he decided to build a custom system by integrating the best tools he could. We use it for creating, managing, and displaying digital collections. He chose Greenstone as the tool to display his digital collections. This study centers on his experience tailoring Greenstone's public user interface and constructing Greenstone collections from various digital objects he created. Morton (2011) used a descriptive approach in his study, Implementing Open Source Programs for Basic Library Functions. This study presents the expected outcomes of experimenting with open-source programming, highlighting a positive experience that suggests potential for further system integration. This thesis talks about three system librarians in the year 2000: a web services librarian on the Dropa website, a digital projects librarian in the Fedora repository, and a systems integration librarian in Koha ILS (who left the library). In early 2010, the Drupal and Koha projects were active, while Fedora was still under development. The writer asserts that the three authors are involved in these projects concurrently, despite the project's ongoing status. Occurring simultaneously during implementation, the goal is to uncover common experiences of working with open-source software for other libraries that might consider implementing it. These shared experiences can provide valuable insights into the challenges and successes encountered during the integration process. By documenting these experiences, libraries can better prepare for potential obstacles and foster a collaborative environment that encourages innovation and knowledge sharing. Ali (2011) conducted a study on the digital library: foundations, concepts, and challenges facing Arab digital libraries. In his study, the researcher relied on the historical approach and the descriptive approach to monitor the characteristics of the subject of the study, and the study aimed to The study aimed to shed light on the requirements of the digital library, digital retrieval mechanisms, and methods of searching for digital information. It also touched on the concept of the digital library, its origins, and the stages of its development. Among the results that the researcher reached is that the rules Data represents the first form of digital resources in digital libraries, with an increasing trend towards investing in the free resources provided by the Internet. None of the projects In the Arab world, who uses any of the metadata standards, whether when creating digital and digitized sources or controlling them? Among the recommendations he presented was the preparation of appropriate software to automate library work, especially the subject of information retrieval. In the Witten study (2005), entitled Creating digital library collections with Greenstone, it is an experimental study in which the researcher says that this software is considered a comprehensive system. to build and distribute digital library collections and provide a way to organize information based on metadata and publish it on the Internet. This study introduces Greenstone and explains how librarians use it to create and customize digital library collections through the user interface. Finalists add

documents and metadata to the collections and create new groups whose structure mirrors existing groups; build groups and place them in place for users to view; and more advanced people can design and customize new group structures. Among the results reached by the researcher is that it is always difficult to produce good, up-to-date documentation for a software system rich in functions. From the user's point of view, the main obstacle to customization is documentation, and therefore the researcher recommends that building groups require access to advice and help from others; In order to continue learning how to design software to meet ever-changing requirements. Fayez (2016) conducted a study aiming to evaluate digital libraries. The aim of the evaluation is to ascertain the extent to which digital libraries achieve their main objectives, submit proposals for development, the interaction of the human element with the computer, and the performance of the information retrieval system and digital technology. Digital libraries are an extension of traditional libraries. The researcher relied on studying the beginnings of the digital library and its development, and from there, a case study, to describe the digital library and its development and analyze the elements of its evaluation. The researcher concluded that it is necessary to include the system. The possibility of exporting and importing information in other libraries, which saves effort and time and avoids repetition, as it can be imported, complete bibliographic data from other libraries, as well as the possibility of exporting it, and the researcher recommended the necessity of providing advanced search capabilities that include Boolean search and advanced search to improve the possibility of retrieving the required information. In his experimental study, Kumar(2013) aims to assist in choosing digital library management software. Libraries require high-quality, integrated programs in addition to advanced retrieval tools, and their high price prevents libraries from using them. Therefore, programs have appeared that are distributed free of charge for the benefit of researchers. They are known as open source or free programs, which are programs that are widely available on the Internet and can be downloaded and installed. One of the most important of these programs is Greenstone, which provides a method to build, maintain, and distribute digital library collections, which opens new possibilities for organizing information and making it available via the Internet. Biswas& Paul concluded that the emergence of open source library software led to a revolution in the field of library and information resource management, and it became a popular choice for most library and information specialists due to its many benefits and useful characteristics. Unquestionably, open-source software makes it possible to close the digital divide in a number of ways. Because they can use OSS, libraries in underdeveloped nations can facilitate resource sharing, digital libraries, and electronic access. Open-source software is increasingly being used by libraries in developed nations to enhance their offerings (Biswas& Paul 2010). Some examples of open-source library automation and digitization software are Greenstone, Koha, and Evergreen. Among the numerous features and functionalities provided by these systems are digital asset management, classification, and circulation. As an online integrated library system (ILS) with capabilities for cataloging, circulation, and patron management, Koha complements digital library software Greenstone in its ability to create and maintain digital collections. (Ahammad, Bahry, & Husaini 2024).

3.Study objectives

This study aims to review experiences in creating digital repositories to preserve various information sources related to academic research and education, using the Greenstone software. This software was chosen due to its open source nature and cost-effectiveness. Therefore, establishing these repositories will be cost-effective. Establishing digital repositories will enable the precise scientific steps required for this topic to be identified, facilitating access to valuable academic resources for students and researchers alike. Furthermore, it will enhance the preservation of scholarly works, ensuring that future generations can benefit from the knowledge and findings contained in theses and dissertations.

4.Methodology

The Greenstone softwear was introduced, and then the various versions of the softwear were discussed, as well as the practical features that the Greenstone provides, and also what are the practical steps that are carried out in order to create digital repositories. This study relied on the comparative approach, where the researcher studied four experiments to establish digital repositories in four countries classified as developing countries and from different geographical regions around the world. These countries are Zimbabwe, Pakistan, Jordan and Iraq. After reviewing the experiences in the four countries, the negative and positive points in each experience in those countries were identified.

5.Greenstone digital library software.

It is a set of software for building and distributing digital library collections. It provides a way to organize information and publish it on the Web or on removable media such as DVDs and USB flash drives. One of Greenstone's unique strengths is its multilingual nature. The reader interface is available in more than 60 languages. Greenstone was produced by the New Zealand Digital Library Project at the University of Waikato

and developed and distributed in collaboration with UNESCO and Human Info GNU. It is open-source, multilingual software, released under the terms of the GNU General Public License in 2000. In 2000, its developers received the IFIP Namur Prize "for contributions to awareness of the social impacts of information technology and the need for a comprehensive approach to the use of information technology that takes into account social impacts." The goal of Greenstone is to empower users, especially in universities, libraries, and other public service institutions, to build their own digital libraries. Digital libraries are radically reforming how information is disseminated and accessed in communities and UNESCO partner institutions in the fields of education, science, and culture around the world, especially in developing countries (Veer, 2012). Greenstone works on all versions: Windows, Unix/Linux and . Mac OS-X Greenstone can be installed on desktop computers, laptops, and servers, and is available via the Internet (Parichi,.2015). As for the default Windows installation, no configuration is required at all. Users routinely install Greenstone on their laptops or workstations, and enterprise users run it on the main web server, where it interacts with standard web server software such as Apache for Greenstone 2 and Tomacat for Greenstone 3.There is also a beta version available for Android, a version in which the digital library runs independently on the user's phone or tablet.

5.1 Greenstone versions:

It is a complete redesign and re-implementation of the original digital library software developed in 2000 (Greenstone 2). It includes all the features of the previous software and is backward compatible. A "Greenstone2 Collection" import feature is provided. Greenstone3 is written in the Greenstone Library Interface (GLI) to help transition to the new software for existing users. Greenstone3 is written in Java and takes advantage of many of the Web technologies, such as the B Digital library software. This makes digital library software highly customizable and extensible in the functionality it provides. In contrast, Greenstone2 is written in C++. Greenstone3 is under active development and downloading is recommended. It also offers maintenance releases for its predecessor, Greenstone2(Witten,2008).

5.2 Greenstone features.

It has two separate interactive interfaces, the reader interface and the librarian interface. End users access the digital library through the Reader interface that runs within a web browser. The Librarian interface is a Java-based graphical user interface that facilitates the collection of material for a collection (downloading it from the web when necessary), enriching it by adding metadata, designing the search and browsing facilities that the collection will provide to the user, and building and servicing the collection. The Librarian interface can be configured to manage remote Greenstone installations. Greenstone3 also provides library management facilities built into the web browser interface (once the user by logging in, this is an advantage over the previous version of the program (Witten,2003). The most important thing that distinguishes this system from other available systems are shown in the table below:

Greenstone special Features	Description
Multi-platform compatibility	Greenstone runs on Windows, Unix/Linux, and Mac OS-X, making it versatile for various systems.
Interoperability:	It supports multiple metadata and document formats, enabling integration with various digital library systems and standards.
Separate Librarian and User Interfaces	The system provides distinct interfaces for librarians to manage collections and for users to access them.
Flexible Document	Greenstone supports a wide range of document types, including text, images, audio, and video, and plugins can accommodate different formats.

Formats	
Easy Collection Building	The software provides a straightforward process for building and publishing collections, both locally and on the web.
Metadata Support	Greenstone supports various metadata formats, including Dublin Core, and allows for metadata enrichment and browsing.
Search and Browsing	Collections built with Greenstone offer effective full-text searching and metadata-based browsing, with intuitive interfaces.
Extensibility	Plugins allow for the addition of new document and metadata types, making Greenstone adaptable to diverse needs.
Open-Source and Collaborative	The source code is freely available, fostering a community-driven approach to development and improvement.

It is clear from the above table that this system is for the benefit of users who are not specialists in the software that needs high capacity and efficiency in design, and through this system, the user can define groups of descriptors. Data can be generated interactively using the Greenstone metadata editor (Witten,2001).

5.3 Steps to Practically Utilize Greenstone,

From installation to creating a digital library collection, there are several sequenced steps that should be followed as shown in the table below.

Step	Title	Actions
1	Install Greenstone	**Option A: Greenstone3** (Java-based, web interface) - Go to greenstone.org - Download Greenstone3 for your OS - Follow installer (Java will be installed if needed) - Launch gs3-server executable **Option B: Greenstone2** (standalone GUI) - Download Greenstone2 from the same site - Install and open the GLI (Greenstone Librarian Interface)
2	Understand the Architecture	- GLI: GUI for managing collections - GSDL: Server backend - Each collection includes metadata, source docs, config files
3	Create a New Digital Collection	- Launch GLI - Go to File > New Collection - Enter name, description, choose metadata set (e.g., Dublin Core) - Click OK

4	Add Content to Collection	- In GLI, switch to *Gather* tab - Drag and drop files (PDF, DOC, images, HTML, etc.) - Supported formats: .txt, .html, .pdf, .doc(x), .jpg, .png, audio/video (with plugins)
5	Assign Metadata	- Switch to *Enrich* tab - Select an item - Enter metadata (title, creator, date, subject, etc.) manually or via batch tools
6	Build the Collection	- Switch to *Design* tab (optional) - Go to *Create* tab and click **Build Collection** - Greenstone processes and indexes content
7	Preview Your Collection	- Click **Preview Collection** - Browser opens local URL (e.g., http://localhost:8282/greenstone3/...) - Browse and test features
8	Deploy Your Collection	- **Greenstone3**: Deploy via Apache Tomcat - **Greenstone2**: Distribute via CD/DVD/USB - Export as static HTML for offline use
9	Advanced Customization (Optional)	- Modify UI via XSLT/layout files (Greenstone3) - Edit collect.cfg (Greenstone2) - Add/configure plugins (PDFPlugin, WordPlugin, etc.)
10	Maintain and Backup	- Regularly back up the collect folder - Keep copies of Greenstone installation, config files, and content

IQ CMS system.

IQ CMS is an advanced software solution specifically designed to meet the requirements of academic, administrative, and cultural institutions. The system is highly comprehensive and flexible, making it suitable for developing multilingual websites, service portals, archiving systems, and digital repositories, with the ability to customize it to suit the needs of various institutions.

1. System Architecture

IQ CMS is based on an MVC (Model-View-Controller) architecture, allowing for a clear separation between application logic, user interface, and data management. The interface is often built using HTML5, CSS3, and JavaScript (including modern libraries like jQuery or Vue.js), while the backend is likely built using PHP or a popular framework like Laravel or even ASP.NET technologies in some versions. The system supports strong integration with SQL databases like MySQL or PostgreSQL.

2. Basic Functions.

- Content Management: Supports the creation, modification, and classification of content in a hierarchical and dynamic manner, with the ability to control permissions and publish content automatically.

- User and Permission Management: Provides a flexible login system that supports users, administrators, and moderators with multiple layers of security.

-Multilingual Support: Built-in interfaces support at least Arabic and English, with the ability to add additional languages.

-Mobile Compatibility: Supports responsive design to ensure a seamless user experience across multiple devices.

-The system seamlessly integrates with academic services like university thesis registration systems, digital repositories, library networks, and academic journal management systems.

-Search Engines and Metadata: Tools are included to generate metadata (meta tags) and optimize content for search engines.

3. Applications

IQ CMS has been adopted by several universities and academic institutions to establish digital repositories for university theses, official university and college websites, research and scientific journal tracking systems, and student and faculty service portals.

4. Security and Technical Support

The system includes mechanisms to protect data from SQL injection and XSS attacks and provides an accurate record of modifications and activities. Local technical teams also support and update it, ensuring a rapid response to market needs and the local regulatory environment.

6.Case Studies

6.1 .Pakistan .University Libraries of Islamabad.

Khan and Sheikh conducted a study paper about how open source software might be used to make digital repositories in Pakistani universities, especially in Islamabad. The goal of the study was to find out what kinds of open-source institutional repositories (IRs) are being used in the university libraries in Islamabad and to find out what librarians think about using IR software in those libraries. The study also attempted to evaluate the obstacles experienced by librarians in employing open-source IR softwares. Pakistan is one of the developing countries in the globe. Islamabad, Pakistan, has a lot of universities, however they are mostly public and private. The government pays for state-funded universities, while non-governmental organizations and private groups pay for private universities. In Islamabad, there are 16 public (government) universities and 7 private (non-government) universities that are accredited by the Higher Education Commission (HEC). A questionnaire was utilized to gather information from the respondents, and the survey method was employed to accomplish the study's research objectives. Of the 23 private and public universities in Islamabad that have been approved by the Higher Education Commission (HEC), 17 have set up IRs. The 104 library professionals who worked at these 17 universities made up the study's population. A "questionnaire is one of the most widely used social research techniques for data collection," according to Blaxter et al. (2010). As a result, a structured questionnaire was modified from Wahab's (2021) study. Five components served as the foundation for the research questionnaire. There were multiple-choice, closed-ended, and Likert-type scale items on the survey. The researchers created an electronic version of the survey and used email to gather information from Islamabad university libraries' library staff. Data was also gathered through social media networks' channels, such as Facebook and WhatsApp. Microsoft Excel and the Statistical Product and Service Solutions (SPSS) software version 21 were used to analyze the data. According to the study's findings, 17 universities have created IRs, with 12 of those being in the public sector and 5 being in the private sector. Chief librarians, librarians, deputy chief librarians, and associate librarians from the 17 Islamabad universities that have created IRs made up the study's population. Twenty professionals did not answer to the study, so 84 responses from the 17 universities made up the total of the 104 respondents. There were fewer respondents from the private sector than from the public sector, with the majority of respondents (58) coming from university libraries (Khan& Sheikh 2022).

6.2 Zimbabwe's Public Academic Libraries

The availability and accessibility of knowledge from southern African universities was found to be lacking. South Africa received a fair amount of attention, and Africa's research output increased from 1.9% to 3.1% in 2007. However, sub-Saharan Africa accounts for less than 1 percent of global research, indicating that Africa's research performance is below expectations (Adams, King & Hooks 2010). The Association of African Universities (AAU) began attempting to include research from Africa in the major body of knowledge worldwide. As a result, the Database of African Theses and Dissertations – Research (DATAD-R) was established in 2000. The greatest underutilized resource in Africa is electronic theses and dissertations (ETDs), which are either stored in inaccessible locations or allowed to collect dust on library shelves. ETD repositories offer schools, students, and researchers a number of advantages. They expose students to evolving formats and types of TDs, preserve and foster knowledge sharing, and enhance graduate education. ETDs increase the visibility and accessibility of students' work by showcasing a university's intellectual production to a worldwide audience (Suleman & Fox 2003, Yiotis 2008). However, creating ETD repositories does not guarantee that TDs will be simple to locate and utilize. Remote users can now find and access things without paying anything or

very little because access barriers have been removed. Internationally recognized technical metadata standards, such the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH), are used by institutional repositories. Web search engines like Google can more easily index the repository's contents thanks to these standards (Swan 2009). A study on the creation of digital repositories for theses and dissertations at Zimbabwean government university libraries was carried out by Tapfuma and Hoskins. The researchers noted that in order to generate new information and advance sustainable development, it is critical to make ETDs easily accessible and searchable online. Preventing duplicate research is also beneficial. The study examined the use of institutional repositories (IRs) by public universities in Zimbabwe to increase the visibility of student work. The Unified Theory of Acceptance and Use of Technology (UTAUT) was used to accomplish this. According to their findings, people's intentions and actual application of the model are influenced by four key factors: social influence, performance expectancy, effort expectancy, and facilitating conditions. Both obligatory and volunteer users are able to employ the UTAUT paradigm. The many electronic publishing platforms that may store ETDs are of interest to institutions that wish to establish ETD repositories. Because it is so easily customizable, DSpace is the greatest program for repositories. Greenstone, Eprints, and Bepress' Digital Commons are additional excellent choices. Tapfuma and Hoskins presented a comprehensive picture of how IR is expanding in Zimbabwe's public universities using a case study methodology and a range of methodologies. Forty assistant/faculty librarians received semi-structured questionnaires, and eight research directors and eight library directors were interviewed. A 62.5% response rate was obtained from the 25 assistant/faculty librarians who filled out the questionnaires. Two institutions were still working on their OA/IR policies, and five universities made their policies available for analysis. To examine the growth of Open Access Repositories (IRs) in Zimbabwe's public universities, they used a mixed methods approach. Assistant/faculty librarians received semi-structured questionnaires and interviews with research and library directors. The questionnaires were completed by 25 librarians, representing a 62.5% response rate. The University of Zimbabwe and the three institutions that make up NUST, MSU, and UZ were not included in the survey, which only examined eight public universities. A census was conducted for accuracy, and confidentiality was maintained. All eight colleges have institutional repositories that have been in existence for nine to thirteen years, according to the study. Two repositories, one in the public domain and six for internal use, are run by seven universities. While the other institutions compile printed versions of theses and dissertations, one institution keeps electronic copies. Exam papers and mostly undergraduate dissertations can be found in intranet repositories. University repositories are multidisciplinary and divided into several groups based on discipline. While the other sites include abstracts and metadata, only two provide full-text electronic theses and dissertations. Finding out if the repositories were registered with OpenDOAR, ROAR, or other open-source platforms was the goal of the study. Five repositories are currently unreachable, and an analysis of OpenDOAR, ROAR, and DATAD-R shows that all repositories that were previously listed on OpenDOAR were excluded (Tapfuma & Hoskins2021).

6.3 Jordan. Al Hussein Bin Talal University

The process of creating the digital library for the university theses went through multiple, sequential stages. Note that the project managers started using the latest version of the software, which is Greenstone 3.09, among several versions available. This project was carried out by graduate studies in the Department of Libraries and Information at the university. The student first carried out an inventory of all the master's and doctoral theses that were discussed and approved at the university. He then moved on to the stage of converting these theses into files in PDF format. The importance of this project is not only focused on building a digital library for the theses that were approved at the university, but the importance of this project is highlighted by the fact that it is a pioneering project to limit and control this type of information sources at the university. This project faced many administrative and technical difficulties. Among the administrative difficulties faced by the project manager was that he did not find any control tool or lists of university theses that were approved at the university, which forced him to conduct a complete inventory of all the graduate programs at the university and the academic theses they produced. Another administrative problem faced by the project manager was that the university theses were scattered between the university's central library, the Deanship of Scientific Research, and the university's colleges. This scattering created difficulty in accessing all theses, and thus required more time and effort in order to actually access all theses and enter them into the lists of university theses so that they could be later entered into the digital repository. Also, not all theses were available on the library shelves. For this reason, the project manager contacted the University's Scientific Research Deanship to count the number of theses. Unfortunately, the Research Deanship also did not have complete data on the number of theses approved since the beginning of the academic year in which thesis Discussion and approval began at Al-Hussein University. However, counting the numbers began in the last four years of 2017, and this data is insufficient. This prompted the researcher to visit the Admissions and Registration Unit to inquire about the numbers or to obtain a database to record them. Project manager also found only one method: manual counting of graduate lists from the 2012

academic year through the summer semester of 2021. The calculations were done manually each year, and each major separately, for the number of graduates in postgraduate studies. Graduate lists were obtained from the Admissions and Registration Unit to record the numbers available, whether on shelves, in the supply department, or in scientific research deanship, and to identify those missing. For these reasons, the project manager contacted some of the graduated students of the missing theses by phone to provide him with copies of their letters. Their contact information was obtained from both the Deanship of Scientific Research and the Admissions and Registration Unit. One of the technical problems was that the software did not support the Arabic language, which caused me a problem in the process of entering data into the software, until this problem was solved, as the software now supports the Arabic language.
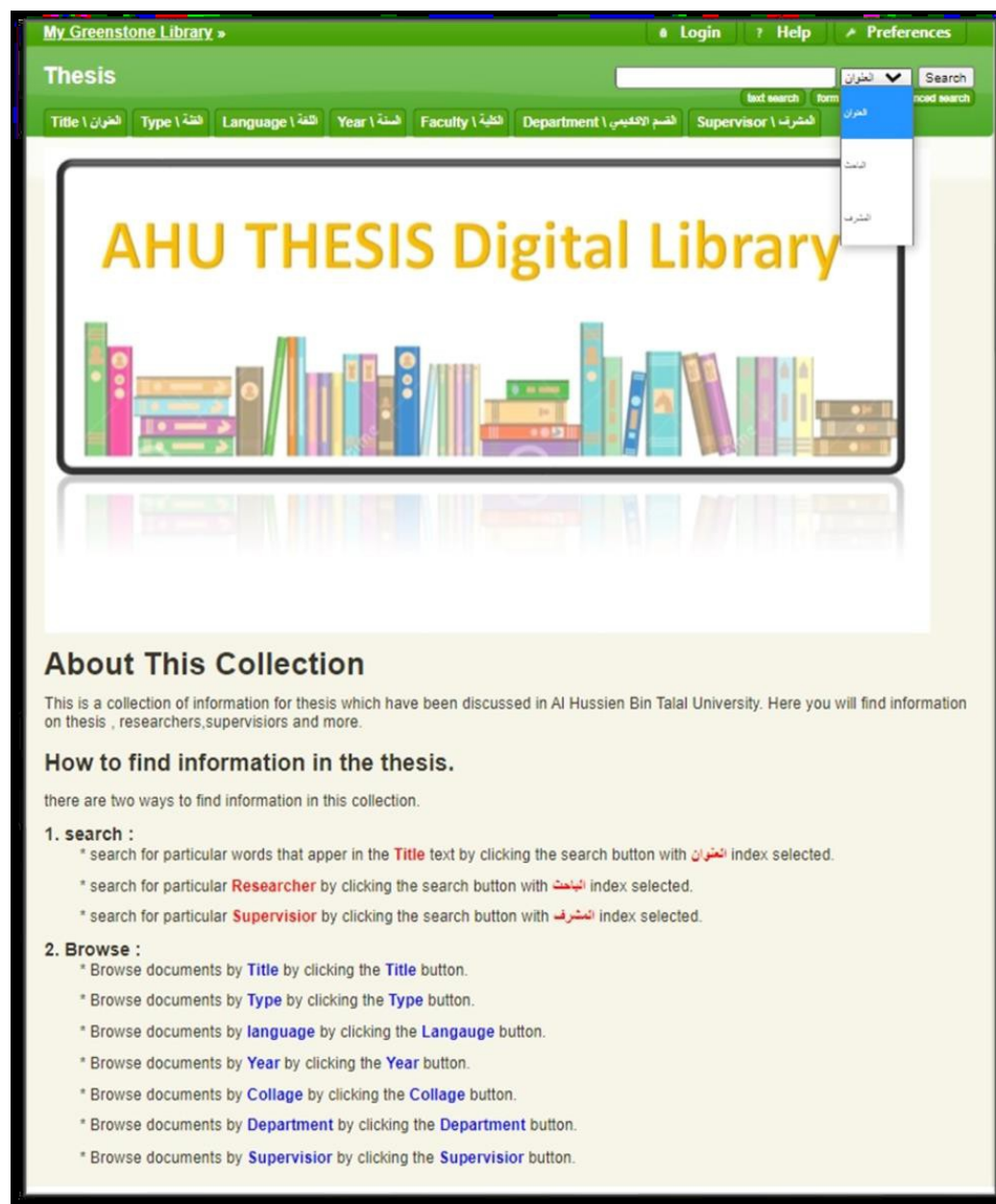
Figure no. 1. Viewing The collection of Al Hussein Bin Talal University

6.4 IRAQ. Iraqi Digital Repository For Theses & Dissertations. (IQ CMS software).

This project aims to compile all doctoral dissertations and theses in all scientific and humanitarian fields that have been conducted in Iraqi universities since postgraduate studies were established. It contains more than 138,000 titles of theses and dissertations that have been discussed and approved at Iraqi universities (since the establishment of graduate studies in Iraq) in all scientific and humanities disciplines. It is constantly updated. The goal is to compile all dissertations and theses in an electronic guide that is comprehensive and follows standard specifications. The specifications can be updated, developed, and adapted to international programs based on Iraqi scientific and technical capabilities. This initiative aims to enhance access to research and foster collaboration among scholars while also promoting the visibility of Iraqi academic contributions on a global scale. By ensuring that this database remains current and relevant, it will serve as a vital resource for students, researchers, and policymakers alike.
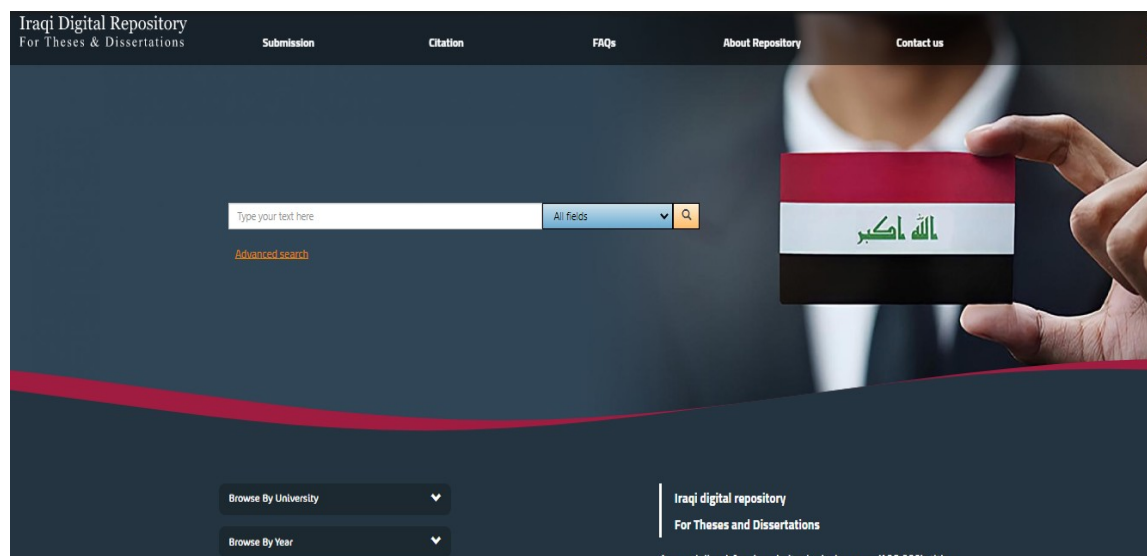

Figure no2. Iraqi Digital Repository for Theses & Dissertations Home page

The project has several objectives:
1-This initiative aims to consolidate Iraqi academic works, specifically theses and university dissertations, into a single website that serves as a scientific repository for Iraq.
2-Establishing subsidiary repositories for Iraqi universities connected to the primary repository to facilitate search and retrieval from a single website, rather than navigating multiple sites.
3-Reconstruct to the greatest extent feasible the materials lost from dissertations and theses due to the challenging conditions experienced in Iraq.
4-The preservation and documentation of graduate students' intellectual assets at the university through long-term preservation media ensures protection against potential damage.
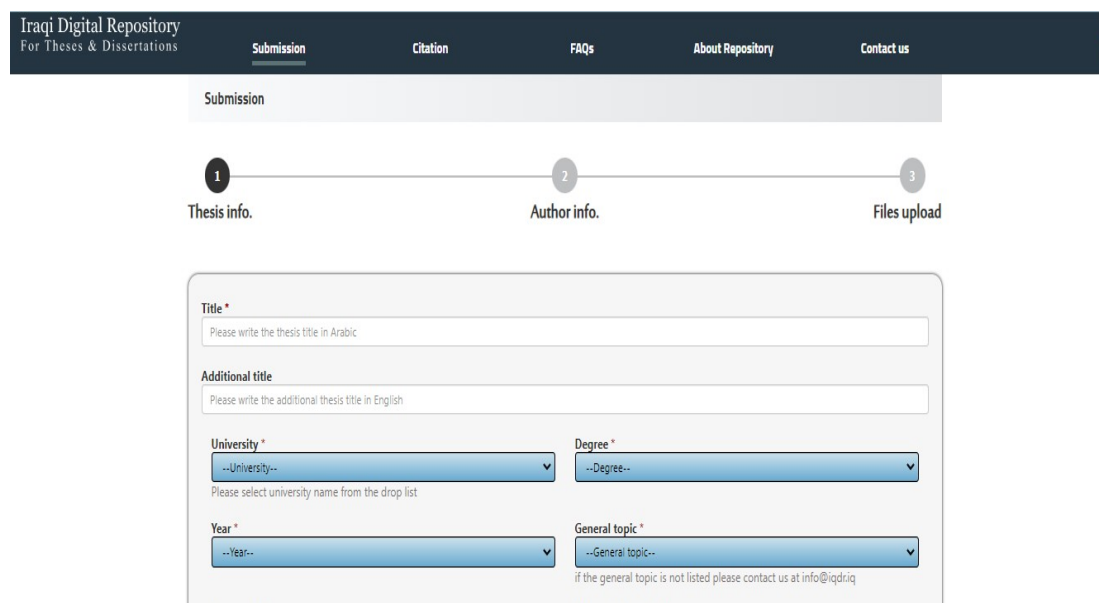
The primary services offered by the depository:
-Facilitating access for Iraqi university professors and students to search for titles of theses and dissertations from Iraqi universities, while providing access to the full texts of dissertations and theses from their own institutions and affiliated universities.
-Facilitating researchers' access to titles of theses and dissertations from Iraqi universities, along with abstracts, indexes, and sources exclusively.
-Verifying the authenticity of the title involves facilitating the objective citation of theses and dissertation titles completed at all Iraqi universities, utilizing data available in the repository.
-Implementing contemporary techniques for the electronic submission of dissertations or theses.

The repository enables researchers to access theses and dissertations in four ways: first, according to the university where the dissertation was examined and approved; second, according to the year in which the

dissertation was discussed; third, according to the awarded academic degree, whether it was a master's or doctorate; and finally, according to the general subject of the dissertation or university thesis.

There is a feature in this repository that enables researchers to add their theses or university dissertations to the repository after approving them in Iraqi universities after providing the following information:

Section	Required Information / Actions
Thesis/Dissertation Information	- Title - University, College, and Department - Academic Degree - Academic Year - Major and Minor - Language - University Website - Keywords - Abstract
Researcher's Information	- Author's Name - Supervisor's Name - Sender's Name - Author's Home Address - Author/Sender's Email
Required File Attachments	- Entire thesis/dissertation in a single PDF file - Abstract in PDF format - References in PDF format - Signed copy of the committee's certificate - Copy of the author's ID card

Figure no 3.The web page through which the required information is filled in to add their theses.

The repository provides a reference citation service through which it is possible to search in the Iraqi Digital Repository databases to verify the authenticity of the thesis or dissertation title and issue a report with the retrieved results.
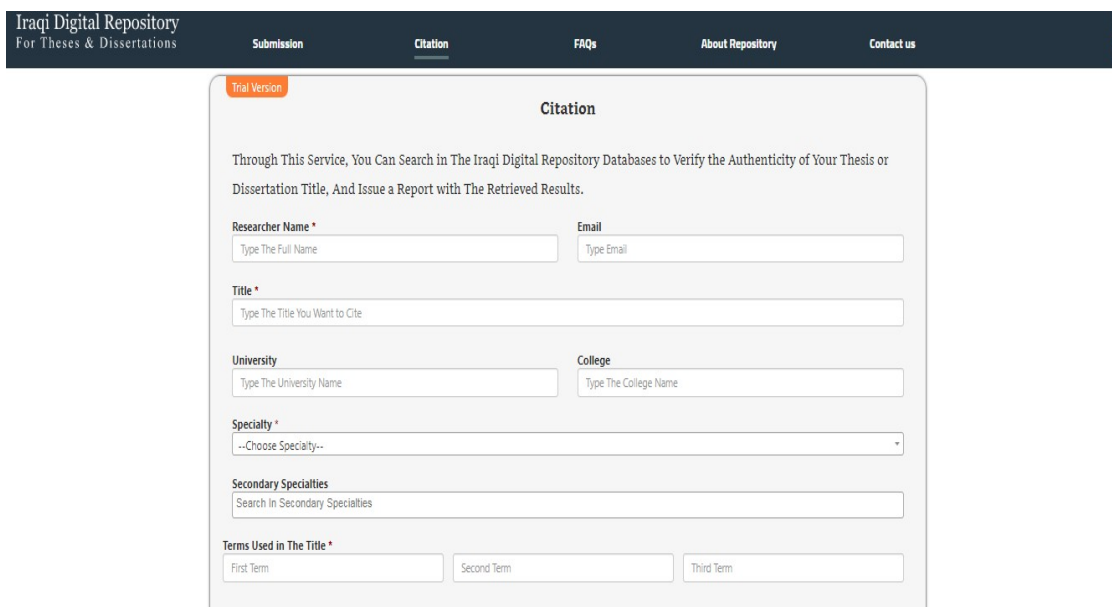

Figure no 4. Citation service webpage

The Digital Repository for University Theses and Dissertations in Iraq is a unique project, as there is no other digital repository in any Iraqi university or academic institution, whether public or private, that collects Iraqi academic dissertations from the establishment of graduate programs in Iraqi universities to the present. Therefore, this project is considered a pioneering and significant undertaking, as it seeks to preserve Iraq's academic scientific heritage while simultaneously serving as a tool for regulating and inventorying Iraqi academic intellectual output. The circumstances that Iraq went through from 1980 of the last century until 2003 had a significant impact on the Iraqi academic sector. Many libraries, particularly academic ones, were subjected to acts of arson, looting, and deliberate destruction. Consequently, many Iraqi university theses and dissertations were lost. Therefore, the Iraqi Digital Repository project is an attempt to compensate for the loss of theses and university dissertations in past periods.

7. Conclusions.

Using free and open source software is an effective tool for creating efficient and low-cost digital libraries, especially when the project budget is extremely limited and specialized commercial software is not available at a reasonable price. Digital libraries play a significant role in serving scientific research, providing researchers in all fields of knowledge with access to digital information resources. Digital library websites provide access to a wealth of information resources, represented by electronic resources in global databases. These resources include research articles, e-books, dissertations, and multimedia materials, significantly improving the quality and scope of research endeavors. By leveraging open access initiatives and collaborative platforms, digital libraries can effectively expand their offerings without incurring significant costs. To keep pace with modern developments and user needs, university libraries have turned to specialized open source software, offering benefits and services that enable the library to achieve its mission. The importance of open source software lies in the participation of many interested parties in its development, free of charge, while remaining committed to processing and making it available to various disciplines. Through the four experiences reviewed in the study, the importance of open source software in the digital repositories and electronic libraries sector was proven compared to commercial software. It is an essential option for many information institutions that lack the funding to purchase specialized commercial software due to its high cost. Furthermore, open source software fosters collaboration and innovation, enabling institutions to adapt and modify their tools to meet their specific needs. This adaptation not only improves their services but also fosters a culture of participation and continuous

improvement in the information society. Overall, both free open source software and commercial software can provide the required solutions, but the project budget remains the most influential factor, although not the only one, in deciding on the appropriate software.

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