

Cloud-Based Institutional Repository System for Grey Literature

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Abstract

Original Research Article

This study developed a Cloud-Based Institutional Repository System (CBIRS) for grey literature to improve the management, preservation, and dissemination of institutional research outputs. The system integrated automated document classification, advanced search and retrieval, analytics dashboards, citation visualization, and dynamic report generation. A descriptive-developmental research design was employed using the Rapid Application Development (RAD) framework. System requirements were gathered through interviews with librarians, faculty, and IT personnel, supported by a review of related literature and repository practices. Functionality testing was conducted by IT experts using structured test cases, while usability evaluation utilized the Post-Study System Usability Questionnaire (PSSUQ-3). Results showed that the system was highly functional, user-friendly, and effective in improving access to grey literature and supporting research productivity. Users positively evaluated the system in terms of information quality, interface design, and overall usability. The system also incorporated automated Dublin Core metadata generation, ORCID researcher profiling, and OAI-PMH interoperability to enhance metadata accuracy and open-access visibility. CBIRS provides a scalable and sustainable platform for institutional repository management and contributes to Library and Information Science and educational technology by offering an innovative solution for research preservation and knowledge dissemination.

Keywords: Analytics dashboards, Cloud-based repository, Grey literature, Institutional research outputs, Metadata management, OAI-PMH, ORCID.

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INTRODUCTION

Grey literature, including theses, dissertations, technical reports, and institutional research outputs, continues to play a critical role in scholarly communication by capturing knowledge that is often excluded from formal publishing channels. Despite its value, it remains underutilized due to limitations in visibility, accessibility, and systematic organization within traditional academic repositories (Becker & Yannotta, 2013; Schöpfel et

al., 2021). This persistent gap highlights the need for more advanced, integrated, and intelligent repository systems capable of improving discovery and long-term preservation of institutional knowledge.

Institutional repositories have evolved as essential infrastructures supporting open access, digital preservation, and research dissemination in higher education institutions. However, many existing systems still rely on conventional metadata workflows and static search mechanisms, which

limit their effectiveness in handling large-scale and heterogeneous scholarly datasets (Lynch, 2003; Pinfield, 2005). As a result, issues such as inconsistent metadata encoding, poor search precision, and limited interoperability continue to hinder optimal repository performance and user experience.

Recent developments in cloud computing and distributed systems have introduced scalable alternatives for institutional repository management. Cloud-based architectures enable centralized storage, improved system availability, and enhanced computational efficiency, making them suitable for managing growing volumes of digital scholarly content (Mell & Grance, 2011; Wang et al., 2010; Zhang et al., 2010). In parallel, advancements in metadata standards and interoperability frameworks such as Dublin Core and OAI-PMH have strengthened cross-system data exchange and improved resource discoverability in digital library environments (Heery & Patel, 2000; Lagoze & Van de Sompel, 2001).

More recent studies emphasize the increasing role of intelligent systems in enhancing repository functionality, particularly through automation in metadata generation, content classification, and retrieval optimization. These developments signal a shift from traditional static repositories toward dynamic, data-driven platforms capable of supporting advanced analytics and intelligent search capabilities in academic environments (Schöpfel et al., 2021). Despite these advancements, many institutional repositories—particularly in developing academic contexts—still lack integrated systems that combine cloud infrastructure, automated classification, and enhanced retrieval mechanisms within a unified platform.

In response to these gaps, this study develops a Cloud-Based Institutional Repository System for Grey Literature (CBIRS) designed to enhance the management, preservation, and accessibility of institutional research outputs. The system integrates automated document classification, advanced search and retrieval functions, analytics dashboards, citation visualization, and dynamic report generation. It also incorporates metadata automation aligned with

Dublin Core standards and supports interoperability through OAI-PMH protocols. By leveraging cloud computing and intelligent processing techniques, the system aims to improve repository efficiency, scalability, and usability.

Ultimately, this study contributes to the advancement of library and information science by proposing an integrated, scalable, and user-centered repository framework that addresses long-standing challenges in grey literature management and supports improved research visibility and knowledge dissemination in academic institutions.

Objectives of the Study

This study generally aims to develop a Cloud-Based Institutional Repository System for Grey Literature.

Specifically, it also aims to:

1. Design and develop a Cloud-Based Institutional Repository System for Grey Literature with the following technical features:
 - a. Automated document classification management
 - b. Advanced data search and retrieval.
 - c. Streamlined analytics and citation visualization.
 - d. Dynamic report generation
2. Test the functionality of the aforementioned features.
3. Evaluate the usability of the system in terms of:
 - a. System Quality (SYSQUAL),
 - b. Information Quality (INFOQUAL),
 - c. Interface Quality (INTERQUAL),
 - d. System Overall Quality;
4. Develop the system user's manual.

MATERIALS AND METHODS

Research Design

This study employed both developmental and descriptive research methods. Developmental

research was used in the design and development of the Cloud-Based Institutional Repository System for Grey Literature (CBIRS), covering both system architecture and software implementation (Mulyana & Ramdhani, 2023; Ramadhani, 2022). This approach allowed for systematic development and refinement of the system through iterative processes.

The descriptive research method was utilized to evaluate the quality and functionality of the developed system. Specifically, it was applied in assessing system usability, performance, and user satisfaction through structured evaluation tools such as the Post-Study System Usability Questionnaire (PSSUQ-3) (Sauro & Lewis, 2016; Lewis et al., 2015).

Developmental research was appropriate for examining system evolution and iterative improvements, while descriptive research supported the collection and interpretation of evaluation data to

determine system effectiveness and usability outcomes. The system development process followed the Rapid Application Development (RAD) model of the System Development Life Cycle (SDLC), which emphasizes iterative prototyping, user feedback, and continuous refinement of system features (Ramadhani, 2022).

Respondents of the study

The study's respondents will consist of thirty (35) IT experts, students, faculty members, and librarians.

Table 1 presents the distribution of respondents for the usability testing. The study will include five (5) Information Technology experts ten (10) students, ten (10) faculty members from different departments, and ten (10) librarians.

Table 1. Respondents of the usability testing

Respondents of the Study	F
Information Technology Experts	5
Students	10
Faculty members	10
Librarians	10
Total	35

Software Development Life Cycle (SDLC)

The Software Development Life Cycle (SDLC) provides a structured framework for the design, development, and testing of high-quality software systems that meet user and institutional requirements (Salve et al., 2018). In this study, the Rapid Application Development (RAD) model was adopted due to its iterative, flexible, and user-centered approach, which is suitable for systems with evolving requirements and continuous improvement needs (Mondero et al., 2024).

The RAD model was implemented through iterative cycles of prototyping, user feedback, and system refinement involving librarians, faculty members, and IT personnel. This approach ensured that system functionalities were continuously validated and aligned with user expectations during development.

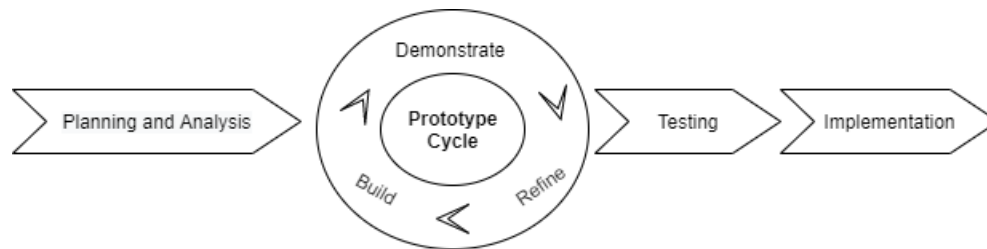
The system was developed using a layered cloud-based architecture. The frontend, built with HTML and JavaScript, handles user interactions such as searching and uploading of grey literature.

AJAX facilitates seamless communication between the client interface and a PHP-based backend server, enabling real-time processing without page reloads.

On the backend, system operations and metadata processing are managed through a dual-layer storage structure. Redis functions as a caching layer that provides fast retrieval of frequently accessed data, while MySQL serves as the primary relational database for permanent storage of institutional records. This architecture ensures a scalable, efficient, and responsive institutional repository system for managing grey literature.

Figure 1 illustrates the software development model used in the system’s development, specifically the Rapid Application Development (RAD) approach. It presents the iterative and user-centered stages followed to ensure an efficient development process. These stages include requirements analysis and quick design, iterative prototyping, testing, and implementation. The RAD model guided the continuous refinement of the system to achieve a functional and user-responsive institutional repository.

Figure 1 *Rapid Application Development (RAD) Model*



Note. Adapted from “*Preserving Scholarly Endeavors: A System for Archiving Thesis and Dissertations,*” by N. L. Mondero Jr., R. F. Ereje, R. M. M. Bermejo, R. M. Dela Torre, K. Soberano, Y. M. R. Dusanan, & M. T. Porquez, 2024, *GAS Journal of Multidisciplinary Studies*, 2(4). <https://doi.org/10.5281/zenodo.11063772>

Software Development Phases

The software development phases of the study include the planning, analysis, design, coding, and testing phase of the study for this study.

a. Planning Phase

The planning phase began with the researcher securing permission from the Technological University of the Philippines Visayas Library to conduct interviews and engage stakeholders as primary beneficiaries of the study. This phase focused on conceptualizing a solution to address the

manual retrieval and disorganized storage of thesis collections and other grey literature materials.

Key stakeholders were identified, and system objectives were established to define the core functionalities of the Cloud-Based Institutional Repository System for Grey Literature. Requirements gathering was conducted through interviews with librarians, faculty members, researchers, and IT personnel to determine system needs and user expectations.

The existing thesis workflow, from submission to library circulation, was also reviewed as part of the interview discussion to identify inefficiencies and gaps in the current process. In

addition, benchmarking of existing institutional repositories and a review of related literature were conducted to guide system feature design, including advanced search, metadata management, and cloud integration. These inputs formed the foundation for the system requirements and initial design direction.

b. Analysis Phase

The analysis phase focused on defining the functional and non-functional requirements of the system through detailed consultations with end users, including librarians, faculty, and students. Data were gathered through interviews and observation to identify the essential features required for an efficient institutional repository system.

The requirements were further refined through literature review and analysis of existing repository systems to identify possible enhancements without compromising core user needs. System architecture, database structure, and process flow were also defined during this phase.

Considerations for scalability, interoperability, and future system expansion were incorporated to ensure long-term usability and adaptability. This phase established a clear and structured foundation for system development tailored to academic institutional needs.

c. Design Phase

The design phase involved defining system operations and developing the interface based on gathered requirements. After completing the planning and analysis phases, the researcher proceeded with prototype development, starting from backend structure to frontend interface design, ensuring consistency and alignment with user requirements.

The system architecture follows a layered cloud-based model that illustrates interactions between users and core system processes. Users access the system through a web interface, where requests are processed through a controller and routed to service components responsible for

document processing, search and retrieval, keyword management, and report generation.

An integrated API supports Artificial Intelligence functionalities, including automated keyword extraction and enhanced search capabilities. The system utilizes both database storage for metadata and file storage for documents, along with secured dataset storage for processed information, ensuring efficient and organized data management within the cloud environment.

d. Coding Phase

The coding phase involved translating the system design into functional software using a structured three-tier architecture consisting of the Presentation Layer, Application Layer, and Data Layer. This modular structure supports scalability, maintainability, and efficient processing of system operations.

The Presentation Layer serves as the user interface for interaction, while the Application Layer handles system logic, cloud services, and AI-based processing for metadata enhancement and retrieval. The Data Layer manages storage of grey literature documents, metadata, and related datasets.

The system implements a data flow where the HTML and JavaScript frontend captures user inputs, while AJAX enables asynchronous communication with a PHP-based cloud server, ensuring real-time processing without page reloads. A dual-layer storage strategy is employed, where Redis functions as a caching layer for high-speed query responses, and MySQL serves as the primary relational database for permanent institutional records. This architecture enhances system responsiveness, scalability, and efficiency.

e. Testing Phase

Functionality and Usability Evaluation

The testing phase was conducted to evaluate both the functionality and usability of the Cloud-Based Institutional Repository System for Grey Literature. This phase ensured that the system met its

design specifications and performed effectively in supporting institutional repository operations.

Functionality Testing

The functionality test was conducted involving five (5) Information Technology experts to assess the performance of each system module. It evaluated key aspects of the system, including the user interface, security mechanisms, and client-server communication processes. The objective was to ensure that all software components functioned correctly and consistently under defined conditions.

A structured set of test cases was developed to validate system functionality. These test cases allowed users and evaluators to assess specific scenarios and classify outcomes as pass or fail. A remarks section was included to support qualitative feedback and improve interpretation of results. The test cases covered test case IDs 1 to 20, corresponding to major system features such as user-friendly interface, advanced search functionality, thesis and dissertation tracking, and document management processes. Each test case included defined test steps and expected outcomes based on system requirements.

Usability Testing

Usability evaluation was conducted using the standardized Post-Study System Usability Questionnaire (PSSUQ) involving 30 respondents composed of 10 faculty members, 10 students, and 10 librarians, from academic and industry sectors.

The PSSUQ Version 3 instrument consists of 16 items grouped into four dimensions: system usefulness, information quality, interface quality, and overall usability. Responses were measured using a 7-point Likert scale, including a “not applicable” option. System usefulness (items 1–6) assessed ease of use, learnability, and task efficiency. Information quality (items 7–12) evaluated clarity, error handling, and system feedback. Interface quality (items 13–16) measured visual design and feature effectiveness. Overall usability was derived from the aggregated responses of all 16 items,

reflecting the users’ overall experience with the system.

Development of the User Manual

The user manual for the Cloud-Based Institutional Repository System for Grey Literature was developed to provide structured, accurate, and user-oriented documentation to support effective system operation. It includes procedural guidance for key functions such as user authentication, dashboard navigation, search and retrieval of records, document submission, metadata viewing, and account management.

A system walkthrough was incorporated to present the end-to-end navigation of the platform, from login and dashboard access to searching, viewing, and managing grey literature records. This serves as a practical reference for users in understanding actual system workflows and interface interactions.

The manual was derived directly from the implemented system functionalities to ensure technical accuracy and consistency with system behavior. It was designed following a user-centered approach to accommodate librarians, faculty, researchers, and students with varying levels of technical proficiency. Validation through user interaction with the system confirmed its clarity, completeness, and suitability in supporting efficient system adoption and utilization.

RESULTS AND DISCUSSION

The primary goal of the Cloud-Based Institutional Repository System for Grey Literature (CBIRS) was to support the efficient management, preservation, and retrieval of institutional grey literature within the academic environment. The system was designed to assist librarians and catalogers in the classification of grey literature through automated document classification, metadata generation, and structured repository organization, ensuring consistency and accuracy in subject cataloging processes.

In addition, CBIRS enhances accessibility and improves the speed of information retrieval for users. It enables students, faculty, and researchers to efficiently search, access, and utilize institutional research outputs through a centralized cloud-based platform. The system also integrates a chatbot-based retrieval feature that supports natural language queries, allowing users to obtain relevant information more efficiently and improving overall information discovery within the repository. Furthermore, CBIRS provides streamlined analytics and visualization tools that present repository usage data, citation trends, and system performance metrics in a clear and interpretable format, supporting better decision-making and research monitoring within the institution. It also includes a report generation feature that produces structured and downloadable reports on repository activity, submissions, and usage

statistics, assisting administrators and librarians in documentation, evaluation, and institutional reporting requirements.

The Cloud-Based Institutional Repository System for Grey Literature comprises the following features.

Advance search and retrieval. The implementation of Advance search and retrieval feature in the Cloud-Based Institutional Repository System for Grey Literature has significantly improved the overall user experience. Users, including students, faculty, librarians, and researchers, are able to navigate the system easily, retrieve information efficiently, and interact with repository features in a clear and organized manner, enhancing accessibility and usability of institutional grey literature resources.

Figure 2: Advance search and retrieval feature dashboard



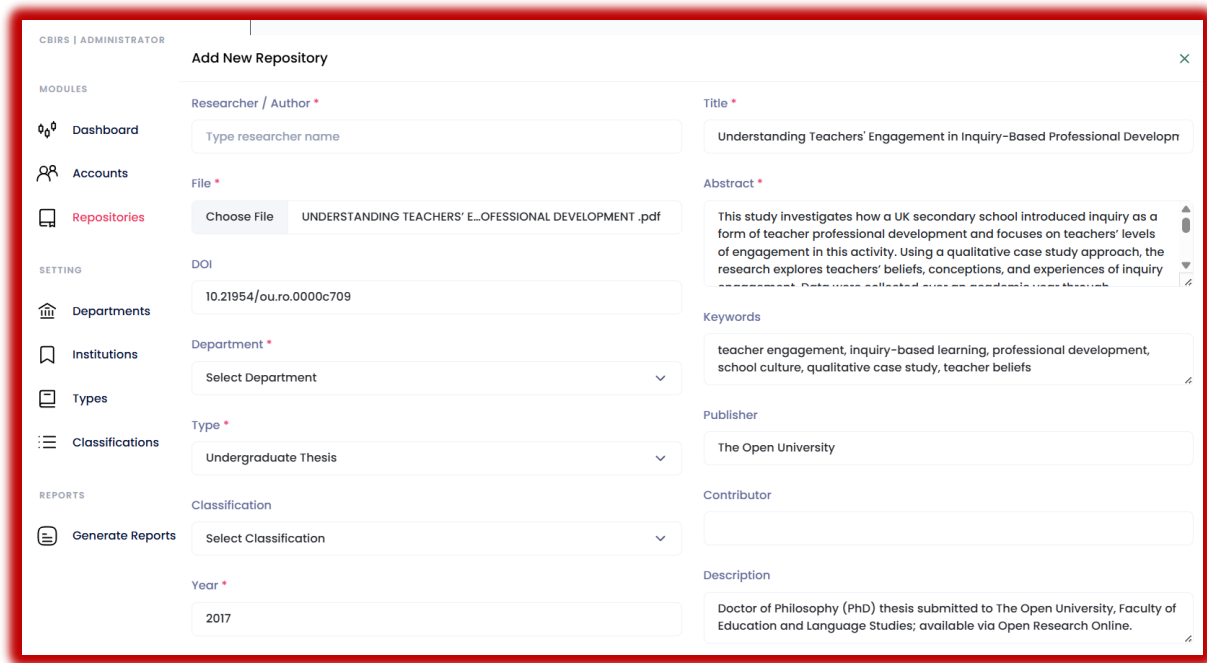
Automated Document Classification dashboard. The Automated Document Classification Dashboard assists librarians and catalogers in organizing and classifying grey literature efficiently within the repository system. The feature supports automated

metadata generation and keyword-based classification to improve consistency and accuracy in the cataloging process. Through the dashboard, administrators can manage uploaded documents, review classifications, monitor repository records,

and organize institutional research outputs systematically. This feature reduces manual processing time and supports more efficient

management and retrieval of grey literature resources within the institution.

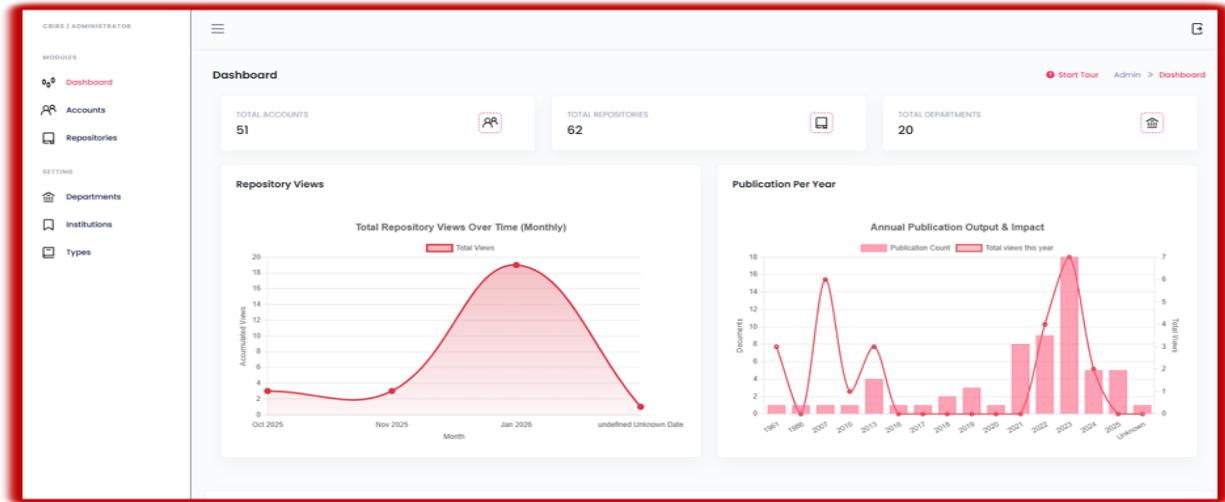
Figure 3: Automated Document Classification Dashboard.



Streamlined Analytics and Citation Visualization Dashboard. The Streamlined Analytics and Citation Visualization Dashboard provide users and administrators with a clear presentation of repository usage data, citation trends, and research activity within the system. The dashboard enables monitoring of document views, downloads,

submission statistics, and citation-related information through organized visual representations. This feature supports librarians, researchers, and administrators in tracking repository performance, analyzing research engagement, and generating data-driven insights for institutional reporting and decision-making.

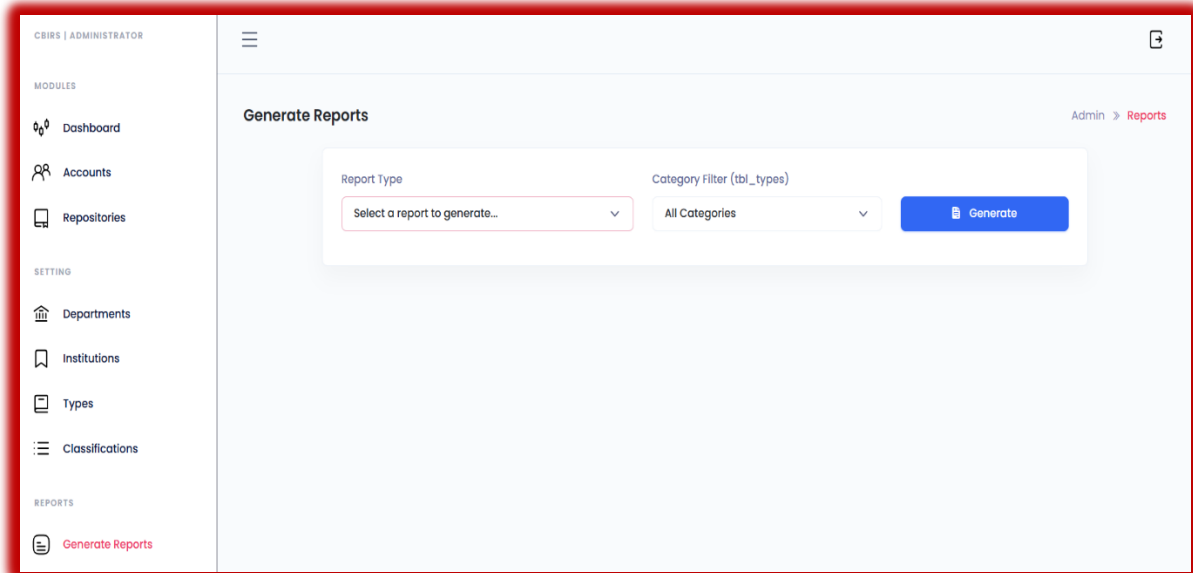
Figure 4: Streamlined Analytics and Citation Visualization dashboard



Dynamic Report Generation dashboard . The Dynamic Report Generation feature enables administrators and librarians to generate organized and downloadable reports related to repository activities, document submissions, user engagement, and system usage statistics. The feature streamlines

the preparation of institutional reports by automatically compiling relevant repository data into structured formats, supporting efficient documentation, monitoring, and decision-making processes within the institution.

Figure 5: Dynamic Report Generation dashboard



The second objective of the study focused on evaluating the functionality of the developed system through structured test case assessment conducted by five (5) Information Technology experts. Functionality testing is essential in determining whether a system performs according to its intended requirements and specifications (Pressman & Maxim, 2020). Results showed that all test cases

achieved a 100% pass rating, indicating that the developed system successfully met all functional requirements across all tested modules. These findings demonstrate the reliability, accuracy, and operational effectiveness of the system consistent with software quality evaluation standards such as ISO/IEC 25010.

Table 2: Summary of the Functionality Test Results

No.	Features	Results	Remarks
1	Automated Document Classification Management	100%	Passed
2	Advanced Search and Retrieval	100%	Passed
3	Streamlined Analytics and Visualization	100%	Passed
4	Dynamic Report Generation	100%	Passed

The third objective of the study focused on evaluating the usability and end-user satisfaction of the developed Cloud-Based Institutional Repository System for Grey Literature using the Post-Study System Usability Questionnaire (PSSUQ), a recognized instrument for measuring perceived usability and user experience in information systems (Lewis, 1995; Lewis et al., 2015). Results presented in Table 3 revealed that the System Quality dimension obtained a mean score of 1.24, interpreted as Strongly Agree, indicating that the respondents perceived the system as efficient, reliable, and easy to use. This finding supports the Technology Acceptance Model, which emphasizes that perceived usefulness and ease of use significantly influence user acceptance of information systems (Davis, 2020).

The Information Quality dimension obtained a mean score of 1.45, also interpreted as Strongly Agree, suggesting that users found the information generated by the system clear, understandable, relevant, and well-organized. This result aligns with studies emphasizing the importance of metadata quality, information retrieval, and repository discoverability in improving user access and scholarly visibility in institutional repositories (Dong & Tay, 2023; Moshia & Ngulube, 2023; Roy & Ghosh, 2023). Likewise, the Interface Quality dimension obtained a mean score of 1.38, interpreted as Strongly Agree, reflecting positive evaluations regarding the visual layout, navigation structure, and interaction design of the system. Nielsen (2021) emphasized that usability and interface consistency

are essential factors contributing to effective human-computer interaction and user satisfaction.

Overall, the PSSUQ evaluation yielded a grand mean score of 1.36, interpreted as Strongly Agree, indicating a high level of end-user satisfaction with the developed system. The findings demonstrate that the Cloud-Based Institutional Repository System for Grey Literature achieved a high degree of usability, acceptability, and operational effectiveness

consistent with established usability evaluation standards (International Organization for Standardization [ISO], 2018). The results further support previous studies on institutional repository usability and user-centered repository design (Ahmed et al., 2024; Becker & Yannotta, 2013), confirming that the developed system provides an effective platform for the preservation, organization, retrieval, and accessibility of grey literature resources.

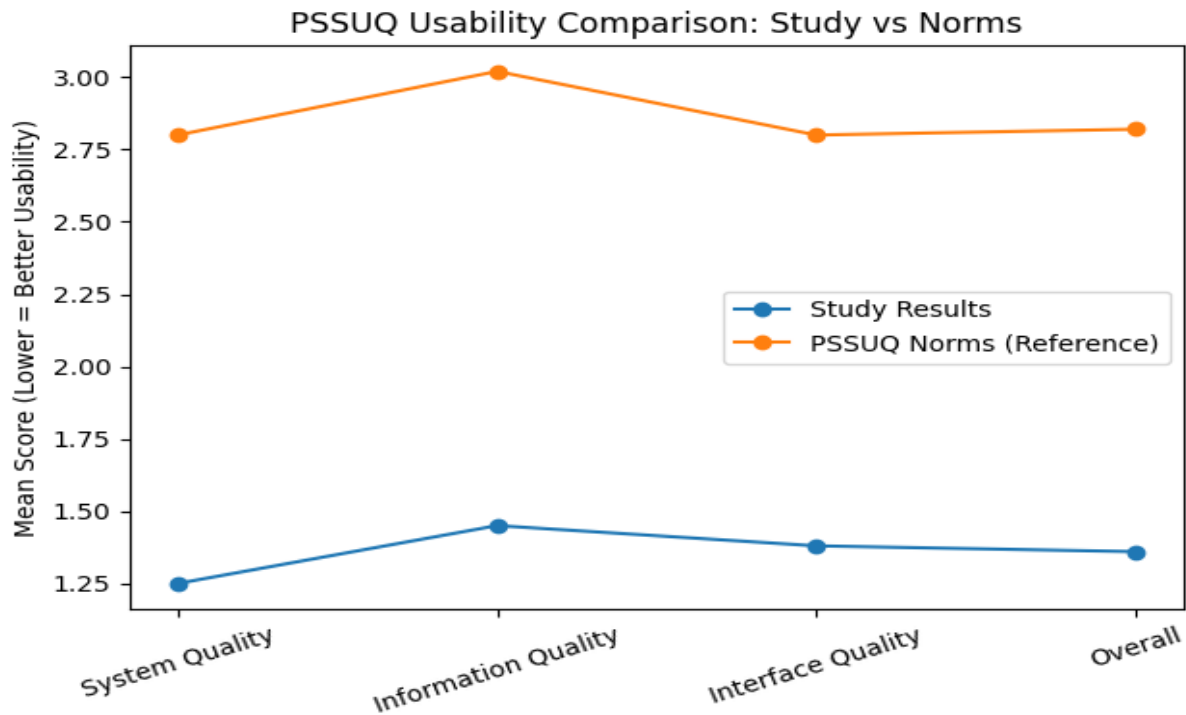
Table 3: Mean Scores on the Level of Usability of the Cloud-based Institutional Repository System for Grey Literature

PSSUQ Criteria	Mean	SD	Interpretation
System Quality	1.24	0.49	Strongly Agree
Information Quality	1.45	0.52	Strongly Agree
Interface Quality	1.38	0.58	Strongly Agree
Overall Usability	1.36	0.49	Strongly Agree

To evaluate the usability of the Cloud-Based Institutional Repository System for Grey Literature, the Post-Study System Usability Questionnaire Version 3 (PSSUQ V3) results were compared with established normative benchmarks to provide an objective assessment of system usability. Results showed that the system obtained lower mean scores across all dimensions—System Quality (1.24), Information Quality (1.45), Interface Quality (1.38), and Overall Usability (1.36)—than the published

PSSUQ normative values. Since lower PSSUQ scores indicate better usability, the findings demonstrate that the developed system exceeded standard usability benchmarks. Figure 29 further illustrates that the system achieved high usability in terms of ease of use, information clarity, and interface design, confirming a high level of end-user satisfaction and acceptability (Lewis et al., 2015; Sauro & Lewis, 2016).

Figure 6: PSSUQ Mean Results vs. Current Mean Norms (Lewis, 2002): Control Chart Comparison



Note: Lower scores indicate higher usability in PSSUQ.

The fourth objective of the study focused on the development of a comprehensive user manual for the Cloud-Based Institutional Repository System for Grey Literature. The user manual was designed to provide librarians, researchers, and end users with clear and systematic instructions for accessing, searching, retrieving, and managing grey literature resources within the system. By presenting procedures in an organized and user-friendly format, the manual supports efficient system navigation, minimizes the time required to locate materials, and enhances the overall user experience.

The development process emphasized the accuracy, clarity, and completeness of the system documentation to ensure effective utilization of the platform. The manual also serves as a supporting reference for librarians and system administrators in maintaining system operations and assisting users during information retrieval activities. Furthermore, the documentation contributes to the development of standardized training and instructional materials that promote consistent and effective system use.

Figure 7: The cover design of the Cloud-Based Institutional Repository System for Grey Literature user manual.



CONCLUSIONS

Based on the findings of the study, the following conclusions were formulated:

1. The successful deployment of the Cloud-Based Institutional Repository for Grey Literature indicates that the system is functional and useful in managing institutional grey literature. Its core technical features. Automated Document Classification Management, Advanced Data Search and Retrieval, Streamlined Analytics and Citation Visualization, and Dynamic Report Generation.
2. The system demonstrated a high level of functionality, as all core features consistently performed as intended and were rated as “Passed.” This confirms that the system is reliable, accurate, and aligned with the functional requirements and objectives of the study.
3. The usability evaluation revealed that the system is highly acceptable to users. It is considered usable, provides high-quality information, and has a user-friendly interface, indicating that it

meets user expectations in terms of ease of use and overall system experience.

4. The development of the system user manual ensures that users are properly guided in navigating and utilizing the Cloud-Based Institutional Repository for Grey Literature, supporting effective system adoption and usage.

RECOMMENDATIONS

The following are the recommendations provided by the system's users and evaluators.

1. AI for Advanced Classification: Future improvements could involve training the AI to automatically classify documents using Dublin Core and the institution’s classification system (Dewey Decimal Classification or The Library of Congress Classification System). This would go beyond the current keyword-based approach and provide more accurate and consistent organization location of repository items.

2. Ensure discoverability through Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) feeds and establish a continuous feedback mechanism from users to address accessibility issues across devices while planning for scalable cloud integrations to handle growing repository volumes and future expansions.
3. a mobile application version of the Cloud-Based Institutional Repository for Grey Literature be developed. This will enhance accessibility by allowing users to search, retrieve, and manage grey literature using smartphones and other mobile devices anytime and anywhere.

Acronyms: CBIRS – Cloud-Based Institutional Repository System; RAD – Rapid Application Development; PSSUQ – Post-Study System Usability Questionnaire; OAI-PMH – Open Archives Initiative Protocol for Metadata Harvesting; ORCID – Open Researcher and Contributor ID

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