

Malaysian Institutional Repositories Approach on the Preservation of Their Digital Contents

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Abstract. The primary goal of institutional repository development is to increase the visibility of universities' knowledge output. Because of the complexity and rapid development of the digital environment, the sustainability of institutional repositories' collections may be jeopardised as they store and manage knowledge output created in digital forms. The purpose of this research is to look into how Malaysian institutional repositories preserve their digital content. Furthermore, the study would investigate the impediments to institutional repositories' implementation of digital preservation activities. This study used qualitative methods to gain a comprehensive understanding of how institutional repositories plan and manage their digital collections, as well as their operational and technical approaches. The study is hoped to contribute to better administration and sustainability of digital collections in Malaysian institutional repositories, as well as serve as a model for other institutions involved in managing digital collections in the country.

Keywords: Digital preservation, institutional repository, knowledge output, information management and library management.

1 Introduction

The establishment of institutional repository in libraries and research institutions has changed the landscape of knowledge output distribution around the world. Ever since Cornell University initiated their institutional repository known as ARXIV in 1991 (Cornell University, 2022), more and more universities took the initiatives to develop their institutional repository. An institutional repository serves as a digital archive for a university or research institution. The repository gathers, store and distribute knowledge output produced by members of the institution (Crow, 2002).

Ahmed et al. (2014) stressed that the institutional repository is a system that could be utilized to collect and distribute the products in which a group of individuals or organizations would contribute as their knowledge output. The knowledge output in institutional repository would come in many formats. The knowledge output contributed by members of the institutions include journal articles, reports from research activities, theses and dissertations, proceeding papers, research findings and other documents considered as important knowledge output by the repository patrons.

In Malaysia, the development of the institutional repository has been an effect from the needs for globalizing and widen the distribution of the local universities' knowledge output (Mohd Zaki & Dollah, 2012; Wan & Abdullah, 2021). Thus, Malaysian research universities through the open access initiatives allowed the universities in Malaysia to share and distribute their knowledge output to the international research environment (Abrizah, 2009).

With the visibility of the knowledge output for Malaysian universities, the opportunity to be acknowledged by researchers and academics from all over the world enhanced and thus, created more collaborations, mobility of students and lecturers as well as cross country research project (Wan & Abdullah, 2021).

The institutional repository platform stored knowledge output in digital format. Therefore, the institutional repository content includes documents in digitized and born digital format. The development of electronic publications enabled more born digital publications being created and submitted to the institutional repositories. The nature of born digital is very different from digitized documents as there are no surrogate for born digital documents. Thus, the need to preserve the born digital documents become essential especially for institutional repository (Eun, 2013).

In ensuring the sustainability of the digital documents in institutional repository, institutions especially universities may have to identify the best effort to preserve their digital collections. Smith (1999) highlighted that digital preservation is a formal effort taken by the organization which include the management, protection, and safe-keeping of the digital collections, especially the knowledge output which could be considered as intellectual assets of an organization. A strategic preservation plan must become a priority for the organization to ensure continuous access to information resources.

1.1 Problem Statement

Malaysian universities, who own and manage their institutional repository must play an active role not only in promoting their institutional repository, but also in ensuring the sustainability of their repository content. Unfortunately, even though organizations are aware of the importance of digital preservation, it is not a priority in institutional repository development plan (Abrizah, 2009; Perrin et al., 2015).

Furthermore, the rapid development of the digital technology has led to speedy publications and productions of digital objects. The variety of hardware and software used to produce digital objects make it more difficult for organizations as some objects are dependent to the software and hardware used to create and read that particular objects (Perrin et al., 2015). Therefore, in order to plan for digital preserva-

tion, organizations must consider having the right approach or strategy for their organizations.

1.2 Objectives of the Study

The main purpose of the study is to explore the approaches taken by Malaysian Institutional Repositories towards ensuring the sustainability of their digital contents. Therefore, the study proposed these objectives:

1. To explore the management of Malaysian Institutional Repositories
2. To investigate the digital preservation activities in the Malaysian Institutional Repositories
3. To identify the risks identified by the members of the organizations related to digital preservation of their repository content.

2 Literature Review

2.1 Institutional Repository

The development and growth of institutional repositories have been the result of the evolution of libraries in academic and research institutions. The rapid development of the digital technology has changed the way information being produced and stored as well as distributed. Hence the development of the repository in the digital hub form (Adjei et al., 2019).

The evolution of the concept of institutional repositories as a means for libraries to encourage the communication of university research output. This interest has been fueled by the realisation that institutional repositories can improve access to research-related information while also increasing the authority of a library within a university. The institutional repositories would improve the availability of the university's research output and determine the role of the library inside a university (Genoni, 2004).

Generally, the institutional repository was described as a collection of research outputs that take many forms. Furthermore, the institutional repository housed a broad range of other intellectual outputs, including news clippings, speeches and lectures, memoranda, videos, annual reports, and other internal publications. (Laxminarsaiah & Rajgoli, 2007). Moreover, an institutional repository could be defined as the active selection of academic work that reflects a university's academic principal (Westell, 2006).

The past 15 years library development shown that the deployment of institutional repositories was a relatively new trend in Malaysia. Several Malaysian universities were making use of institutional repositories to increase their visibility (Abrizah, 2009). Institutional repositories are an excellent avenue for universities to showcase their research findings and publications and all academic institutions must move towards their development (Edzan, 2008).

Malaysian universities, as evidenced by the number of institutional repositories, are following the global trend of globalising their knowledge output. OpenDOAR or the Directory of Open Access Repositories in 2021 identifies 25 institutional repositories from Malaysia where 24 of them belongs to Malaysian universities (OpenDOAR, 2021). According to the Registry of Open Access Repositories, Malaysia has 42 institutional repositories listed in their registry. Malaysian University Libraries own 41 of the 42 repositories. (Registry of Open Access Repositories, 2020).

Adoption of institutional repositories could be viewed as a type of digital library built by a university community through the contributions of scholars and other community members. They should also be viewed as knowledge management systems (Branin, 2005).

Another major reason for the creation of an institutional repository is to ensure that the institution's institutional memory is well captured and stored. According to Riddle (2015), an institutional repository should serve not only its patrons by archiving their research collections and intellectual output, but also the institution to which the researchers are affiliated by storing and reporting on the number of knowledge output produced and their contribution as part of the institution's knowledge memory.

The open access movement prompted significant organisational changes in universities, research institutions, and academic libraries, as well as scholarly communication changes. Because it is their mission to provide open access to scholarly literature, academic libraries have always supported open access principles and projects. As a result, new academic librarian roles have emerged (Cassella & Morando, 2012). The development of institutional repository was the result of the open access movement where knowledge output became more accessible to the massive public.

Hockx-yu (2002) also discussed how accessibility for institutional repositories could benefit researchers and writers by promoting or making their research and papers known and accessible to others in similar fields of study.

Institutional repositories have successfully helped academics gain insight in the world's eyes. At the same time, it should serve as a platform for ensuring the long-term viability of their resources. As a result, proper digital preservation strategies must be considered and planned in order to ensure the longevity of the intellectual output in the institutional repository.

2.2 Digital Preservation

Digital preservation refers to a set of activities that must be carried out in order to ensure continuous access to digital knowledge output for as long as it is required. Furthermore, beyond media failure or technological change, digital preservation could refer to all of the actions required to provide access to digital resources (Beagrie & Jones, 2008).

Eun (2013) emphasised the importance of digital resource preservation due to the growing number of access points for digital collections. He also mentioned that, while the media for institutional repository resources is diverse and constantly changing, the approach to preserving these collections digitally must be well thought out and planned in order to ensure future access to the collection.

The growing number of digital resources would result in technological changes, obsolescence, and deterioration of storage media. As technology obsolescence and the fragility of digital media are unavoidable, these issues will have an impact on future access to digital resources (Smith, 2007).

Digital preservation must take into account both bit preservation, which preserves the original features of the resources, and functional maintenance, which allows users to access the resources even if technology or storage media change (Semple, 2004).

Although digital preservation is essential for organisations, particularly institutional repositories, the implementation process may be difficult. There are some obstacles that organisations must overcome in order to carry out continuous digital preservation activities. Levi (2008) stated that, while the need to preserve digital assets has only recently emerged, it is growing and becoming more demanding by the day. She also mentioned the difficulties that organisations face in preserving their digital assets.

Digital data was generated, stored, and accessed electronically. As a result, the documents are susceptible to deterioration and physical damage. Obsolescence can refer to damaged or reduced hardware, software, or even the arrangement of data in a saved file. Physical damage, on the other hand, could have affected a variety of components needed to access digital information, such as hardware and media (Par-mar & Rawat, 2021).

Understanding the nature of digital objects is the first step in digital preservation. A digital object does not exist in isolation. We cannot access or read digital objects on their own, unlike physical or printed materials. To access, read, and store digital objects, the appropriate hardware and software must be used. The combination of software and hardware elements was also influenced by current technology used to create and maintain the objects for current and future use (Heslop et al., 2002).

Digital preservation, like other types of preservation, is not a stand-alone concept. Digital preservation is a concept that includes important elements such as policies, strategies, and actions. An organisation should ensure that they have all of the necessary elements to ensure that their digital collections are preserved for long-term access (Levi, 2008).

2.3 Digital Preservation in Institutional Repository

One of the goals of Internet-accessible digital repositories or intranets was to preserve intellectual output regardless of the format or application used to create the resources. New challenges arose, particularly in the digital realm. When digital documents were added to a digital repository, it was critical to ensure that the software and tools used aid in the long-term preservation of the digital content (Madalli et al., 2012).

Unfortunately, digital preservation had not been integrated into institutional repositories' workflows, and there was little expertise or agreement on how digital preservation should be handled (Adjei et al., 2019).

The time has come to incorporate these online world experiences into institutional repositories as library services have become more integrated with internet services.

To improve interoperability among institutional repositories, a minimum number of the simplest, yet widely used protocols should be adopted (Hakimjavadi, 2012).

Adjei et al., (2019) highlighted four major research areas that they investigated in their study of digital preservation practises in Ghanaian institutional repositories. The first research area is concerned with digital preservation policy. They believed that adequate proof compliance with the regulatory environment, which frequently includes regulations and statutory standard practise, was required for the management and long-term viability of all types of preservation challenges. An institutional repository must have a properly written policy as a guideline before embarking on their digital preservation journey. Through a stated digital preservation policy, institutional repositories should explicitly announce their goal of preservation.

The strategies implemented for digital preservation were the next critical aspect for the research on digital presentation in institutional repositories. The strategy would be the plan for implementing their digital preservation activities. The strategy could include software, hardware, storage, and backup plans for their repository collections, as well as disaster planning (Adjei et al., 2019; Ilo et al., 2020).

It is also critical for the organisation to assess its management support for digital preservation (Adjei et al., 2019). Commitment to long-term digital preservation would necessitate ongoing administrative and financial support. As a result, having the organization's management on board with the digital preservation activities would determine the program's success.

Adjei et al., (2019) propose investigating the challenges that institutional repositories may face in their digital preservation activities. They believed that organisations needed to understand the challenges they would face in preparing for long-term digital preservation activities for their institutional repositories.

3 Methodology

To determine the approach taken by Malaysian Universities to ensure the sustainability of the digital content of their institutional repository, a qualitative study was conducted in selected institutional repositories.

Two institutional repositories hosted by two Malaysian public universities were chosen as sample cases for a case study. The universities chosen were in Kuala Lumpur and Selangor. The sample universities were chosen using a number of criteria in this purposive sampling approach. First and foremost, both universities are research institutions. The E-Prints system is then used by both universities to host their institutional repository. The institutions from which interviewees were drawn are not mentioned for the sake of anonymity and confidentiality, but are identified as IRA (Institutional Repository A) and IRB (Institutional Repository B).

The semi-structured interview method was used to collect data. The in-person interviews took place in the university library. Each institutional repository selected three respondents. The respondents were chosen based on their level of authority and

responsibility for the institutional repository. Respondents include the institutional repository's chief librarian or deputy chief librarian, the head of department in charge of the institutional repository, and the officer in charge of the institutional repository.

The information gathered during the interview sessions was transcribed for use in the data analysis process. To analyse the transcriptions from the interview sessions, the researcher used a thematic analysis. The process would adhere to Braun and Clarke's six-step thematic analysis approach (Braun & Clarke, 2006).

4 Findings

The findings of the study would uncover the management of Malaysian institutional repository content. Then, the study would investigate the digital preservation approach taken by the institutional repository to protect their digital collections. Furthermore, the findings would discuss the risks identified by the institutional repositories towards the sustainability of their digital contents.

The discussion would reflect the three research objectives identified for the study. Respectively, the discussions would be divided into three main topics:

- The management of the institutional repository.
- The digital preservation approach taken by the institutional repository.
- The risks identified by members of the institutional repository.

4.1 *The Management of The Institutional Repository*

The initiation of the institutional repositories started around the same period. Although IRA officially launch their institutional repository in 2010, the establishment of the repository begins in 2007 when they visited libraries in New Zealand to benchmark their institutional repositories. IRB on the other hand established its repository in the year 2007.

The purpose of establishments differed from one another. According to Kamraninia and Abrizah (2010), the main reason for establishing an institutional repository is to ensure the visibility of the knowledge output available within the institutions. Bevan (2007), on the other hand, emphasised that the goal is to collect and store all of the university's theses in a single repository. Nonetheless, both institutional repositories stated that the primary reason for developing their repository was to promote and ensure visibility of their knowledge production, as well as to provide global access to their publications.

The content of the institutional repositories focuses majorly on the knowledge output of their academic staff and students although there are some collections include administration product of the organization. For IRA, journals published by departments and faculties within the organization were also digitized and stored in the repository. IRB, besides other collections, also store research monographs in the repository. There are also other selective materials being stored and preserved in individual repositories. For example, IRA also store teaching materials, slide presentations and

common reports, while IRB keeps newspaper cuttings, patents, annual reports as well as magazines and newsletter related to the organization.

The contributors, or the people who could contribute to the repository in IRA includes research assistants, academic staff, and students. While IRB allowed any members of the institution to give their contributions to the repository.

As for the technological elements used to manage their repository may be different from each other, both IRA and IRB use E-Prints system to host their institutional repository. Yet, IRA's repository server and the backups were kept and managed by the university's IT department while IRB managed their own servers and other backups servers and storage media.

4.2 The Digital Preservation Approach Taken by the Institutional Repository

For the cases to make preservation as a crucial process in their institutional repositories, they need to ensure it is part of the mission of the library. Both institutional repositories agreed that preservation is part of the mission of their institutional repository.

IRA argued that preservation is definitely part of the mission and goals of their institutional repository. While IRB highlighted that one of their objectives is to digitally preserve their research and scholarly materials.

A digital preservation policy would need to be developed in collaboration with the repository's personnel and collection management to move from an interest in preservation to implementation (Da Silva & Borges, 2017). Although both repositories value preservation, they lack a solid policy for the preservation and sustainability of their knowledge output. Their policies vary, and they may lack a properly written policy pertaining to their institutional repository.

IRA's institutional repository is governed by four policies: metadata policy, data policy, content policy, and journal publisher rules. The IRB, on the other hand, stated that their policy is to ensure the quality of materials stored in their repository.

They may have established some strategies for their organisations to ensure the sustainability of their repository collections. IRA, for example, had set an annual target for collections being deposited to the collection in order to ensure the institutional repository's steady development. While the IRB was focused on having a proper backup for their institutional repository's collections. They currently have four backup collections of their repository. The first is an automatic backup within the repository server, followed by backups of the server library, tapes in the VTL library, and Net app Server Storage.

A proper rights and agreement enforced for the organisation may be required to support the sustainability of the knowledge output being preserved in the institutional repository. This is critical to ensuring that no legal action is taken against the repository and the collections it houses. Before the librarian preserves the thesis and dissertation as repository content, IRA confirmed that they have a proper copyright transfer and agreement in place. They also make certain that all materials in their research repository and common repository are free of plagiarism. On top of other policies, the

IRB highlighted the Publisher Copyright Policy and Self Archiving for Post and Pre-Print as one that they enforce in their organisations.

The materials deposited in institutional repositories must be of the highest quality and contain all of the necessary metadata. The repositories developed their own strategies to ensure the quality of knowledge output within their repositories. IRA ensured that all materials are of the highest quality because they believe that materials play the most important role as future references, particularly for the university's research and scholarly development. While the IRB has taken a different approach, in which users deliver their knowledge products to the library and library staff deposit the materials into their repository system. This approach would ensure that the materials deposited meet the repository's standard requirements.

To maintain a steady development of the institutional repository while also preserving the knowledge output within the system, the repository would need well-trained staff as well as adequate financial support from the organisations.

The financial condition of an organisation may also influence the digital preservation strategy used for the institutional repository. According to a paper by Balaji Babu et al. (2012), among the elements that would affect the quality of management in institutional repositories are the policy on digital preservations, funding of the repository infrastructure, local content development, R&D and monitoring, and collaborative efforts among all repository stakeholders.

According to IRA, currently there is no dedicated funding for long-term content preservation in their repository. They emphasise that Librarians are in charge of both record maintenance and preservation activities. The Archive Division staff has received extensive training in repository administration and maintenance. Staff members who need additional training can apply for funding to attend a library course. The IRB stated that they were given an annual budget to maintain the repository server. There is no budget for the development of the preservation process. They also mentioned that the department could use the library's training budget for staff development.

4.3 The Risks Identified by Members of the Institutional Repository

Institutional repositories rely on digital preservation to ensure the long-term viability of their knowledge output. They may also identify the risk that the organisation faces in the process of ensuring the repository's sustainability. Both IRA and IRB identified four risks that they believe are critical to the collection's content.

The first risk identified by IRA is the repository's content's sensitivity. It is regarded as a risk because librarians must check the sensitivity of materials before uploading them to any IRs. It is critical to ensure that the materials are freely available. There are several considerations that must be highlighted, such as copyright, patents, and grant policies.

The copyright of each article is the next risk identified by IRA. Before releasing any material contributed to an IR, the library staff will have the editor check the copyright. IRB also identified intellectual property issues as a major risk. According to previous research, researchers may not understand copyright issues pertaining to ma-

materials to be deposited in institutional repositories (Abrizah, 2009; Shukla, 2013). As a result, the institutional repository staff must exercise extreme caution because not all materials in their collection may be made public due to a lack of copyright clearance from the owner.

Another risk that IRA faces is the quality of the digital thesis and dissertation. Some researchers and lecturers are hesitant to contribute to the IR because of the poor quality of their students' digital theses and dissertations. This will have an impact on the number of repository collections. The final risk identified by IRA is technological advancement. The rapid advancement of technology has always put IRs content at risk; the administration must be aware of a few risks, such as backups that cannot be recovered and the risk of hacking.

The next risk issue identified by the IRB is hackers. Because the library manages and maintains the institutional repository's server, all precautions must be taken to ensure that it cannot be hacked by criminals. Virus attacks have also become a major concern in digital preservation. Viruses can disrupt repository management in a variety of ways, including network and storage media issues (Unegbu, 2013).

The server room is another risk that could affect the content of the IRB institutional repository. Because the weather in our country is hot and humid, the repository must ensure that they have proper temperature control over the server room. This is critical to ensuring that no technical issues arise in the server room.

The last risk issue identified by the IRB is the institutional repository's metadata. The metadata provided by the EPrints system may not be in accordance with the Dublin Core metadata for preservation. As a result, the preservation of repository content may not adhere to the proper preservation process.

5 Conclusions

The field of digital preservation is always changing. Years of research may be required to gain a comprehensive understanding of digital preservation. This research on the implementation of a digital preservation strategy for institutional repositories in Malaysian research universities is a minor contribution to the field of digital preservation. As the world and technology evolve, the field will provide more opportunities for more interesting research.

The study's findings revealed a trend in the development and administration of institutional repositories by Malaysian research universities. Although each university's approach to the development of institutional repositories may appear to be trend-following, the universities were prepared to ensure the sustainability of their knowledge output. They have laid out their strategy for preserving their collections, albeit in bits and pieces. The implementation approach that has already been put in place in Malaysian institutional repositories, the struggle that they are facing in order to have a full-fledged strategy for digital preservation, and the proposed framework that would assist institutional repositories in properly planning and implementing digital preservation strategies for their institutional repository.

The institutional repository has grown in importance in the library and information management landscape. As digital information creation advanced, libraries, academic institutions, and research centres produced a large number of digital knowledge outputs every day. The institutional repository, also known as the location for gathering, managing, and preserving digital collections, is critical in ensuring long-term access to digital collections. A well-planned digital preservation strategy would allow repositories to manage the large volume of digital knowledge output in a more effective and sustainable manner.

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