Exploring the Need of Integrated Digital Academic repository for sharing intellectual output in Higher Learning Institutions (Case of Tanzania)

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Abstract: This paper presents the findings of the study conducted in three Higher Learning Institutions (HLIs) of Tanzania. The purpose of the study was to explore the existing models and technologies used in sharing and dissemination of knowledge in (HLIs) of Tanzania. Questionnaires, interview and observation were used to gather data. The findings showed that, universities produce wide range of intellectual outputs (IOs). More than half population involved in the study create and store their IOs in personal computer hard drives while others store in internet cloud servers and departmental web servers. Sharing and dissemination of Intellectual output done through different media. The identified methods proven unreliable, hindering availability and accessibility of scholarly works. Authors proposed integrated digital academic repository that manages and disseminate scholars work through central database. Requirements for design and development of the proposed system have been identified. Design and development of proposed system has been suggested.

Key words: Higher learning institution, intellectual output, knowledge management, knowledge sharing, knowledge dissemination, Scholars, learning materials

1. Introduction

In today's world, knowledge is considered as a strategy resources that formulate the knowledge-based economy of countries. Knowledge has been identified as important as other factors of production such as land, labor and capital that requires management for the development of society (Mavodza and Ngulube 2012, Córcoles 2013). Knowledge based economy is an economy in which knowledge is being created, acquired, transmitted and used more effectively by individuals, enterprises, organizations and communities to promote economic and social development Oseghale and Adeyomoye 2011, Bakshi 2013).

Effective management, dissemination, sharing and use of knowledge assist in solving problems such as diseases, poverty, illiterate, environmental degradation and deforestation especially in African countries whose half population(50%) live in underprivileged societies, lacking access to information and suffer a lot when they fail to acquire and use information in their lives(Chisenga 2006, Oseghale and Adeyomoye 2011, Bakshi 2013). According to Sivakumar(2012) every developed institution has a duty to place and disseminate knowledge through centers, which can easily be accessed by the underprivileged society.

Higher Learning Institutions (HLIs) have been described as the centers of creativity, innovation and the main producers of knowledge, both scientific and technological, that require a reliable, technological, affordable and accessible media to manage and disseminate it (Córcoles 2013). Knowledge management is a practice of organizing, storing, and sharing of vital information, so that everyone can benefit from its use. Despite the number of practices in knowledge management process, knowledge sharing has been identified as the most important aspect of knowledge management process as it facilitate dissemination and application of the created knowledge (Oseghale and Adeyomoye 2011) . As pointed out by Pinto (2012), knowledge become useful when it is created, shared, disseminated and applied, otherwise it end in itself.

Researchers, student and faculty members in HLIs produce wide range of intellectual outputs such as research articles, datasets, theses, dissertation, reports, presentation and learning materials (Tansley 2003). The created knowledge must be shared and disseminated for it to be of positive impact to an individual, institution and country. Materials created should be made available and accessible to Scholars and public in general (Bakshi 2013) Scholars and Public should apply the knowledge and
some use the disseminated information as a base for their research, this led to knowledge evolvement and economic development (Chisenga 2006).

Despite, the increase of the digital materials produced in HLI (Transley et al 2003) availability and discoverability of the scholarly work remained to be a challenge. Archaic dissemination techniques, subscription fee and publication charges have been pointed out to be among the reasons of having limited number of intellectual output and access to the scholarly works (Chisenga 2006). About 80%-85% of HLIs outputs such as research articles, manuscripts particularly from African countries have never made accessible and discoverable to the scholarly community and the world at large (Ezema 2010, Jain 2010). Instead intellectual outputs remain marooned onto authors computers, departmental web servers and in library shelves of which access is guaranteed to limited number of people or none and also lost because most of the materials are not well organized and have no clear documentation (Tansley 2003, Jain 2010).

Unavailability and limited access to scholarly works present problems such as repetition of works done by other scholars, limitation in knowledge evolvement, waste national resource, effort and money as well as negatively affect countries development (Shapira 2005, Sarker and Tiropanis 2010).

To this end, the purpose of this study is to explore the current situation of intellectual output sharing process, identifying the challenges, assessing the need and identifying requirements for the development of integrated digital academic repository system for HLIs of Tanzania. In order to achieve this objective, the study is divided into the following specific objectives:

1) to identify types of intellectual output produced in Tanzanian HLI.
2) to analyze how scholarly works created in Tanzania HLI collected, organized, archived, managed, shared and communicated to scholarly community and the world.
3) to identify the challenges associated with the current archiving and dissemination techniques of scholarly works used in Tanzanian HLI;
4) to propose new model enhancing knowledge sharing and dissemination in HLI
5) to identify design requirements of a proposed model

2. Methodology

The study was conducted in three HLIs named: Nelson Mandela African Institution of Science and Technology (NM-AIST), Muhimbili Health of Allied Sciences (MUHAS) and Sokoine University of Agriculture (SUA). The chosen study area are the science universities offering undergraduate and postgraduate studies, though for our study postgraduate students, researchers and faculty members were involved considering that, they at most produce intellectual output. The composition considered the importance of including main stakeholders producing and managing intellectual outputs in HLIs. Questionnaires and interview guide questions were used as data collection techniques. Questionnaires were administered to researchers, students and faculty member’s whereby, library managers were approached for face-to-face interviews. Library managers were interviewed for detailed information and experience on how knowledge sharing process is been done in their institution. Questionnaires were designed to capture information on types of intellectual output produced and how they had been stored and disseminated to public. Respondents were also asked about the challenges associated with the current archiving and dissemination techniques. Detailed literature review on materials related to topic was done to familiarize with existing digital contents sharing techniques and identifying challenges and weaknesses associated with each method. Data were summarized and analyzed using the Statistical Package of Social Science (SPSS). Pictorial presentations of data were used to compare and derive important patterns that are to be used for further studies.

3. Findings And Discussion

Respondent profile

The respondent profile was meant to describe the respondent designation and educational level, from which authors were been able to judge appropriateness of the respondent in intellectual output creation, usage, sharing and dissemination. A total of 95 questionnaires were administered to students, researchers and faculty members of the studied institutions. The population consisted of 67% students, 28% researchers and 5% faculty members as shown in Fig 1.
As shown in Fig 2 responses by level of education showed that 76% were master’s students, 17% were PhD (candidates and holders) and 7% were administrative staffs.

Author assumed that the population is appropriate for production of intellectual outputs whereby, students may produce theses, dissertation, technical project reports, researchers come up with research findings and faculty members create learning materials such as lecture notes and presentations. It has been observed that, in HLI particularly for postgraduate studies, student must produce intellectual output such as research papers, theses and dissertation as a criteria for graduation, and faculty required to publish following publish or perish rule Institution may take advantage of the regulation by introducing a mandatory policy demanding scholars to self-archive and disseminate their research findings and learning materials in institutional database, where they can be used as a source of scientific information to other researcher and student. Moreover, can be used as the base for next generation research development as well to showcase and publicize institution research product to the public. To achieve the goal, institutions need a stable, permanent, accessible, affordable technology that will facilitate storage of large volume of intellectual outputs and disseminate it to the large number of scholars and the public.

**Intellectual Output Creation, Collection, Organization and Dissemination in HLI**

The findings showed that, different types of intellectual outputs including leaning materials, research articles, manuscripts, technical project materials are among the digital materials produced by Scholars in Tanzanian HLI. Fig 3 shows that, 28% of respondents had engaged in production of learning materials such as presentation and class notes, 23% had created research articles, 21% technical reports, 21% created manuscripts and 7% did not specify type of intellectual outputs that they had ever created.

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**Fig 1 Population composition**

**Fig 2 Respondents’ level of education**

**Fig 3. Intellectual output produced in HLI**
The findings revealed that, HLIs are abundant of knowledge and equipped with different type of people producing academic materials, which would be worth efficient to be preserved and disseminated to the designated community to be applied. However, we usually come across research papers published by institutions on different journals, with no or little amount of other types of intellectual outputs produced by the same institutions. It shows that, institutions does not considers other types of intellectual output as important as research articles. However, Pinto(2012), observed that, for a knowledge or material created to have positive impact it must be disseminated and applied to the designated community, otherwise it ends in itself.

Personal computer hard drive, internet: emails, cloud servers and printed copies were mentioned as technologies used in storage and manage of HLIs intellectual outputs. As shown in Fig. 4., 51% of the respondents collect and archive intellectual outputs in personal computer (PC) hard drive, 30% store on internet particularly on cloud servers such as email, Google drive and drop box, 17% print and preserve hard copies of their works and 3% were not certain about the methods they are using.

**Fig. 4. Intellectual output storage mechanisms**

It has been realized that scholars in HLIs share and disseminate their research and academic works via different technologies such Internet: emails, social network, institution website and cloud servers, journal publication, seminar presentations, posters and printed copies in libraries. The results in Fig 5 showed that, 35% of respondents use internet as their content dissemination mechanism, 30% publish their output onto journals, 24% presents their outputs in seminar and workshops, 4% print and archive their copies, 4% publish their works through posters and 4% were not certain about the media they use. The findings revealed that, produced intellectual outputs are widely scattered stored, locating a particular material requires searching need sources. Searching and retrieving of contents, which are widely distributed, consume time and use much more bandwidth compared to when the resources are searched from single source, which is well organized.

**Fig 5. Intellectual output dissemination mechanism**

Limited storage space, high publication cost, accessibility cost, limited internet connectivity, physical security, access and sharing limitation were mentioned as challenges in the in process of management and dissemination of intellectual outputs. As shown in Fig 6, 45% of respondents had
ever experienced limited storage space to archive their output, 30% mentioned high publication and accessibility cost, 20% experienced limited access and sharing, 35% claimed unreliability of their system (crash), and 10% identified physical security as their challenge.

Fig 6 Sharing and dissemination challenges

4. Proposed integrated digital academic repository for HLI

Having identified challenges in managing, sharing and dissemination of intellectual outputs, in this paper author proposed a new model of intellectual output sharing and dissemination called integrated digital academic repository. The model assist the central management of intellectual output of HLI in a central database, whereby scholar. The proposed model will facilitate collection, archiving and dissemination of intellectual output that are created in Tanzania HLIs. Researchers, students and faculty member’s intellectual outputs will centrally be collected, reviewed, archived in and disseminated to the scholarly community and public. The model collects and archive scholarly works from all over Tanzanian HLIs in a central database.

Digital academic repository system (DAR), will enable researchers to communicate research findings and find out what is been done by other researchers from their institutions and other universities on their field and other fields in HLIs of Tanzania. Scholars will have access to research results and learning materials, which can be used in academic or research activities as source of scientific information. Faculty members of various universities will be able to share academic materials useful for academic purpose and research activities.

Requirement specifications

This section present user perspective towards development of proposed system and user requirements, which were gathered during data collection. According to Summerville (2004), requirements plays vital important role and is a primary tool towards development of any information system. They define what to be performed by a system and specify how it will be performed. Requirements are categorized into two groups namely: functional requirement and non-functional requirements. Functional requirements describes the things, actions, tasks and functions that the system is required to perform or services the system should provide. Non-functional requirements describe properties and constraints such as interface requirements, reliability, performance, storage capacity, usability and system security. The non-functional requirement does not direct relate to the system functionalities, though are the ones describing how the system function should be performed (Mylopoulou 2002).

Authors described and elaborated the proposed model to stakeholders (researchers, student and faculty), who in turn gave their inputs about what the system should do and how the materials should be organized, collected ,shared and disseminated to the public for it to be of usable and reliable source of scientific information. Their inputs were given in form of data as described below.
User Perspective towards Development of Integrated digital academic repository

Despite the existence of digital repositories into some of the visited institutions: MHUHAS and SUA that collects and disseminate scholarly works of their institutions and materials related to climate change field respectively, scholars of the said universities joined hand with the scholars at NM-AIST who are currently not possessing digital repository, supported the development of the proposed integrated digital academic repository as it expands and widen the search area of materials. The findings shows that 97% of respondents supported the development of the proposed repository whereas, 3% did not support. Likewise the result show that 87% of respondent were extremely interested, 10% were somewhat interested, 3% were neither interested nor uninterested and no one mentioned not to be interested. From the statistics, authors realized that user are in need of the proposed system and that brought attention to authors to deep more for the requirement or services that user expects the system to offer.

Type and format of the intellectual outputs

From the study, respondents identified different types of intellectual outputs and different file format to be archived in and disseminated through the proposed repository. Theses and dissertations, technical project reports, research articles and leaning materials (lectures, seminar presentations) are the common items users demanded to be accommodated in a proposed system. Whereas, Text files (doc, pdf), Multimedia (video, audio) and Binary files are the file formats that user need to upload and access from the system as shown in fig.

![Fig 7. Intellectual output formats](image)

Submission and organization of intellectual outputs

The findings revealed that, 86% of respondents (user) needs to access reliable information from the system, they proposed the submitted materials to be reviewed and checked for the correctness and if the materials correspond to the vision and mission of a particular institution before uploading to the system ready for use, 14% suggested the submitted materials to be uploaded directly by the corresponding submitter (researcher, student, faculty).Moreover, 41% of respondents demanded materials to be organized based on field of study, 26% authors name, 32% category wise(paper, books, articles, presentation)and 1% did not specify. The modes of material organization considers easily search and retrieving of information.

Modes of sharing and dissemination of intellectual outputs.

The result show that, 60% of respondents need the archived intellectual outputs to be shared and disseminated to scholars within institution, outside institution and the public at large. Whereas, 33% requires the materials to be shared among the scholars within and outside institution, 3% prefer the materials to be shared only with scholars in institution and 3% were not certain about which mode to use. The fact that, not all produced materials are necessarily to be shared in globe, some are only necessary to a particular institution or people while others might be necessary to the globe. Authors considered all suggestion necessary and documented to be included in the further development stages, roles have been defined allowing user to specify whether the submitted materials should be available to all people accessing the system(public access) or institution members(institution) or to be archived and only accessed by the author/submitter of the work(private/individual access).
Summary of functional requirement

This section presents the summary of user requirements (functional requirement). Authors analyze gathered requirement and present them in high level language as shown in table 1. System functions and entities performing actions have been identified and descriptions on each case has been given.

List of use cases depicting the functional requirements of a proposed Integrated Digital Academic Repository

<table>
<thead>
<tr>
<th>Use case ID</th>
<th>Use case Name</th>
<th>Sub use cases</th>
<th>Actor(s)</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User management</td>
<td>Register universities</td>
<td>System Administrator</td>
<td>The system should provide administrator interface to register universities and administrators for registered universities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Register user</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Submission</td>
<td>Log in Upload contents</td>
<td>User(researcher, student faculty)</td>
<td>The system should provide a means for registered user to submit their intellectual output through their defined user interface</td>
</tr>
<tr>
<td>3</td>
<td>Reviewing</td>
<td>Log in View notification View submission Approve/denies submission</td>
<td>Reviewer</td>
<td>The system should provide a means through which submitted contents will be checked for correctness and if adheres abide to university, policies, regulation and standards.</td>
</tr>
<tr>
<td>4</td>
<td>Accessing</td>
<td>Log in View contents</td>
<td>Student, researcher, Faculty, public</td>
<td>The system should provide interface for users to access contents, however for the contents declared private to individual or university, user must log in to be directed to a specific university page</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Download/citation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Reporting</td>
<td>Log in View contents</td>
<td>Managers</td>
<td>The system should provide summary report of trends and status of contents contribution in repository</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Get summary report</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Use Case Diagram employed to present how each user interact with the system. The Use Case Diagram is a Unified Modelling Language (UML) providing a pictorial representation of a system and how user interact with the system (Levy 2008). The use case diagram depicts the abstract view of the system as shown in Fig 8.
5. Use case diagram Descriptions

System administrator

System administrators manage system, users and control the operation of the system. System management involve registration of new institutions and administrators of the registered institutions into the central database system. The registered institution system administrators are given privilege to register prospective system users under their institution. Reviewer

Despite the new intellectual output sharing model allowing collection and dissemination of intellectual output from different users of different institutions in HLI of Tanzania. The collections will not be uploaded into the system, instead effectiveness and correctness of the materials must be checked. Intellectual output to be uploaded into a system must be passed the correction and evaluation phase. Each institution register a person responsible for evaluating the contents before including into the system. Once editor approves that the contents is useful productive and adheres to the institution rules, the content is uploaded and access permission is granted to the authorized user over the content.

Manager

Decision maker’s gets access into the stored digital contents of the researcher’s student and faculty members particularly of their institutions. Having access to resources, managers have given privilege to monitor and check progress report relating to contribution of each member of the community, and can make decision and recommendation on given statistics summary report.

User (researcher, student, faculty)

Researchers, student and faculty members of HLI are the users. The group of which expected to submit their digital contents to be stored in a central database and disseminated as a means of sharing knowledge to other scholars and the public. The submitter also are the consumers of the intellectual output in digital academic repository, they can access contents submitted by other scholars of their institution or other HLI institutions of Tanzania.

Non-functional requirements

The fact that, Scholars need access over the materials produced by different scholars from different institutions of which results to large volume of information, storage device with high storage capacity is required to store the contents. Materials collected and archived in repository in long term as source of
information in future studies, back up is necessary as useful in case of system crash and easy recovery. Web based interface will be provided for easily access of materials. Intellectual output will be organized into module basis following the institution, schools and department on which submitter belong to minimize searching and retrieving response time. Ensuring the reliability and usability of the contents archived in a proposed repository, each content submitted is checked for correctness and usefulness basing present standards. Roles and user-ids have been identified to secure the system and the contents archived in it.

6. Conclusion and Future Work

The current situation of intellectual output sharing and dissemination in Higher Learning Institution of Tanzania identified and presented in this paper. Challenges and weaknesses facing scholars in sharing and accessing academic and research resources produced in Higher learning institution of Tanzania have been identified. It has been observed that, HLI produce large number of digital contents including research article, theses, technical project reports, conference proceeding and learning materials. However access and availability of this materials remain to be a problem in scholarly community and the world. Universities lacks central system to collect, organize, manage and share their intellectual outputs. Materials are scattered allocated, published onto international journals of which access is limited by subscription fees and pay-per view fees, and some housed onto individuals hard drive or left unpublished in university library shelves providing of which access is granted to limited number of people or none around institution.

Considering the situation and challenges hindering intellectual output sharing process, authors proposed new model for sharing collecting, organizing, managing, sharing and dissemination of intellectual outputs created in Higher learning institution of Tanzania. The proposed model provide a platform for central management of materials, which are created in Tanzanian HLI. Functional and non-functional requirements of the proposed system have been identified and summarized. Therefore our future work will be to design and develop architectural framework of the proposed model enabling centrally collection, archiving, organization, sharing and dissemination of scholarly works.

Acknowledgment

The researcher Thanks God for blessings, Supervisors Prof. Irina and Mr. Loserian Laizer for their supervision and guidance towards accomplishment of this paper. Special Thanks also is given to the management of Nelson Mandela African Institute of Science and Technology for their invaluable financial support in undertaking this study.

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JEL Classification: D83, I20