Chapter 2  Review of Related Literature

2.1  Introduction

This chapter presents a critical analysis of the related literature to identify and record existing knowledge on the topic of research. The total reviews are brought under four main categories. The first category includes studies on the adoption of DSpace software for the creation of DLs by libraries across the globe. The second category comprises the comparative studies of different OSS for DLs. The third category contains studies that explore various factors influencing OSS adoption in all types of organizations. The studies listed under the fourth category provide information on the measurement of OSS maturity. These reviews are presented as they provide various factors that influence the adoption of OSS by libraries. Moreover, these studies offer
valuable insights to understand whether the maturity of OSS is one of the factors of adoption considered by organizations. The reviews are arranged chronologically under each category.

2.2 Adoption of DSpace for DLs

Today’s digital environment demands that the development of DLs is no longer an option for libraries but rather an obligation to control the flow of knowledge through various forms of digital materials. A number of articles discussed the adoption of DSpace software for developing various digital systems and the experience of investigators in developing and maintaining these systems in their institutions.

Cervone (2006) illustrated the aspects of system software selection giving particular emphasis to those points where a digital library project differs from a traditional enterprise-level software selection process.

Digital library system software selection differs in some significant ways from traditional software implementations. In particular, security and authentication issues, long-term cost and maintenance considerations, vendor viability, as well as training and documentation are areas where the software selection team needs to devote greater attention if the project is to be successful.

Sutradhar (2006) described the adoption of DSpace for the establishment of an IR at the Indian Institute of Technology (IIT), Kharagpur. The benefits of maintaining an IR were listed that include the archiving of research papers of the members of the institution for online access as well as digital preservation. The resources in the IR include instructional materials, records, data sets, electronic theses, dissertations, annual reports, as well as published papers. The investigator observed that IRs change many of the current practices of
scholarly communication and publishing. The study has also provided the reason behind the adoption of DSpace for the IR. DSpace, being an open source technology platform, can be customised to meet future needs. DSpace was found to be a suitable platform for building an IR as it is OAI-PMH compliant, uses Lucene searching (supporting fuzzy search logic) and it has the “handle” system (for global unique ID of documents).

Barwick (2007) shared the experiences of setting up an IR at Loughborough University, UK. The study outlined the various decision processes involved during the 12-month pilot phase. The selection of the suitable OSS was one of the main tasks. The University selected DSpace above EPrints and Fedora because DSpace had a good web interface and the ability to manage various file formats. The University was looking at developing a “blended” repository and DSpace was found quite suitable. The IR was set up in May 2005. They were able to customize the software. Moreover, they found the structure of DSpace flexible to organize their repository collections according to the University’s faculty/departmental structure. The license embedded into the DSpace software, caused some problems for submitters and this was settled by a minor change of the license’s wording.

A case study presented by Hulse, Cheverie and Dygert (2007) outlined the process through which the Washington Research Library Consortium selected and implemented the DSpace in a shared information technology environment. The issues confronted in dealing with a multi-institutional implementation were examined through both a detailed description of the implementation and a generalized description of the challenges the consortium faced. They revealed that the collaborative approach presented significant benefits in drawing on the breadth of expertise available among the Consortium and utilizing a shared information technology infrastructure. OSS designed for IRs like EPrints, DSpace and Digital Commons were selected and evaluated by the
consortium. The evaluators found the functionality across these platforms to be generally similar. Initial testing of the DSpace product indicated that it would not be a significant challenge to existing technical support and expertise. As the DSpace platform was designed primarily for a single institution, some customization for a consortium implementation was made. Since DSpace was an out-of-the box platform, the consortium could customize every implementation.

A study on the problems associated with the creation of an IR for a consortium of institutions on one software platform was presented by Joki (2007). DSpace was selected for the PEPIA (Project for Electronic Publications and Institutional Archives) which is a Norwegian government-sponsored effort, to provide institutional repositories to multiple Norwegian universities, university colleges and other research institutions through a consortium. Because of the highly specific requirements and very limited resources (time, money, personnel), a well extensible software platform was required. DSpace was chosen as it was the system which had the most functionality of the ones evaluated. Further, DSpace had a large user group, which would come in handy if help was needed during the development process. Another important requirement was that the system could be hosted on the already existing server platform, preferably without having to acquire new competence in programming languages. The study found that it is possible for multiple organizations to join forces and create a consortium to develop an IR on one software platform.

A study to understand the OSS based DL development in India was conducted by Jose (2007) using online questionnaire. He recorded that DSpace, Eprints, Fedora and Greenstone were the most popular OSS packages used in India.
The result of his study revealed that DSpace was the most popular among the OSS DL solutions in India.

Lam and Chan (2007) documented Hong Kong University of Science and Technology’s (HKUST’s) experiences in developing its IR. The study highlighted the reasons for adopting DSpace over other OSS packages. The task force decided to focus on OSS that supported OAI-PMH (Open Access Initiatives – Protocol for Metadata Harvesting). Two such IR software programs were evaluated, namely EPrints and DSpace. EPrints was widely used by IR implementers in 2002. DSpace was developed with experience gained from EPrints, but with a clever move from the Perl programming language to Java and Servlet. And at that time, it also had better Unicode support, which was essential to the repository that would contain Chinese materials. With the above consideration, the library decided to adopt DSpace.

Laxminarsaiah, and Rajgoli (2007), described the adoption DSpace for the establishment of an IR for the ISRO HQ library for enabling online access to the various resources on satellite applications, remote sensing, tele-medicine and tele-education and other allied topics. The IR accommodated newspaper clippings, research papers, speeches/lectures, office orders/memorandums, videos, annual reports and the in-house publications. The selection of software for the IR was made by detailed study of OSS like Archimede, CERN (CDSware), DSpace, E-prints and Greenstone. DSpace was found suitable on grounds of technical support and training in using the software. It was also observed that the majority libraries in Bangalore city used DSpace which would facilitate interacting with them for technical support. DSpace was selected as it had tremendous potential and can support numerous forms and formats.
Devakos and Toth-Waddell (2008) in their study described a project to increase access and longevity of electronic government documents in the Ontario Legislative Library. They found that digital repository software, such as DSpace, could be used to extend access to, and longevity of, special collections. DSpace has a number of preservation features including the ability for libraries to set preservation support by file type, checksums to ensure file authenticity, and persistent identifiers. DSpace uses open standards to facilitate interoperability and hence makes it easy to re-use metadata and for search services, such as Google, to crawl content. DSpace is organized by the concept of communities often corresponding to administrative units within an organization.

Reporting the IR development at ICFAI Business School (IBSA), Ahmedabad, Doctor and Ramachandra (2008) observed that developing an IR provided a means for the institution to create archives and make available their wealth of knowledge, increase visibility and prestige through exposure to its digital scholarship. IRs are emerging technologies for capturing intellectual capital, knowledge sharing and management in academic and research institutions especially in developing countries like India. They conducted a survey to identify the various OSS being used for IR in India. It was found that out of 20 IRs, 13 used DSpace. IBSA also chose DSpace for its IR. They realized that the installation of the IR was complex, requiring technical know-how of different software. Creation of communities and collections, archiving of documents into the repository, enriching them with metadata were essential for efficient retrieval of information.

An evaluative study of Indian digital libraries and repositories was done by Mittal and Mahesh (2008) by applying literature review and content analysis. They reported the phenomenal increase in the number of digital libraries and
repositories the world over. They also noted that India was following the global trend and a number of digital libraries and repositories have been developed in the country. The use of OSS for the creation of IR/DL was found to be common. Among the OSS, DSpace was increasingly adopted for the creation of IRs/DLs in India.

DSpace is also adopted for creating ETDs across the globe. Ghosh (2009) in her case study on nine ETD digital libraries in India observed that “ETDs are a new generation of theses and dissertations that can include colour diagrams, colour images, hypertext links, audio, video, animations, spreadsheets, databases, simulations, and virtual reality worlds”. She collected data using questionnaire survey, face to face or telephone interviews, and content analysis of ETD web sites and bibliographical databases. Out of 9 ETDs 8 (89%) were using DSpace software. However, the study did not provide information on the process of selection of the software for these ETDs.

Winter and Bowen-Chang (2010) reported the adoption of DSpace for building an IR at the main library of the University of the West Indies, St Augustine, Trinidad and Tobago. They observed that an IR could increase the visibility of an institution’s scholarship while paving the way for greater collaboration among researchers outside the institution. The research draws upon the DSpace experience of the University of the West Indies, St Augustine and serves as a model for future projects in the implementation of the DSpace software, particularly in developing countries. One of the main challenges of implementing the IR was choosing the right software that would adequately suit the library’s needs and at the same time be cost-effective. Four OSS platforms were evaluated: DSpace, EPrints, Fedora and Greenstone. The evaluation exercise was conducted over a one-month period and included contacting various universities to determine their IR experience and visiting websites of institutions that employed the OSS. The selection process
eventually guided the digitization team to recognize that criteria such as purpose, cost, features and functions, and support were paramount to the internal needs of the University. At the end of the evaluation exercise, the DSpace platform was selected because a community of users existed who could be consulted, it has the ability to accept information in all formats and the software is designed to accommodate long-term preservation.

An IR was built using DSpace software at the Independent University, Bangladesh (IUB), for the systematic storing and access to the research output of the university (Shoeb, 2010). DSpace software was chosen for the IR after reviewing literature on it and observing the comparison of the different OSS packages done by other institutions. In addition, 40 students were given the task of analysing the features of different OSS for IRs. DSpace received highest scores over other software on many aspects. The customization of DSpace was the most challenging task at IUB.

Müller (2011) in his study provided methods to choose a Free and Open Source Integrated Library System (ILS) based on objective criteria. The methodology applied involved three broad steps. The first step consisted of evaluating all the available ILS and keeping only those that qualify as truly open source or freely licensed software. The second step involved evaluating the community behind each open source or free ILS project, according to a set of 40 criteria in order to determine the attractiveness and sustainability of each project. The third step entailed subjecting the remaining ILS to an analysis of almost 800 functions and features to determine which ILS were most suited to the needs of libraries. The final score was used to identify strengths, weaknesses and differentiating or similar features of each ILS. More than 20 open source ILS’s were submitted to this methodology but only 3 passed all
the steps: Evergreen, Koha, and PMB. The study used “maturity” as one of the evaluation criteria.

The survey conducted by Sawant (2011) using web based questionnaire revealed the existence of 16 online IRs in India. DSpace was the software used by majority (11) of the IRs. The author tried to understand the preference of IR developers for DSpace. It was reported that DSpace could be easily customised to meet local needs. Moreover, the large communities of DSpace developers were working on improvements and innovation of the software. More workshops were offered on DSpace by various institutions in India to train library professionals. Documentation Research and Training Centre (DRTC) provided a shell script for installation of DSpace to ease the installation process. The results of the study showed that the respondents considered end-user interface to be the top ranking IR-system feature.

Alayon, Nemiz, Superio, de la Peña and Pacino (2012) presented the experiences of adoption of DSpace for developing an IR at the Southeast Asian Fisheries Development Center (SEAFDEC), Philippines. The IR was developed mainly to provide a reliable means for its researchers to store, preserve, share their research outputs, enable easy access to and increase the visibility of its scientific publications. Prior to DSpace, the library developed an in-house digital library using the Greenstone Software in 2009. They were not satisfied with some of the features of Greenstone. They evaluated Eprints and DSpace as these were quite common in Southeast Asia and selected DSpace focusing on its leadership and largest community of users and developers worldwide. Initially, DSpace version 1.7.x was used and later updated to 1.8.x XML Manakin using the Mirage themes.

An overview of IR, developments that are taking place in the Arabian Gulf Region was given by Ahmed and Al-Baridi (2012) in their study. The data
were mainly drawn from various sources on the Internet and by e-mail contact with the authors’ acquaintances in several universities and institutions of the Arabian Gulf region. The study covered educational institutions of higher learning and research of the Gulf Cooperation countries only, which included Bahrain, Kuwait, Qatar, Saudi Arabia, Sultanate of Oman and the United Arab Emirates. They reported that open access and IR developments were at the early stages in the Arabian Gulf region. There was an imperative need to spur the developments in these areas in order to derive utmost benefits to both researchers/stakeholders and institutions. DSpace was the most popular OSS for IRs in the region. Out of three IRs in the region, two used DSpace.

Chen, Chen, Hong, Liao and Huang (2012) highlighted the importance of DLs that are focused on creating, organizing, and managing multimedia digital content and collections, and providing search, retrieval, and other information services over computer network. They also put value on OSS for DLs as they were increasingly considered a beneficial alternative to commercial DL software. The increasing budget cuts in libraries were another reason for searching alternatives. Additionally, the costs of maintenance and producing software were very high. Free access and a good level of functionality were the main reasons accounting for the usage and interest in open source DL software. The authors reported the adoption of DSpace 1.4.1 with modifications for a DL that preserved Taiwan library history.

Adewumi, Omoregbe, Misra and Fernandez (2013) conducted a study on three repository software- DSpace, EPrints and Greenstone (DEG). Considering their increasing adoption and usage by universities, the study applied a model that could compare the qualities of repository software. The proposed model was used to measure quality in DEG. The model was validated through real data and the results indicated that DSpace was the better option.
2.3 Comparative studies of OSS packages in libraries

Al Zeheimi, Zeki, Razi, Jalaldeen, Zain, and Abubakar (2014) conducted an in-depth field study to explore the perceptions of library and information science community towards open source software adoption in libraries of Oman and to understand factors affecting OSS adoption at libraries in Oman from library professionals’ opinion. The study was undertaken by quantitative survey and case study research method. The study population included participants from seven institutions of Oman who belonged to library and information science field. The study found that lack of awareness on OSS products was the main reason behind the absence of adoption of OSS in Oman.

Khode and Chandel (2015) conducted a survey to assess the status of application of OSS in India. They used various sources to find out the users of OSS in India. The methodology included visiting users’ list available on the website of respective OSS, consulting case studies and research papers on OSS, searching on Internet and communication with library professionals through various mailing lists such as NMLIS, LIS-Forum, etc. The study revealed that Koha OSS was the major Integrated Library System (ILS) used by Indian libraries followed by NewGenlib and Open Biblio. The study also discovered that there were 96 open access repositories in India created by using OSS which are accessible in public domain. Out of 96 repositories, 67 were created by using DSpace, 26 by E-print and 3 repositories by Greenstone.

2.3 Comparative studies of OSS packages in libraries

For the purpose of building a digital library of Library and Information Science, Madalli (2003) compared the features such as operating system, web server, language, database, resource identifier, Dublin Core, METS, OAI-PMH, submission and supported file formats of Greenstone, Eprints, DSpace.
and Fedora OSS. The comparative analysis found that DSpace was a powerful OSS suitable for the proposed digital library. Its features like allowing submission of digital documents by different members from different locations were found most convenient. However, the software lacked METS standard, the study reported.

Jones (2004) revealed the result of a comparative study of DSpace with ETD-db, software specifically designed for E-theses. The purpose of the study was to identify and select suitable ETD software. The investigator observed that the overall methodology employed by DSpace was superior to that of ETD-db. The study also identified that DSpace was far more functional with regards to essential features such as security and administration which was an important infrastructure for any piece of software of this nature.

Han (2004) revealed the implementation of a Content Management System (CMS) at the University of Arizona Library as a way to manage the electronic contents effectively in terms of preservation, organization and dissemination. The CMS was perceived to be supporting improved information accuracy, increased flexibility, enhanced system management, and reduced maintenance cost for both locally developed documents and external e-contents. The selection of the software for the CMS was an important step. Preservation of the contents, metadata and access were the key areas considered for the success of a digital content management system. Search for a CMS through commercial and open source products were made which resulted in the identification of 17 systems. Out of 17, three candidates (Fedora, Greenstone and DSpace) were selected on the basis of broad criteria such as digital preservation strategies, metadata standards, and access policies. The three software were further evaluated based on four major criteria. Operational; Technical; Scheduled; and Economical. DSpace received the highest marks in
operational analysis, schedule analysis and economic analysis, while Fedora received the highest score in technical analysis. The overall scores showed that DSpace ranked first among these systems. DSpace keeps a file’s original name, size and created date. In addition, its built-in data integrity check by using MD5 (a “message digest” algorithm for security applications) to ensure the correctness of each file was noteworthy. More importantly, it defined a migration strategy including introducing the concept of file formats as a hierarchy of “unknown”, “known”, and “supported”. DSpace’s consideration for scalable storage allowed the system to use multiple hard drives, which is particularly useful for an IR.

Kumar (2009) evaluated some of the most popular digital library packages. The evaluation was done by using a checklist consisted of 12 categories of items, each with varying degrees of importance: content management, content acquisition, metadata, search, access control and security, report and inquiry, preservation, interoperability, user interface, standard compliance, automatic tools and support. The weights were assigned on the basis of a modified Delphi technique. Three OSS viz. DSpace, Fedora and Greenstone were taken for evaluation. The consolidated score showed that DSpace emerged as a good option having best search and browsing support as well as good support for metadata and provides more power to administrator to put access restrictions at collection level.

A comparative study of DSpace and Eprints was carried out by Karmakar, Das and Thakuria (2010). They identified the following features specific to DSpace; DSpace indexes digital content, so users can search and retrieve results quickly. DSpace distributes digital content over the World Wide Web and also searchable through search engines. DSpace is easy to upgrade. DSpace preserves digital materials over the long term. DSpace has a persistent network identifier for work that never changes or breaks. DSpace has a
number of preservation features including the ability for libraries to set preservation support by file type, checksums to ensure file authenticity, and persistent identifiers. DSpace uses open standards to facilitate interoperability and hence makes it easy to re-use metadata and for search services, such as Google, to crawl content.

Randhawa (2012) attempted a comparative study of Greenstone and DSpace software for building digital libraries. The comparison was based on features like the availability, version, developer prestige, operating system, system requirement, license, language, technical and training support, examples, security, browse and search and other relevant points. The purpose of the study was aimed at supporting professionals to select a suitable OSS for building digital library. The study concluded that both Greenstone and DSpace were appropriate software for creating digital libraries with minor variation in the features and work flows.

Madalli, Barve and Amin (2012) presented an analytical study along with observations regarding digital preservation support available in existing open-source digital library software (OSS-DL) based on test beds created for that purpose. They had set up a test bed environment and installed major OSS-DL. All of the selected software were available under open source license terms and conditions. The OSS-DK included CDS-Invenio, DSpace, EPrints, Fedora, Greenstone, DoKS, and MyCoRe. These software programs were used specially for creating digital archives/digital libraries/institutional repositories. They compared metadata format, persistent identification, audit logs, details of files, actual file storage, checksum and versioning support. The study found that to a large extent Fedora supported more features that were essential from a digital preservation point of view, but it lacked a user-friendly interface; hence, there were not many installations of Fedora. DSpace and EPrints are
now used heavily all over the world to build digital repositories/institutional repositories. To some extent, both of these software programs supported digital preservation. There were large number of repositories available with DSpace. In India, many institutes have taken steps to build digital archives using DSpace.

Masrek and Hakimjavadi (2012) appraised 59 features of three widely utilized open source IR solutions (DSpace, EPrints, Fedora) from the perspective of managing ETDs. For this purpose, all applications were installed and the features were tested in a test-bed environment (a benchmark machine) with a predefined set of ETD collections and registered users. They adopted evaluation criteria set suggested by Gibbons for the study because this criteria set considers the ETD-specific aspects of software solutions. The findings of the study revealed that, although all three solutions are capable of managing ETD systems, in most of the comparative areas that are vital for an ETD repository DSpace was ahead of EPrints and Fedora.

Lihitkar and Lihitkar (2012) compared the features, functions and usability of ten OSS, i.e., Greenstone, DSpace, E-Prints, Fedora, Ganesha, Invenio, XTS, Dienst, VuDL, and NewGenlib. Investigative and evaluative research methodologies were used for the study. Data were collected by surfing Internet and downloading the ten OSS under study. A worksheet was prepared using different criteria for comparative study. It included license, new version, downloaded site, size of the software, bundle of associated software, operating system, language support, facilities such as searching and browsing, multimedia, metadata etc. The study concluded that the compared OSS packages were flexible, and can be customized and modified at many different levels–including the programming level. The authors recommended Greenstone and DSpace for building digital libraries.
Tramboo, Shafi, and Gul (2012) attempted a comparative study of DSpace, Greenstone and Eprints. The study compared licence cost, product type, update cost, resource identifier, OAI PMH, supported item types, metadata formats, user interface functions, thumbnail preview, searching capabilities, browsing options, syndication, user authentication, statistical reporting, software platforms, databases, programming languages, web server, associated software, machine to machine interoperability, licence and services. The study did not propose any specific DL systems. This study can be used as a reference guide by any organization or institute to decide which one will be ideal for creating and showcasing their digital collection.

Choi (2014) evaluated the application profiles and development characteristics of library open source projects. The author evaluated 594 library OSS projects from Sourceforge and Foss4lib with a number of criteria like development status, license type, sponsorship etc. The study found that while various types of library OSS applications were found to be under development and in use, there has been a steady decrease in the number of projects initiated since 2009. Although sponsorship was significantly positively associated with several indicators of OSS project success, the proportion of sponsored projects was relatively small compared to the proportions reported in some other contexts. In total, 71 per cent of the projects have a restrictive license scheme, suggesting that the OSS ideology is valued among library OSS projects. The results also indicated that library OSS projects exhibit several characteristics that differ from the traditional developer-oriented OSS projects in terms of their technical environment.
2.4 OSS adoption factors in various organizations

Mtsweni and Biermann (2008) studied the implementation of open source software within the South African government. The study reviewed that OSS were increasingly becoming an alternative for proprietary software particularly in the government sector globally. The adoption and implementation of OSS by the government sector were cited as one of the enablers for the adoption of OSS by the private sector. It is also apparent that in the government sector internationally, OSS is seen as a viable technology for reasons such as lowering software costs, growing local software development industry, and bridging the digital divide.

Yuan (2009) in his dissertation tried to investigate the factors leading to the adoption of OSS by Singaporean companies. The study highlighted that the adoption of OSS was driven by the perception of a cost advantage. The organizations that adopted OSS agreed cost as their biggest concerns and top priorities. The next significant finding was the need for increased OSS skills. The organizations that succeeded in adopting OSS possessed pre-existing skills in OSS use. This was instrumental to better mitigate risks and to lower their training costs. The final principal finding was that OSS appeared to be used mainly in systems infrastructure applications.

Mutula and Kalaote (2010) investigated OSS adoption in the public sector in Botswana and South Africa. The study explored different aspects of OSS deployment in the public sector. The study found that even though IT managers in government of Botswana had positive attitude towards OSS, there was limited use of OSS. Compared to Botswana South African Government provided support for harnessing OSS.
Gurusamy (2011) in her research on “Open source software adoption in the Australian Public Sector” investigated various factors that may enable or inhibit OSS adoption in public sector organizations. The study used two major technology adoption theories: Diffusion of Innovation (DOI) theory and the Technology Acceptance Model (TAM). The study observed that maturity of OSS products was an enabler for OSS adoption as organizations tended to adopt mature OSS products. The respondents agreed that most of the open source software they use was very mature and well documented. Characteristics of the software were identified as an enabler and were represented by the ability to add new features, prompt fixing of software bugs, availability of source code, and product maturity.

Midha and Palvia (2012) examined the factors that lead to OSS success longitudinally over a period of time with two measures of project success: project popularity and developer activity. They examined 283 OSS projects over a span of 3 years to understand the impact of various factors, categorized as intrinsic and extrinsic factors, on OSS project success over the first three years of its life. A longitudinal analysis of these factors was conducted at various stages in the OSS life cycle to reach unique insights into various project management decisions. The study had the following hypotheses that formed the factors of OSS success.

1. OSS projects with higher technical success are more popular
2. The cumulative existing developer base of the previous versions of an OSS project is positively associated with its current version’s market success.
3. The cumulative existing developer base of the previous versions of an OSS project is positively associated with its current version’s technical success
4. OSS projects that use a non-restrictive license exhibit higher market success than those that use a restrictive license.
5. OSS projects using a non-restrictive license exhibit lower technical success than those using a restrictive license.
6. The cumulative existing user base of the previous versions of an OSS project is positively associated with its current version’s market success.
7. The number of language translations of an OSS project is positively related to its market success.
8. Complexity of the OSS project is negatively related to its technical success.
9. OSS projects that delegate responsibility exhibit higher technical success.
10. Modularity of the OSS project is positively related to its technical success.

The study was concluded with the testing of hypothesis. The hypothesis 1 was not supported while 2 and 3 received mixed results. The rest of the hypotheses were supported.

Rossi, Russo and Succi (2012) investigated the importance of factors for the adoption of free/libre open source software (FLOSS) in the public sector. Based on the methodological approach on two exploratory case studies with contrasting result logic, they built a multi-level framework grounded both on literature review, and feedback from stakeholders. The study considered phases of adoption (initiation, implementation) and the levels of adoption (technological, organizational, environmental and individual). The study found the importance of a strong and decision-centric management board to give the impulse for the initiation phase of the process. As perceived by the stakeholders, a strong governmental support is of paramount importance to increase the adoption at the public level, although in the case studies examined...
the initiation stage started from the impulse of a championing management. Both case studies passed the initiation phase successfully. Continuous employees’ training, organizational objectives consensus, and business process reengineering were found important for the implementation phase.

Spinellis and Giannikas (2012) listed the research around benefits and significant factors driving OSS adoption, and concluded that the most important reason of choosing open source was purchasing cost and the total cost of ownership. Although other benefits like stability and performance, flexibility, and control, external support, and security were also stressed in the advantages listed by open source adopters, it seemed that total cost of ownership and lower acquisition cost were the most significant ones. On the other hand, there were also many factors that operated as barriers toward the organizational adoption of OSS.

Li, Tan and Yang (2013) analysed whether human capital, that is, knowledge, skills, experience, abilities, and capacities possessed by employees, played a vital role in the adoption of open source software (OSS) by organizations. The study conducted by a survey among 104 OSS-adopting organizations and 111 non-adopting organizations in China. The result supported the argument that OSS-adopting organizations could be clearly distinguished from their non-adopting counterparts in terms of their availability of internal OSS human capital, accessibility to external OSS human capital, organizational size, IT department size, and criticality of IT operation. Theoretical and practical implications are discussed in the study.

Marsan and Pare (2013) conducted a qualitative survey to find antecedents of OSS adoption in health care organisations in Canada. They conducted 18 semi structured interviews with IT experts from all levels of the Province of Quebec’s health and social services sector in Canada. The study found that
eight factors associated with three distinct theoretical perspectives influenced OSS adoption.

2.5 Measuring the maturity of open source software

Clark (1997) in his study on “the effects of software process maturity on software development effort” observed that controlling and improving the processes used to develop software was a primary remedy to the problems of time lag, over budget, non-conforming to requirements and of poor quality. The Software Engineering Institute at Carnegie Mellon University had published the Software Capability Maturity Model (SW-CMM) for use as a set of criteria to evaluate an organization's process maturity. The model is also used as a roadmap to improve a software development process’s maturity. The premise of the SW-CMM is that mature development processes deliver products on time, within budget, within requirements, and of high quality.

Mockus, Fielding and Herbsleb (2002) in their research on “Two case studies of open source software development: Apache and Mozilla” addressed key questions about the development process of Apache and Mozilla. They observed that OSS development had the capacity to compete successfully, and perhaps in many cases displace, traditional commercial development methods. In order to begin investigating such claims, they examined data from two major OSS projects, the Apache web server and the Mozilla browser. By using email archives of source code change history and problem reports, they quantified aspects of developer participation, core team size, code ownership, productivity, defect density, and problem resolution intervals for these OSS projects.
Zhang (2007) in his research on “Open source software maturity model based on linear regression and Bayesian analysis” introduced an OSS maturity model that facilitated the software assessment and helped users to make a decision in choosing an OSS from a large pool of OSS candidates in the same category. Though a few maturity models had been proposed in the past, the parameters in the model were assigned not based on experimental data but on human experiences, feelings and judgments. These models were subjective and can provide only limited guidance for the users at the best. The study has proposed a quantitative and objective model which was built from the statistical perspective.

Spiro (2009) in her report on “Archival management software” explored ten archival management systems belonging to commercial and OSS domain. Archival management systems are a kind of software that typically provide integrated support for the archival workflow, including appraisal, accessioning, description, arrangement, publication of finding aids, collection management, and preservation. The study brought out the maturity status of six commercial software and four OSS. The commercial software includes Adlib Archive, Calm for Archives, Cuadra Star, Eloquent Archives, Minisis M2A and Past Perfect. The OSS includes Archivist’ Toolkit, Archon, ICA-AToM and Collective Access. The study collected data from interviews with users as well as on previous studies of archival software and information provided by the developers and vendors. The study offered features matrices including software maturity for selected archival management systems so that archivists can make quick comparisons of different software. The maturity of software included the year of software release, number of installations, release of different versions of the software, and the smooth progression of the software over the years.
Raza, Capretz and Ahmed (2012) presented a usability maturity model specifically aimed at usability-related issues for open source projects. The model examined the degree of coordination between open source projects and their usability aspects. The measuring instrument of the model contained factors selected from four of their empirical studies, which examined the perspectives of OSS users, developers, contributors and the industry. The model was questionnaire based and incorporates five maturity levels and eleven usability factors. The study was a first of its kind and contributed a methodology to evaluate the usability maturity of OSS.

Akbari and Peikar (2014) explored the trend of OSS development in the field of Geospatial Information Systems (GIS) and the maturity of Web Geospatial Information Systems (WebGIS). This paper applied Open Source Maturity Model (OSMM) to the most significant WebGIS software in GIS field to measure their maturity. The study found that OSMM was a mechanism for evaluating open source products to help professionals choosing the most suitable one. The study selected MapGuide OS, UMN MapServer and PostGIS for evaluation. Under longevity assessment the study examined life span, version number and the total number of downloads. Under product team assessment it examined size of the project team and the number of commits from the top ten contributors for the last year. Under support option assessment, community support and paid support were examined. The study observed developer creator documentation, web postings and commercially published documents under documentation assessment and operating system, web server, standards, database integration under product integration assessment. The training option assessment sought the availability of web based mini tutorials, developer created tutorials and commercial tutorials. The final maturity scores were calculated on the basis of points obtained for the six elements of maturity- software, support, documentation, training, integration.
and professional services. UMN Mapserver got the highest score (83.5) followed by PostGIS (78.5%) and by MapGuideOS (56%). The results indicated that UMN MapServer is fully mature open source software compatible with other similar commercial products.

2.6 Conclusion

The investigator has reviewed 48 studies under four categories. The studies that describe the adoption of DSpace for DLs were attempted to understand the factors influencing the choice of DSpace. Since this is a case study of DSpace, more previous studies would strengthen the understanding of the issue. The factors that influenced the selection of DSpace include adherence to standards, use of Lucene search engine, handle system, the community structure of DSpace, matching to exiting support and expertise, unicode support, tremendous potential for growth, having forums, community of users, cost, facility for customization, more workshops on the area, leadership and largest community. The studies have touched some aspects of maturity.

The studies that attempted to compare the features of different OSS for digital libraries provide us insights on the way libraries selected particular software from among several OSS. The features compared include operating system, web server, language, database, resource identifier, Dublin Core, METS, OAI-PMH, submission and supported file formats, security and administration, preservation, metadata and access, migration strategy, version, developer prestige, system requirement, license, language, technical and training support, user interface functions, thumbnail preview searching capabilities, browsing options, syndication, user authentication, statistical reporting, software platforms, databases, associated software, machine to machine
interoperability. Though maturity of OSS was not checked, studies compared some aspects that come under the subject of maturity of software.

The studies that highlighted the organisational factors of OSS adoption include government support, cost advantage, pre-existing skills in OSS use, positive attitude towards OSS, ability to add new features, prompt fixing of software bugs, availability of source code, and product maturity.

Studies that focus on measuring the maturity of OSS offer insights on Capability Maturity Model, organization's process maturity, development process of Apache and Mozilla projects, source code change history and problem reports, developer participation, core team size, code ownership, productivity, defect density, and problem resolution intervals for these OSS projects, year of software release, number of installations, release of different versions of the software, and the smooth progression of the software over the years. One study attempted to measure the maturity of WebGIS software.

The review of literature shows that libraries and organisations adopt various criteria for the selection of OSS. Though several factors considered by libraries come under maturity, there is lack of studies on the exploration of measuring maturity of OSS for libraries. This area is left unattended by researchers and the present study tries to fill this research gap.
References


2.6 Conclusion

Technology, 35(1) p. 30-40.


