Application of Open Source Software in University Libraries in Tanzania: The Case of Sokoine National Agriculture Library (SNAL) and the Open University of Tanzania (OUT) Library

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Abstract— **this paper assesses the opportunities and challenges of the application of Open Source Software in information management in the university libraries of Sokoine National Agriculture Library (SNAL) and the Open University of Tanzania (OUT) Library in Tanzania. The findings of this paper revealed that Open Source Software (OSS) has the potential to enhance efficiency in library and information management. However, there are shortcomings also which the study revealed like most of the library users lack skills with which to access resources from the Open Public Access Catalogue (OPAC), and there is lack of software expertise for repair, maintenance and upkeep. Based on the findings, it is recommended that the automated library systems, which evidently lack the very important aspect of technical know-how regarding OSS, must prioritise training for librarians not only in how to use the software but also in how to write the source code and possibly create their own software. The library users also need appropriate training to enable them to make optimum use of these resources.**

Keywords— **Open source software, Library information management, Library automation, Information and communication technology, Proprietary software**

I. INTRODUCTION

Open Source Software first evolved during the 1970s. Richard Stallman, an American software developer, believes that sharing source-code and ideas is fundamental to freedom of speech (POST, 2005). According to Wheeler (2004), OSS or free software gives users the freedom to run the program for any purpose, to study and modify the program, and to redistribute copies of either the original or modified program without having to pay royalties to the original developers. Open Source Software movement has got a major share in the market of software from its beginning. Libraries are the early institutions which adopted computer packages for management of information and automation of library procedures. OSS movement is very popular in libraries around the world. Libraries have been blessed with Free and Open Source Software including Integrated Library Software, Digital Library Management, Content Management, Inter-Library Loan Management, Document Delivery Services, and other web-based services around the world including developing as well as developed countries (Rehman, Mahmood and Bhatti, 2012).

Many of today's internet functions, such as e-mail, and the translation of computer names to Internet Protocol addresses are almost completely based on OSS (SAPM, 2003). According to POST (2005), over 67% of web servers run using OSS. In fact, the majority of websites and e-mail systems operate using OSS. Consequently governments and academic institutions have developed a keen interest in OSS due to their reliance on sophisticated software.

Today, initiatives by different international organisations, such as the United Nations Educational, Scientific and Cultural Organisation (UNESCO), are aimed at developing and encouraging the use of free OSS in automating information systems (UNESCO, 2008). The East African Centre for Open Source Software (EACOSS) has, since 2004, been raising awareness and promoting the use of OSS through training and advocacy. The centre, with funding from the International Institute for Communication and Development (IICD), offers two types of training, one for future workers in the Information and Communication Technology (ICT) business, and the other for anybody interested in working with a computer. In the next phase the centre will teach people in rural areas how to work with computers using OSS (EACOSS, 2008).

Chawner (2003) argues that the low start-up cost associated with using free OSS is frequently mentioned as its main attraction. Free OSS is also seen as a solution to the problems many libraries experience with commercial integrated library system software that is not only slow to evolve but is also expensive to upgrade. The expected benefits of the OSS approach would also include more flexibility and fulfilment of libraries' requirements. Today, many libraries use Linux for back-room operations, such as web servers, database servers or terminal services. In comparison to other sectors, the

emergence of Free and Open Source Software in the field of library and collection management are more feasible option as the collaboration and organization are the key issues in library services. Library professionals have always focused on collaboration, resource sharing, consortia and on open access, standards, archive initiatives; and so on in order to help each other in collection development management and implementation of tools and technologies (Reddy and Kumar, 2013).

Major open source software developed for library collection management is; Koha (a web-based Integrated Library Management System (ILMS), ABCD which represents the Automation of Libraries and Centres of Documentation, NewGenlib a New Generation Library software, D-Space which is an open source software package that provides the tools for management of digital assets, and is commonly used as the basis for an institutional repository, The Greenstone Digital Library Software (GSDL) - a top of the line and internationally renowned Open Source Software system for developing digital libraries, Evergreen - an open source Integrated Library System (ILS), PhpMyLibrary - a PHP/My SQL web-based library automation application meant for smaller libraries and Fedora - a software which gives organizations a flexible service oriented architecture for managing and delivering their digital content (NARA, 2015).

A. Statement of the Problem

Despite the widespread adoption of OSS, there are continuing debates over the competition between OSS and proprietary software. As developing countries find ICT too expensive to afford, OSS helps them cope with technology and automate their systems (Lungo, & Kaasbøll 2007). A number of OSS is offered today for libraries to deliver new value added services to end-users while handling large packages of library data. Many of the librarians are either uninformed of these software or due to inadequate technical expertise they do not anticipate to implement these software in their libraries (Barve and Dahibhate, 2012).

According to SAPM (2003), OSS can be downloaded freely with no restrictions placed on accessing the actual code of the software. The code of the software can be modified, copied or changed from its original construction to meet the demand of users. Hebert (2006), on the other hand, argues that proprietary software costs money and access to the actual code of the software is restricted, making it difficult for it to be modified, copied or changed from its original construction. There has been an outcry by various libraries in developing countries concerning the challenges associated with proprietary software, which is costly and vendor-based. But surprisingly enough, the academic libraries are not taking initiatives to shift to the OSS.

SUA and OUT libraries have been using open source automated library software to manage their information resources. However, despite the long history of using this software, few research studies have been carried out to determine its effectiveness in facilitating the management of information resources in these libraries. Therefore, this study intended to assess the prospects and challenges of using open source library automation software for managing information resources in SUA and OUT libraries.

B. Aim and Objectives of the Study

The main aim of this study was to assess the prospects and challenges of utilizing open source library automation software for managing the information resources of the Sokoine National Agriculture Library (SNAL) and the Open University of Tanzania (OUT) Library. The paper therefore sets out to:

- Examine the ways in which OUT and SUA libraries use open source library automation software to manage their information resources.
- Gather the views of stakeholders on the contribution of open source library automation software to the management of information resources in their libraries.
- Identify the challenges experienced in the use of OSS for managing information resources.
- Recommend available options with which to overcome these challenges.

C. Open Source Software

Open Source Software has a source code that is published openly, which is usually available at no charge (Peeling and Satchell, 2001). The software development model gives organizations a new option for acquiring and implementing systems, as well as new opportunities for participating in open source projects, particularly in libraries and information centres, which have specialized requirements and make extensive use of technology to provide services to their users. OSS, which is available free of charge, provides freedom to run the program for any purpose, study how the program works and adapt it to local needs, to redistribute copies so that others can benefit from the software, and freedom to improve the program and release the improved version to the public so that the community can benefit from it (Chawner, 2003).

D. Proprietary Software

Proprietary software is owned by an individual or a company (usually the one that developed it). For example, virtually all Microsoft software, including the Windows family of operating systems and Microsoft Office is proprietary. There are almost always major restrictions as to its use and its *source code* is always kept a secret (Linux Information Project - LIP, 2004). Source code is the form in which a computer program is originally written using a programming language prior to being converted into *machine code* read by a computer's Central Processing Unit (CPU). It is necessary to have the source code to be able to modify or improve a program.

E. Why Free and Open Source Software

Wheeler (2004) suggests that many people believe that free OSS is as good as or better than all proprietary software on moral, ethical or social grounds. With such software, users have control and flexibility, an advantage that allows them to modify and maintain such software. The opposite of OSS is *closed* or proprietary software, the source code of which can be viewed but cannot be modified and redistributed. Open source software may be available under one of the various open source licenses that may ease agencies ability to acquire these tools. These licenses generally make the source code available with provision for local developments, additions, or modifications to the code (NARA, 2015). For instance, a study conducted on OSS in Uganda revealed that majority of the academic libraries were able to modify the source codes, share the software and considered OSS-ILS as the best system in offering improved functionality over available proprietary/commercial ILS (Adoma and Ponelis, 2015).

One of the strongest arguments for using free OSS is the opportunity to arrive at a higher degree of independence regarding price and licensing conditions. Free and OSS enjoys a significant market share in many areas. For example, A*pache* is used in more than 65% of all internet web servers, often with *Linux* as the operating system. In many cases, free and OSS has better performance when directly compared with its proprietary counterpart. Scalability and flexibility within the model for the development of free OSS enables it to be developed for a larger number of platforms and environments (SAPM, 2003). Recent studies suggest that some free OSS have a higher performance than proprietary software. For example, a Linux-based system is faster than a Windows 2000-based system. Linux file servers were found to outperform Windows 2000 file servers; similarly Linux mail servers are faster than Windows 2000 mail servers (Wheeler, 2004).

SAPM (2003) and Barve and Dahibhate (2012) justified the use of free OSS by citing the following factors: higher security level, higher stability, no or low licensing fees, possibility to modify source code, ample access to Information Technology (IT) specialists, and independence from major software vendors. One considerable advantage of free OSS is, of course, that one can customise and modify the product for a certain target group of users (make the software simple and functional). For example, a specific development environment can be created, or an application for electronic services aimed at the general public can be developed, or a desktop computer with adapted functionality can be set up. Chawner (2003) argues that free OSS has reduced vulnerability to viruses in addition to its being technological neutral, meaning that applications can run on more than one platform, such as Windows, Linux, Unix and MacOS X.

F. Open Source Library Automation Software for Management of Information Resources

The globally networked computer environment allows us to share data as well as software (Morgan, 2004). Today OSS has a number of applications, including the virtual universities (the best-known form of online education), online courses (offered in a variety of forms by various sources), electronic government which requires software to function, automated library processes, such as Online Public Access Catalogue (OPAC) and circulation records. Library website design, frequently asked questions, chats and classification of resources are being carried out through the use of OSS (Lakhan and Jhunjhunwala, 2008).

Most software that we all use every day is known as proprietary, which in a nutshell means that it costs money and that the actual code of the software is restricted, in that the code of the software cannot be modified, copied, or changed from its original construction. The code is unreadable and pretty much is what it is. Open source software, on the other hand, is quite the opposite. The open source mentality revolves around sharing and collaboration, and these two important elements describe open source software perfectly. First and foremost, open source software is free for anyone to have; more importantly, not only is the software free, but it is also free for anyone to copy, hack and modify (Uzomba, Oyebola, and Izuchukwu, 2015).

There are many different kinds of open source library software solutions out there today that could be embraced by the library. Some of the open source software in today's market includes: Emilda, EspaBiblio, Greenstone, Avant, ABCD, Weblis, DSpace, Evergreen, Gnuteca, InfoCID, Jayuya, Koha, NewGenLib. oBiblio, OPALS, OpenAmapthèque, OpenBiblio, PhpMyLibrary, PMB, Senayan etc. Of all the open source software available in the market, Koha and Evergreen have gained major extensions in functionality not present in their counterparts (NARA, 2015). Also, Muller (2011) stated that "Koha and Evergreen are considered sustainable communities because they both have obtained a critical mass of interested developers, contributors and users". Both communities have managed to put in place a very solid collaborative infrastructure made of development tools to help manage goals, function, architecture and design.

An example of the interfaces for some of the software mentioned above is indicated below:
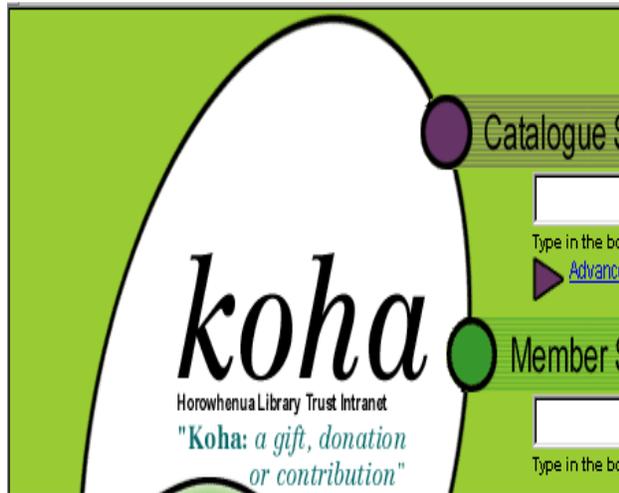
Fig. 1. Koha Library Automation Software Interface

Important areas where free OSS are highly applicable include office applications, infrastructural applications (name servers, catalogue servers and mail servers), operating systems servers, workplace computers (Personal Computers), web servers and browsers, databases, business-specific systems and security software (SAPM, 2003).

There are many open source library applications available today. Each satisfies a particular need and each application can be integrated into a collective, synergistic whole, forming an Integrated Library System (ILS) which manages books well (Morgan, 2004). The expensive nature of most computer software and the fact that the global economy is unevenly distributed mean that developing countries suffer when it comes to accessing proprietary software. To address this problem, software engineering companies have developed OSS that can be accessed freely by everyone. Their objective is to foster technology and empower developing countries to cope with the changes at little or no cost (NARA, 2015).

G. Advantages of Open Source Software

OSS developers have the opportunity to build on each other's ideas. The availability of OSS source code allows the worldwide community of open-source developers to participate in peer-distribution, peer-review, and peer-production (Barve and Dahibhate, 2012). A program can continually be improved and redistributed for the benefit of the entire community. As the open source model of openness and collaboration expands, the quality of OSS products also improves (University of Ottawa, 2007).

The issue of overall quality aside, OSS has four inherent advantages over proprietary software. First, OSS is considerably less expensive than proprietary alternatives. For example, Linux can be installed for free while the license for Microsoft's Windows operating system can cost thousands of dollars a month. Second, access to the underlying source code means users can detect and fix programming bugs; also, OSS

can be tailored to a user's specific needs, and upgrades happen at a pace chosen by the user, not the vendor. Third, the transparency of OSS improves security because security flaws can be detected and corrected. Fourth, OSS allows users to be flexible in their choice of vendors. If users are not happy with the service they receive from Red Hat, they can choose another Linux vendor. This prevents users from becoming overly dependent on their technology or support contracts (Peter, 2008).

H. Disadvantages of Open Source Software

Despite the number of advantages of OSS, there are some downsides which include: the lack of professional support, the lack of release co-ordination and erratic updates. However, with such a large development and user-base, many discussion forums and help sites are available for users (Peter, 2008; Uzomba, Oyebola, and Izuchukwu, 2015).

I. Advantages and Disadvantages of Proprietary Software

The general advantages of proprietary software are that it is reliable, it has professional support and available training, it is packaged, comprehensive, and in modular formats, and is regularly and easily updated. The downside is that it is expensive and has closed standards that hinder further development and it may become unmaintainable once its originators leave the company (Peeling and Satchell, 2001).

As the cost of proprietary library management software is very high, financially weak libraries cannot invest large amounts of money in library automation. Extra payment is required for software updates and maintenance. However, the library community is largely made up of not-for-profit, publicly funded agencies. Not surprisingly, the principles and practices of OSS are very similar to the principles and practices of modern librarianship. Both value free and equal access to data, information and knowledge. The open source Integrated Library System (ILS) consists of all the essential functional modules (cataloguing, circulation, OPAC) and also provides some features that are available with costly software applications (Kumar, 2008).

J. OSS with Sokoine National Agriculture Library (SNAL) and the Open University of Tanzania (OUT) Library

The Sokoine National Agricultural Library (SNAL) was established by Act of Parliament No. 21 of 1991, which elevated the then university faculty to a National Agricultural Library. SNAL serves both as a university library for Sokoine University of Agriculture (SUA) and as a National Agricultural Library for Tanzania. SNAL at SUA uses the *Weblis* (Web-based Library Integrated System) as its main open source library automation software for information management. The software has been in use since 2005. Similarly, the Open University of Tanzania (OUT) library has been using *Weblis* since 2006. OUT is an open and distance learning institution offering Certificate, Diploma, Degree and Postgraduate courses. It was established by Act of Parliament No. 17 of 1992, which became operational in March 1993.

The University is centrally located in Dar es Salaam. It offers education through various means of communication such as broadcasting, telecasting, ICT, correspondence, enhanced face- to-face contact, seminars and contact programmes. The OUT also conducts its operations through regional centres and study centres. Currently there are 25 regional centres and 69 study centres (OUT, 2016).

II. METHODOLOGY

This study used both qualitative and quantitative descriptive survey design to achieve a high degree of reliability and validity of the data. Moreover, the survey method allowed the use of more than one instrument in data collection such as open-ended and closed questions in questionnaires and observation, which essentially supplemented each other to counteract the weakness or bias of one method, thereby generating adequate and balanced data (Aina, 2002).This study was conducted in SNAL and OUT. The study collected primary data through a self-administered questionnaire given to the librarians, and secondary data from published and unpublished books, newspapers, reports, journal articles, and internet resources. Nondumiso (2006) suggests that questionnaire and observation are the most commonly used powerful tools in qualitative research. Open-ended interviews were conducted with the library directors and heads of departments. A total of 12 respondents, who constituted 4 system administrators, 6 data entry librarians and 2 library directors, were used for this study These respondents had different characteristics as regards their sex, gender, academic qualification and marital status.

The study was guided by the following research questions:

- To what extent do the librarians use open library automation source software in the information management process?
- What is the stakeholders' contribution to the deployment of open access library automation software in facilitating the management of information resources in libraries?
- What challenges affect the use of open source library automation software?
- What are the viable options for overcoming these challenges?

III. FINDINGS

This section presents and discusses the research findings, conclusions and recommendations of the study, based on the set research questions, which were, to what extent do the librarians use open library automation source software in the information management process? What is the stakeholders' contribution to the deployment of open access library automation software in facilitating the management of information resources in libraries? What challenges affect the use of open source library automation software? What are the viable options for overcoming these challenges?

A. Ways by which OUT and SUA Libraries Use Open Source Library Automation Software to Manage Information Resources

The results indicated that both libraries use the open source library automation software for the provision of online services through OPAC, for acquiring and organising library resources, for maintaining circulation records, cataloguing, addressing frequently asked questions, holding chats, classifying resources, and for maintaining library user databases.

B. Views of Stakeholders on the Contribution of Open Access Library Automation Software to Facilitating the Management of Information Resources in their Libraries

The findings of this research revealed that the librarians are comfortable with the application of the OSS for library information management. However, training is required for library users in the use of OPAC for effective and efficient retrieval of resources to take place. Technical-know how is greatly needed by the system administrators so that they are able to do proper repairs and maintenance of the library automation software.

C. Challenges Experienced in the Use of Open Source Software in Information Resources Management

Lack of expertise for library automation software repair and maintenance and poor access to library resources through OPAC contributes greatly to the low level of satisfaction with the software among librarians rendering services to clients. Other challenges include the frequent power cuts, network overload, which causes difficulties in retrieving electronic information resources, and poor internet connectivity that leads to failure to update the library automation software.

D. Options for Overcoming the Challenges

In order to improve library services through open source library automation, libraries should strive to provide training and continuing education programmes, particularly for system administrators and software technicians. In addition, instruction and orientation should be provided to library users. The knowledge and skills of library staff must be enhanced on a continual basis; this should include staff training in strategic development plans. After all, technology is useful only in the hands of knowledgeable staff.

IV. CONCLUSION

The purpose of this study was to assess the prospects and challenges of utilising open source library automation software in information resources management of libraries at SUA and OUT in Tanzania. Generally, the research findings show that the application of Open Source Software is of great importance in library automation. The fundamental requirement for automation is the infrastructure, which consists mainly of computers as the essential component for automation. Computers are electronic devices on which

automation depends. It is that super product of electronics that is capable of performing the functions desired by the user with maximum accuracy and speed. Although the findings revealed that libraries have enough basic infrastructures suitable for such applications, they lack an adequate number of professionals to operate the software when technical faults arise. Also it was observed that training is also important for users, most of whom are not capable of retrieving information resources using OPAC.

V. RECOMMENDATIONS

Although many libraries in Africa lag behind in terms of technological changes and development, they have great potential. Whilst ICTs have expanded the possibilities of accessing information, they also present new challenges for users and librarians alike. Therefore, librarians and other stakeholders in universities must re-orient their profession to transform traditional library services into modern automated library information services in tune with global challenges. Choosing appropriate ICT hardware and software, continually pressing for more funds from parent institutions or donors for alternative sources of funds, providing staff and user training and raising awareness are the key strategies that can lead to effective utilisation of OSS for managing library information.

A. Recommendation for Further Research

More studies to analyse the perceptions of open source library automation software and the impact of library information management on improving library services are needed. Further, more research to evaluate the effectiveness of library staff training on software management, and library user education and training would help raise awareness concerning information access and management.

REFERENCES

[1]   A. Rehman., K. Mahmood and R. Bhatti, "Free and Open Source Software movement in LIS profession in Pakistan", *Library Philosophy and Practice* (e-journal), Paper 852, 2012.

[2]   B. Chawner (2003), School of Information Management Victoria University of Wellington webpage on Free/Open Source Software: new opportunities, new challenges. [Online]. Available: www.vala.org.au/vala2004/2004pdfs/33Chawn.PDF.

[3]   C. S. S. Nondumiso, (2006), University of Western Cape webpage on improving library services through the application of business performance concepts, [Online]. Available: http://etd.UWC.ac.za.

[4]   D. A. Wheeler (2004), homepage on why Open Source Software/Free Software (OSS/FS), [Online]. Available: www.dwheeler.com/oss_fs_why.pdf.

[5]   EACOSS (2008), webpage on Open Source Software: The free alternative for Africa, [Online]. Available: www.i-network.or.ug/index2.php?option=com_domain.

[6]   E.C. Uzomba, O. Oyebola and A. C. Izuchukwu, "The use and application of open source integrated library system in academic libraries in Nigeria: Koha Example. *Library Philosophy and Practice (e-journal)*. Paper 1250, 2015.

[7]   E. Hebert (2006), webpage on how Open Source Software can improve http://www.degreetutor.com/library/managing-expenses/open-source-library.

[8]   E. Kumar (2008), webpage on open source integrated library management system, [Online]. Available: www.asbindia.in/vimal/docs/OS-ILS.pdf.

[9]   E. L. Morgan, (2004), American Library Association, San Francisco, webpage on Open Source Software in libraries, [Online]. Available: http://informations.com/musings/ossnlibraries/.

[10] J. H. Lungo and J. Kaasbøll (2007), webpage on experiences of Open Source Software in institutions, cases from Tanzania and Norway, Department of Computer Science: University of Dar es Salaam, [Online]. Available: www.ifipwg94.org.br/fullpapers/R0062-1.pdf.

[11] L. O. Aina, *Research in Information Sciences: An African Perspective*, Ibadan, Stirling-Horden Publishers (Nig) Ltd., 2002.

[12] National Archives and Records Administration (NARA), "Open source tools for records management: NARA/OMB M-12-18, managing government records directive reporting on requirement A3.2". National Archives, Office of the Chief Records Officer Report: USA, 2015.

[13] N. Peeling, and J. Satchell, (2001), webpage on analysis of the impacts of Open Source Software, [Online]. Available: www.govtalk.gov.uk/documents/qinetiQ-OSS_rep.pdf

[14] Open University of Tanzania (OUT) (2016), homepage on OUT, [Online]. Available: http://www.out.ac.tz/pages/about.html.

[15] P. Adoma and S. Ponelis, *Open Source Integrated Library Systems in Academic Libraries in Uganda: Initial Results*. Uganda: Muni University, Arua, 2015.

[16] Parliamentary Office of Science and Technology (POST) (2005), Parliament homepage on Open Source Software, [Online]. Available: www.parliament.uk/documents/upload/POSTpn242.pdf.

[17] S. Barve and N. B. Dahibhate, "Open Source Software for library services" *Journal of Library & Information Technology*, Vol. 32, No. 5, pp. 401-408, 2012.

[18] S. E. Lakhan and K. Jhunjhunwala, "Open Source Software in education" *Educause Quarterly*, No. 2, pp 32-40, 2008.

[19] S. Peter, (2008), webpage on *Open Source Software vs proprietary software*. [Online]. Available: http://software.ivertech.com/_ivertechArticle13894.

[20] Swedish Agency for Public Management (SAPM) (2003), webpage on free and Open Source Software, [Online]. Available: http://www.isd.mel.nist.gov/projects/rtlinux/swedish-open-source.pdf.

[21] The Linux Information Project (LIP) (2004), webpage on proprietary software definition, [Online]. Available: http://www.linfo.org/proprietary.html.

[22] T. Muller, "How to choose a free and open source integrated library system", *International digital library perspectives*, Vol. 27, No. 1, pp. 57-78, 2011.

[23] T.R. Reddy and K. Kumar, "Open Source Software's and their impact on library and information centre: an overview", *International Journal of Library and Information Science*, Vol. 5, No. 4, pp. 90-96, 2013.

[24] United Nations Educational, Scientific and Cultural Organization (UNESCO) (2008), webpage on UNESCO's position on proprietary and free and Open Source Software: as endorsed by the intergovernmental council for the information for all programme, world summit on the information society Geneva 2003 – Tunis 2005, [Online]. Available: http://www.google.com/search.

[25] University of Ottawa (2007), webpage on open source: Canadian internet policy and public interest clinic, [Online]. Available: http://www.cippic.ca/open-source.