

Open Source Solutions in Education and Library – A Case Study of BPCL, NIT Rourkela

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Abstract:

Higher Educational Institutions and libraries today are taking more interest in putting their resources and services online for better output and trying to bring the academic community functional around the globe onto a common platform so called cloud. However, there are many challenges even then online education has been showing the great promise for future generations. Open Source Software especially have created space to everyone for optimal online learning and libraries are playing a vital role in knowledge sharing to support the academic and research activities with the help of open source software like learning management system, library management, digitization, web application development, etc. These amazing software have made the education in reach of even those who find difficult to continue education. This paper discusses the role of open source software in education and libraries and highlights the case study of Biju Patnaik Central Library, NIT Rourkela.

Keywords: Education, Open Source Software, Higher Educational Institutes

Introduction:

The concept and practice of open source involves making the program's source code openly available to all in public with freedom for developer and programmer to have the access to the code of core program and functions, which enable them to modify, add any new features and redistribute again for further use by community. Open source software are entirely different from proprietary software. The Open Source Initiative (OSI) has set a standard—the "open source definition"—by which software qualifies for an open source license.¹ Open source software must meet the following criteria:

- **Unrestricted distribution** – Any user is free to use and distribute to others or sell the software without paying any amount as royalty.
- **Distribution of Source Code** - The source code of the open source program must include the provision of modification in the program.
- **Modifications** – The license of open source allows modification with changing the terms for distribution of improvised version of the program.
- **Integrity of Source Code** – If the license of open source permits the distribution of patch file along with original source code then a user of the open source product cannot modify the code and distribute it. The new code has to be given a new name with new version.
- **No personal discrimination** – No person or group shall be discriminated while distributing the open source product.

- **No restriction on application** – Open source software or program can be used for any purpose and in any field of universe of knowledge without having any restriction on application.
- **License distribution** – The original program includes all privileges and same thing applies who receive it so recipient does not require applying for a fresh or separate license.
- **License must not be product-specific** – The license includes rights and is not limited to specific product rather it extends to products extracted from a larger software aggregate.
- **No restriction on other software** – Distribution of open source products does not include any restrictions event if it is bundled with products developed on other software platforms.
- **Technology neutrality** – Open source software does not involve the licenses issued based on the specific technology involved.

Open Source Software – History:

The three operating systems namely UNIX, GNU and Linux has formed the foundation of the open source movement. Open source has been closely associated with academic and research activities since its inception.

Bell Labs and MIT in joined venture launched the UNIX in 19760s to create a new operating system named **Multics**. Later few programmers developed a new operating system called UNIX based on the previous work to create an opportunity of flexibility for the users. The higher educational and academic universities / institutions managed to purchase the source code of UNIX at a lower price compared to the price paid by corporates and other government bodies that time.

Ken Thompson along with two other students Bill Joy and Chuck Haley joined the University of California, Berkeley in 1975 and later in 1977; they began the distribution of an open source version of UNIX called BSD followed by new release of revised edition called 2BSD in later years.

At the same duration, the MIT Artificial Intelligence Lab launched another similar software in which the code was bit improvised but the venture lost its momentum in the face of advances in computer science.

Further, the GNU Project was founded by Richard Stallman in 1984 that allows users to edit the code and distribute the edited version under General Public License. However, the operating system developed under GNU Project did not have a kernel until Linus Torvalds developed the kernel for Linux. Further, in 1992, the kernel was integrated within GNU Operating system.

Later, with the help of programmers, Linux had more changes in the system that made Linux more sophisticated. There had been many commercial and enhanced version of Linux operating system such as Red Hat, Novell, Mandriva etc. but the Linux is still available freely under open source category.

Learning and Digitization with OSS:

Digitization being the new phenomenon has completely transformed the education to new shape. Educational institutions has joined hands together for more changes in education with the help of digitization through

- a. Online Courses

- b. Educational Portals
- c. Courseware
- d. Virtual Universities

Online Courses are being offered in many forms by educational and other institutions to make the education digitized though many of these courses are not accredited. Some of the higher educational institutions offer the courses by creating the digital collection of study material received from different academic sources. These resources may be archived with the help of libraries.

There are many education portals being many in numbers, directly connected with higher educational institutions and have become the internal part of education though content is not well connected with course curriculum.

Courseware is being used in academic of higher educational system outsourced that provide study material for both online and offline purpose. Many educational institutions use complex courses for their students' education program.

A virtual university creates and offers opportunity for higher education program via electronic media using Internet. The goal of any virtual university to enable distance learning and to reach those students and learners who are not able to reach physically to the university and living far from the main university. This gives them freedom to continue education having the physical barrier and ensure quality education too.

The Internet being the network of network provide many opportunities to these educational institutions to combine educational and economic goals with globally access platform. Undoubtedly, these require technical support to create and sustain the platform on which digital education depends. Many universities depend upon the vendors for technical support for delivering online learning components to ensure virtual learning environment. However, these are helpful but put extra burden on their already overburdened finances. Further, due to intense competitions among vendors, few major vendors dominate the higher educational software and it creates the risk of monopoly in future and leaves an option for these educational institutions to develop in-house software to fulfill their IT requirements. However, unfortunately these projects turned out to be very expensive with many flaws.

Another possibility for these institutions are to join the collaborative projects of open source software development that enables higher educational institutions to manage the financial and technical resources with ease. A large number of user community support and provide variety of testing environments for the open source new software.

These open source software are more reliable and may benefit the educational institutions from continuous development. Investing on open source software development may turn out as cost effective way of meeting e-learning software challenges.

Impact of Open Source Software on Learning:

Open source software has emerged as possible solution to manage the resources and requirements. There are many higher education universities / institutions who have implemented open source system considering many merits which are as follows:

- a. **License Fee** – Most of the educational institutions pay the huge amount for the software maintenance to the software companies and for further latest updated. But the open source software are complete free with source code open.
- b. **Flexibility to Customize** – Since the code of these open source software are available and open to all, customization is easily possible and new features to these software can be imported from other open source software.
- c. **Service Community** – The network of open source community is very large and it helps to get the continuous support through forum, online, phone, emails etc. However, the risk of discontinuation service can't be eliminated completely but volunteer support is always possible from community.
- d. **Continuous Improvement** – The community ensures the regular development and update in the software so that software keeps improving. Many volunteers, organization contribute freely.
- e. **Benefit in Tax** – Many governments of different countries have removed tax to boost open source projects.

When there are advantages for using open source project, at the same time, these project have some disadvantages as well.

- a. The major drawback of open source software is implementation of the software as using the new software for beginners may become challenging and source code may be irrelevant if they do not find the software useful for the purpose.
- b. Many times, it may also happen that software may not be compatible with existing software and hardware components.
- c. Guarantee of completion of project and delivering the desired result is always doubtful in case open source projects. Sometimes, the project may fail due to lack of resources or funding because the success of any project depends on the interest, time and collaborative workforce.
- d. The most alarming factor to consider open source project is to lose the technical support. The users are less interested in sources code and more interested in usability. If the technical support in future disappears, these institutions may have trouble in improving the open source project in the absence of fund or some time other resources.

Open Source Tools in Education and Library:

a. Learning Management System:

Rapid proliferation of open source learning management system (LMS) has left the great impact on education. These learning management system tools are used to create and manage learning content online. Some of the known and widely used learning management system are mentioned below.

LMS Tool	Description
Moodle	Moodle is open source and very powerful learning management system. In this learning management system, it allows the instructor to customize online courses on a flexible platform. Moodle can be downloaded and installed in any computer. Created course can be enhanced by many plug-ins available for easy learning. Most robust RDBMS MySQL and PostgreSQL can be used to contain the data with higher security. The best part of this software is that it supports cross platforms such as Windows, Linux, Unix, Mac OS X or any other system which supports php. The official website of Moodle is http://www.moodle.org
Bodington	University of Leeds developed java based virtual learning environment namely 'Bodington' that aims to provide a durable, flexible system for large & complex institutions with many departments available. The best part is that it allows uploading the content quickly and assisting to manage the learning content with ease with the facility of multilayered administrator model. Many universities and colleges have implemented this tool worldwide. It supports Shibboleth, Linux, Microsoft, Mac OS X, or UNIX. The official website of bodington can be accessed at www.bodington.org
Claroline	Claroline software has been built using free technologies such as PHP and MySQL for meeting the pedagogical needs of teachers and learners for training and online courses for teaching in structured way. The more emphasis has been given on enhancing tool to give both (student and instructor) a refined learning environment. The Claroline Consortium established in 2007, is mainly responsible for enhancing and promoting the software and is licensed under the GNU GPL. The main website of the tool is available at www.claroline.net
Dokeos	Dokeos is another web based application designed especially to facilitate online learning and course management with facility of flexible, user-friendly environment. This software is developed using PHP and MySQL with the assistance of individual programmer, organizations and universities. It includes all the ideas of 'The Cathedral and the Bazar.' ¹⁴ Dokeos is licensed under the GNU GPL and has the official website accessible at www.dokeos.com
.LRN	MIT developed a very powerful tool called 'dot learn' written as .LRN. This software is based on AOLserver and OpenACS and supports online learning and interaction with the facility of easy flexible framework and customization. It is supported by .LRN consortium and is licensed under the GNU GPL. The main website is accessible at www.dotlrn.com
ATutor	University of Toronto developed a powerful learning content management system called ATutor with different featured modules to support the e-learning and interaction easy and comfortable for teaching and learning community. This software is licensed under the GNU GPL and accessible at www.atutor.ca

b. Integrated Library Management System:

Integrated library management system has brought the major changes in services in the library of higher education universities and institutions. These tools have been of a great help to market and enhance the library services, resources and better research output. Some of the known integrated open source library management systems are as follows:

ILMS Tools	Description
Koha	Koha is very powerful open source integrated library management system and has the different functional modules such as acquisition, cataloguing, circulation, serial control, online public access catalogue and many more features that are advanced. It supports international standards and protocols such as MARC 21, RFID, z39.50, web 2.0 technologies etc. The best part of this software is that it allows customization at every level and runs with the help of open source technologies such as Apache webserver, MySQL, PHP and Perl Server side script language.
NewGenLib	Verus Solutions Pvt. Ltd. developed a very powerful integrated library management system with the assistance of knowledge domain provided by Kesavan Institute of Information and Knowledge Management in Hyderabad, India. The first version of the software was released in 2005 as commercial package but it was declared open source under GNU GPL in January 2008. Many libraries across the world are using NewGenLib for automating their libraries and managing their routine library work.
Evergreen	Georgia Public Library developed an integrated library management system namely Evergreen. This software is being used in more than 1800 libraries and used to organize number of catalog of statewide consortia. As of 2014, several more companies and groups also provide support and related services for Evergreen.
SLiMS	SLiMS stands for Senayan Library Management System. It has good features for the libraries and librarians to carry out the job easily with accuracy. Some of the features which make the SLiMS really good are OPAC with thumbnail document image support, management of digital content files such as PDF, DOC, RTF, XLS, PPT etc., Documents record details available in MODS (Metadata Object Description Schema), RSS, OAI-PHM in Dublin core format for metadata harvesting purposes.

c. Content Management System:

Content management system is best tool for communication and dissemination the information related to your work, organization etc. The development of open source content management system has created an opportunity, brought the major changes in web development, and made the work possible for the professionals especially for those who do not have any idea about programming language. These CMS are very much helpful for developing web application with ease. Some of the popular and robust content management systems are mentioned below.

CMS Tools	Description
Joomla	Joomla is open source and free content management system mainly used for publishing the web content and web application. It supports model-view-controller web application framework to work independently. This software is written in PHP, uses object oriented programming techniques, stores data in robust database management system called MySQL and includes features such as page caching, blogs, RSS, language internalization etc.
WordPress	WordPress is one of the most popular free and open source content management system mainly used for designing blog for sharing the

	information with end users. WordPress is developed in PHP and MySQL and includes many strong features like blogging, mailing list and forum, media galleries, and online stores. WordPress is highly recommended for blogging and used by more than 60 millions websites. The software is released under the GPLv2 (or later) license.
Drupal	Drupal is free and open source content management system written in PHP and MySQL and is very powerful application for designing a completed web application. This software also includes all features a normal CMS has and is released, distributed under the common GNU General Public License. Basically Drupal is used by the developed for developing the dynamic websites for corporate or business purpose.

D. Digital Library Management System:

Digital Library software is a best tool to organize the digital objects in organized way with some standards to ensure preservation and retrieval of the content with ease. There are many good open source digital library software being used worldwide to manage the digital objects available in different formats such as jpg, pdf, doc, ppt, xls, avi etc.

Digital Library Tools	Description
DSpace	DSpace is a powerful open source digital repository software which was developed in 2002 by HP and MIT. Mainly used for archiving the scholarly output and published digital content. It supports all kind of formats. It is developed in JSP and XML having the robust RDBMS namely PostgreSQL. It supports long term storage, access and preservation of digital content. (www.dspace.org)
Greenstone	Greenstone is open source, multilingual digital library software developed by University of Waikato, New Zealand with the support of UNESCO and Human Info NGO in Belgium. It helps to develop the digital library. It is the best tool for building and distributing digital library collection on the Internet or CD-ROM. (www.greenstone.org)
E-Prints	Eprints a very powerful open source digital library management software developed by University of Southampton, UK. This software is complaint with OAI-PMH for metadata harvesting and basically used for institutional repositories and scientific journals. This software is released under a GPL License. (www.eprints.org)

Web 2.0 and Open Source:

Open Source Software in education and libraries is not limited to only the above mentioned software. Web 2.0 term includes a set of technologies and practices that has changed the definition of Internet and it user interface and changed the way people use Internet. Some of the most important features of web 2.0 are **social networking websites, image sharing, blogs, RSS feeds, tags, podcasts, wikis and open discussion forums**. Now, the transferring knowledge has become two way process where users receive the information and also contribute the information. As a

result, information has become common and most accessible commodity, which is circulated via interactive communities around the globe.

The incorporation of Web 2.0 technologies can be seen in almost every learning management systems, content management system and other software being used worldwide for education and in libraries. It has changed the concept of digital education and made the learning more interactive, interesting and attractive. One very interesting thing is that web 2.0 has not been designed for learning management system tools only but it was designed for general use in all domain of knowledge.

Advent of Web 2.0 has made the learning student centered and has enabled us to harness the individual intelligence and is playing a major role in information sharing. **Ian Davis** says, web 2.0 is an attitude, not a technology. It is about enabling and encouraging participation through open applications and services. By open, we mean technically open with appropriate APIs but also, more importantly, socially open, with rights granted to use the content in new and exciting contexts.

Now days, blogs, wikis, podcasts, media sharing are commonly used technology/tools in education and libraries. Students all over the world are encouraged to create blogs and other interactive applications to enhance peer communication in and outside of the classroom.

Open Source and Biju Patnaik Central Library, NIT Rourkela:

Biju Patnaik Central Library also known as BPCL is the knowledge center of National Institute of Technology Rourkela, which enables its users to enrich their knowledge with rich contents available in the library. The library was established in 1965 and uses almost every latest open source technologies being used worldwide in libraries and education too. BPCL has huge collection of more 84500+ books, 18000 bound volumes, access to more than 6000+ online resources (journals and e-books), standards, print periodicals and digital repositories of intellectual output etc. These documents enable the NITR academic fraternity to enhance the quality output in academics and also in research output. National Institute of Technology Rourkela, being the institute of importance strives the quality education and services with it's different service centers and BPCL is one of them. The library ensures quality services to its users with quality resources.

Some of the best practices being followed in library to assist its users for better academic output.

a. Online Public Access Catalogue (OPAC)

Biju Patnaik Central Library (BPCL) is fully automated with open source technology i.e Koha and ensures to manage all housekeeping operation of library such as acquisition of books & periodicals, serial control, circulation of documents, technical processing of documents as per standard classification scheme and cataloguing rules. Koha is very popular library management system to manage the library activities and automate the manual work, it has gained the international recognition due to simple features, and international standards such as MARC-21, z39.50 protocol etc. This software has unique feature of online public access catalogue which enables all the users of library to browse and search all the documents available in the library from anywhere with some other features such as online renewal, online reservation, tagging, commenting, online fine payments etc. Online public access catalogue can be browsed at <http://opac.nitrkl.ac.in>



Fig - 1

b. Radio Frequency Identification System (RFID)

RFID is best known for securing the system to protect the documents from theft. BPCL has implemented the RFID in which all the documents have been provided the RFID chip on each document to enable high security and for easy circulation. Member cards of the students have integrated RFID Chip inside which ensures self issue/return with the help information kiosk available in the library.

c. Institutional Repositories of Intellectual and Research Outputs – BPCL maintains three institutional repositories of E-Articles, E-Theses and Digitization of Odia Books.

a. E-Articles @ NIT Rourkela

The repository of scholarly publications such as journal articles, conference papers, book chapters etc. was established using open source digital library software called DSpace. The best part of this repository is that all the documents archived in this repository is available for open access with restriction to only few requested documents. The repository can be accessed at <http://dspace.nitrkl.ac.in>



Fig - 2

b. E-Theses @ NIT Rourkela

This repository includes the theses, dissertations, technical reports of different course such as B.Tech., M.Tech., M.Tech. (Research), M.Sc., MBA and Ph.D. This repository being maintained using another open source software called E-Prints developed at University of Southampton, United Kingdom. This repository is also available in open access domain and can be accessed at <http://etheses.nitrkl.ac.in>

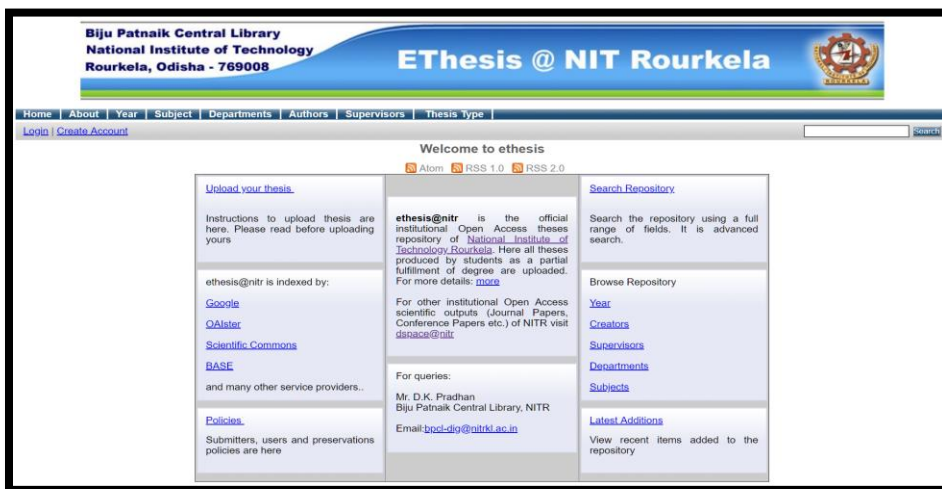


Fig – 3

c. Open Access to Odia Books (OAOB) Project

Open access to Odia Books also known as OAOB Project is very unique in nature and has the collection of cultural heritage of Odisha. The content of this repository is supported by two non-profit government organizations namely Pragati Utkal Sangh and Srujanika. They provide very old Odia books which do not have copyright violation or in consultation with original author. The books received from these NGOs are scanned at BPCL, processed, cleaned and then archived at the repository which can be accessed at <http://oaob.nitrkl.ac.in>. The documents of this repository also are available in open access and can be browsed from anywhere in the world.

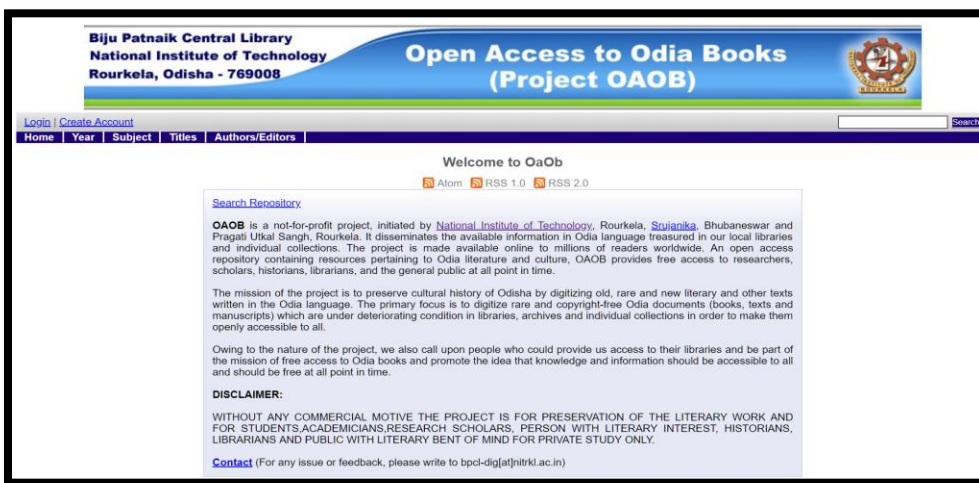


Fig – 4

d. Subject Guide

Biju Patnaik Central Library (BPCL) has initiated another unique service to support its users by subject guide, which contains the information related to different subjects and departments in different pages containing the details of books, theses, e-books, online e-resources, open access documents, patents, standards etc. This service has been established using another very useful open source software called Subject Plus, which can be accessed at <http://library.nitrkl.ac.in/libguide/subjects/index.php>

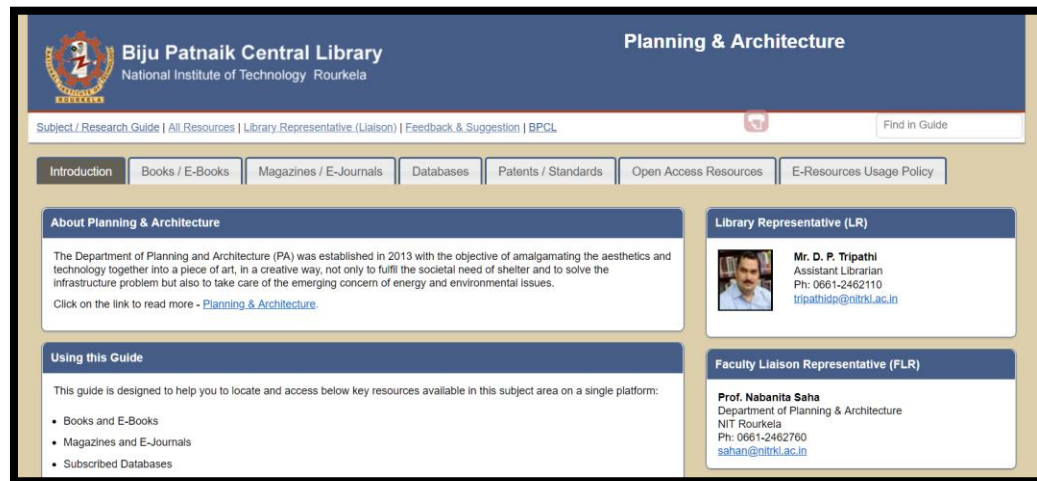


Fig – 5

e. Library Website developed with Open Source Content Management System Joomla

Website is best medium to connect the users and also to disseminate the information among users on different issues. BPCL has developed its own website using open source content management system namely Joomla. The website has been designed in such way that the information available can be reached within one or maximum two clicks. The site contains the full details about library resources and services being provided to NITR academic fraternity.

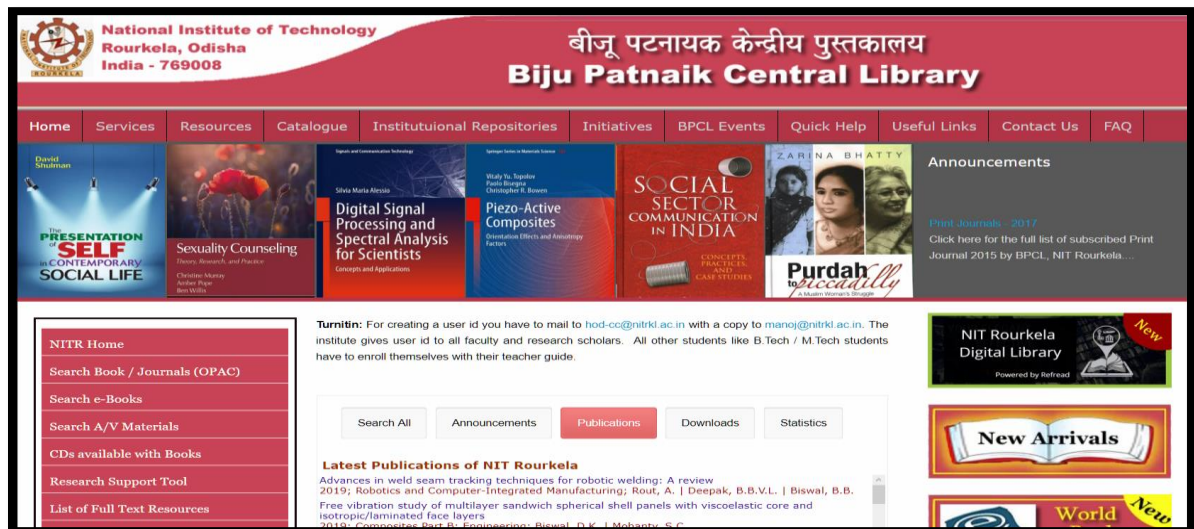


Fig – 6

Conclusion:

Undoubtedly, the open source software has enabled the higher education institutions and universities to manage their data and courses easily with the help of software and make to available to the global academic / education community. However, it is true that throughout the globe, students have the access to quality education via internet. Open access is an initiative that helps the students a worldwide access to peer-created and reviewer journals and its content.

Open source software has accelerated the research, enriched the education, sharing the learning content with rich and poor and making the literature as useful it can be. However, the development of open source has provided the opportunity to libraries and education centers for knowledge sharing and managing the resources with ease. Today, open source and digital education aims to reach everyone and to maximum extent, the efforts have been successful.

In academic libraries, open source are playing major role in automating the libraries, digitizing the scholarly output and content and managing the research data. The outcome of using open source is very positive but still it has to go long way.

References:

1. Lakhan, Shaheen E. and Jhunjhunwala, Kavita (2008), "Open Source Software in Education", EDUCASE Quarterly, No. 2
2. Coar, Ken (2006), "The Open Source Definition", <http://opensource.org/docs/osd>.
3. A patch file is a collection of changes made to enhance a program, compiled in a way that another user could easily implement when working on the same program.
4. "A Brief History of Open-Source Software," http://eu.conecta.it/paper/brief_history_open_source.html.
5. Wheeler, Brad (2007), "Open Source 2010: Reflections on 2007," EDUCAUSE Review, Vol 42 No.1, p. 52, <http://www.educause.edu/ir/library/pdf/erm0712.pdf>.
6. Courant, Paul N. and Griffiths, Rebecca J. (2006), "Software and Collaboration in Higher Education: A Study of Open Source Software", <http://www.ithaka.org/about-ithaka/announcements/ooss-study-final-report>.
7. Robert W. Hahn (ed.), James Bessen, David S. Evans, Lawrence Lessig, and Bradford L. Smith (2002), "Government Policy Toward Open Source Software," AEI-Brookings Joint Center for Regulatory Studies, Washington, D.C. <http://www.aei.brookings.org/publications/abstract.php?pid=296>.
8. "Perceived Disadvantages of Open Source Models," http://eu.conecta.it/paper/Perceived_disadvantages_ope.html.
9. Christina Smart (2015), "Choosing Open Source Solutions," JISC eLearning Focus, <http://www.elearning.ac.uk/features/oss>.
10. "Making High-Quality Educational Content and Tools Freely Available on the Web," Open Educational Resources, William and Flora Hewlett Foundation. <http://www.hewlett.org/Programs/Education/OER/openEdResources.htm>.
11. Curriki Global Education and Learning Community <http://www.curriki.org/xwiki/bin/view/Main/WebHome>.
12. Connexions, <http://cnx.org/>.
13. MIT OpenCourseWare, <http://ocw.mit.edu/OcwWeb/web/home/home/index.htm>.

14. This law applies to the education sector in England, Wales, and Scotland. See "Special Educational Needs and Disability Act 2001," Office of Public Sector Information, 2001, http://www.opsi.gov.uk/acts/acts2001/ukpga_20010010_en_1.
15. Raymond, Eric S. (1998), "The Cathedral and the Bazaar," First Monday, Vol 3 no. 3, http://www.firstmonday.org/issues/issue3_3/raymond/#d1.
16. Carton, Sean (2007), "Web 2.0: What Is It Really?" ClickZ Network, <http://www.clickz.com/showPage.html?page=3625146>.
17. Davis, Ian. (2005), "Talis, Web 2.0, and All That," Internet Alchemy blog, <http://iandavis.com/blog/2005/07/talis-web-20-and-all-that>.
18. Lamb, Brian. (2004), "Wide Open Spaces: Wikis, Ready or Not," EDUCAUSE Review, Vol 39 No. 5, pp. 36–48, <http://www.educause.edu/ir/library/pdf/ERM0452.pdf>.
19. Downes, L. and Mui, C. (1998), "Unleashing the Killer App: Digital Strategies for Market Dominance" Harvard Business School Press, p. 152.
20. Budapest Open Access Initiative, <http://www.soros.org/openaccess>.
21. Werry, Chris (2001), "The Work of Education in the Age of E-College," First Monday, Vol 6 No. 5, http://www.firstmonday.org/issues/issue6_5/werry.
22. McGillicuddy, S. (2007), "Vendors Duke It Out Over Open Source 'Forking'," CIO News, http://searchcio.techtarget.com/originalContent/0,289142,sid19_gci1259981,00.html.
23. Ruth, S. R., Sammons, Martha and Poulin, Lindsey (2007), "E-Learning at a Crossroads: What Price Quality?" EDUCAUSE Quarterly, Vol 30 No. 2, pp. 32–39, <http://www.educause.edu/apps/eq/eqm07/eqm0724.asp>.
24. Wellen, Alex (2006), "Degrees of Acceptance," New York Times, <http://www.nytimes.com/2006/07/30/education/edlife/conted.html>.
25. Robinson, Evan T. "Accreditation of Distance Education Programs: A Primer," American Journal of Pharmaceutical Education, Vol 68 No. 4, <http://www.ajpe.org/aj6804/aj680495/aj680495.pdf>.
26. <http://www.wikipedia.org>
27. <http://library.nitrkl.ac.in>
28. <http://moodle.nitrkl.ac.in>
29. <http://opac.nitrkl.ac.in>
30. <http://dspace.nitrkl.ac.in>
31. <http://ethesis.nitrkl.ac.in>
32. <http://oaob.nitrkl.ac.in>