Trends that will Affect Technology and Resource Decision in Academic Libraries in Near Future

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Abstract— **In the last twenty years, Information Communication Technology (ICT) has witnessed rapid growth and change on very low interval. This change has affected the scholarly communication and higher education system globally. The changing information seeking behavior and recent trends in ICT has forced library professionals worldwide to rethink on the traditional way of purchasing resources and technology in academic libraries. Now librarians have to think and watch carefully the trends in higher education, ICT, Information seeking behavior of users and the social media, so that they may take judicious and economical decision in the front of resources and technology which is the most vital part of the library system.**

Keywords - Academic library; cloud computing; scholarly communication; online resources

I. INTRODUCTION

Medium of scholarly communication and ICT are changing on very low interval and replacing the existing medium by the cheap and advanced versions very quickly. It appears that the world of electronic information seems to be resting on shifting sands. New resources are being developed every day, existing resources evolve in new form and more information is coming up in different electronic formats, which are even accessible through mobile centric applications and interfaces. As we know, in many cases electronic resources require software and hardware support to access them. So many times, changes in the form of electronic resources require specific software and hardware to access or better view. This has pushed libraries, if not always, but many times, to and worry about subscribing to new resources, will the existing hardware and software support the new resources or not? The situation becomes more critical for librarians, particularly in developing and under developed countries, where the authorities does not provide additional budgets to support hardware and software associated with the new resources.

The above situation has created a large number of users which are equipped with the latest technologies and having mind set to change the way they get information from the library or through the social networking services even at the cost of changing their devices. To cater the academic needs of such type of users, which will increase in multifold in near future, and the decision of resources and technology to support these user's requirements and the services to meet out the user's expectation is going to be the main challenge in coming years for the librarians. Further, the spheres (professional, educational, and social) of our lives are increasingly merging,

marked by the rise of social networking services providing new interfaces for interacting with friends, the sharing of information, and professional collaboration is also going to be challenging. Based on the ACRL 2012 reports [1] and observing the trends in higher education, this article focuses on some important trends being witnessed and their impact on resource and technology decisions in academic libraries in near future.

II. INCREASING USE OF LAPTOPS AND MEDIA TABLETS

Bringing own technology at classes and library has become the norm, not the exception. A number of studies conducted worldwide shows exponential growth in the usage of personal devices within the libraries. CAR's 2005 and 2008 surveys found that in an over just three years, the percentage of students owning laptops grew from 55.6 to 80.5 percent [2]. In the beginning of the 21st century, many libraries around the world had started their "Wireless Lending Laptop Programs" under which users were issued laptops to use Internet via wireless. Studies show that the wireless access of Internet and LLS (Laptop Lending Services) have become common features in modern academic libraries, particularly in western countries [4]. However, in the academic libraries of developing and underdeveloped countries it could not get momentum due to the budget crunch.

After the advent of media tablets and its affordable prices, the trend is changing. As trends show, in coming year's media tablet will capture the market of laptops and it will be first preference of students to get academic information using this device [5]. As the market tendency shows, the prices of Smartphone will fall drastically for entry-level devices with faster two and four-core processors, and with bigger, brighter, higher-resolution screens. On the software front, Windows 8 will likely be in third place behind Android and Apple. The era of PC dominance with Windows as the single platform will likely be replace with a post-PC era where Windows will be one of a variety of environments IT will need to support. The library will have to fight on both the fronts. At one front the services based on Windows would have to be continued and on the other front the demand of services based on new platforms will have to start. Further, the publisher will also come up with new publishing models which will support these devices.

As laptops and other portable devices gain prominence in academic world, some potentially important factors need to be considered: first, changing nature of portable devices and,

second, changes in the spaces and environment in which these devices are used, including technology infrastructure, aesthetics, policies, security and management challenges. Before subscribing to the resources, librarians should once think whether support for the access of these resources through personal devices is there. The current ICT infrastructure, which they are going to develop for future, will have to support the newer devices. It is going to be the most challenging job for all library professionals in near future.

III. MOBILE-CENTRIC APPLICATIONS AND INTERFACES

Mobile devices are changing the way information is delivered and accessed by the academics and the library users. The increasing influence of mobile technology in providing library services is apparent in the number of case studies recently conducted and the growing number of mobile friendly websites, e- resources, databases, and native applications being developed for libraries [6]. According to the 2013 "ICT Facts and Figures" report from the ITU Telecommunication Development Bureau, the mobile market consists of over 6.8 billion subscribers, with a majority living in developing countries. The unprecedented evolution of these devices and the apps that run on them has opened their door to myriad uses for education [7].

Libraries are increasingly dependent on the vendors for making available the mobile software solutions and mobile access to pre-packaged content of journal articles and e books. All the giant players of publication industries have started providing mobile –centric applications and interfaces to use e-resources. The publication industry frontline EBSCO host has apps for the iPhone, iPod touch, and Android as well as a mobile interface [8]. Many other world famous publishers including JSTOR, Elsevier, Wiley, and Thomson Reuters, have mobile interfaces or apps. Mobile access of library OPAC is available through SirsiDynix and Innovative Interfaces integrated library systems, while OCLC provides mobile access to Worldcat. Apart from this, Self-service features such as renewing books, placing holds, and finding recommended titles are among the apps library users want and some of the libraries are providing this.

It appears that the ubiquitous presence of mobile devices has made it virtually impossible for libraries to continue ignoring them [9]. The opportunity of new technology and its application to manage the library functioning and providing new services has been demonstrated through a number of studies. Generally, library mobile application functions include library notices, search function for lists of books, and other events going to be organized in the libraries on short notices. Apart from this, library mobile applications can allow users to search, bookmark, annotate, link, and highlight content from scripture, general conference talks, lesson manuals, and other curriculum on mobile devices. In recent year's many public and academic libraries have developed their own apps. However, one key consideration for librarians is that all of a library's website simply cannot, and should not, be included in a mobile website. Therefore, libraries and librarians face the critical issue of determining how to stimulate intention for use of library apps and how to meet user needs [10].

Although there are still many uses that have not been realized yet by the publishers and the libraries; over the past several years mobile learning has moved quickly from concept to reality among the patrons. As the trend show, in near future, touch, gesture and voice search is going to change the way mobile apps work. It may be predicted that very soon many tools optimized for app store application development in 2010 will have been acquired or will have ceased to exist. That's why, the advisory Board of the STEM identified number one, "the demand for personalized learning is not adequately supported by current technology or practices" of ten challenges ranked as most significant in terms of their impact on teaching or learning in STEM+ education in the coming five years [7].

IV. NEW SCHOLARLY COMMUNICATION AND PUBLISHING MODELS

Worldwide commercial publishers are coming up with new scholarly communication and publishing models at an ever-faster pace, this requires libraries to be actively involved or be left behind. New publishing models are being explored for journals, scholarly monographs, textbooks, and digital materials; so that the demand of new generation users may be fulfilled without affecting the health of library budget. As we know, education paradigms are shifting now and including online learning, hybrid learning and collaborative models to met out the increasing number of students demand. Increasingly, students and faculties want to use their own technology for learning and expecting to be able to work, learn, and study whenever and wherever they want on their choice of devices. Massive Open Online Courses (MOOCs) are being widely explored as alternatives and supplements to traditional university courses, particularly in science, technology, engineering, and medicine discipline. So now, the libraries have challenge to manage the new scholarly communication and publishing models and opportunity to get involved.

The opportunities for universities and academic libraries burgeoned with the development of the Internet and some research and academic libraries are now coming up as publishers and developing programs offering a set of core publishing services to editors and partners. Libraries are supporting these services by reallocating resources, partnering, seeking synergies with related services and developing modest revenue streams. Now some academic libraries have taken an active role in changing the scholarly communication environment by creating or expanding publishing services. A 2011 survey of member institutions of ARL, the Oberlin Group and the University Libraries Group found that approximately half of the respondents had or were developing library-publishing services. Three quarters published journals, while half-published monographs and/or conference proceedings. The libraries commonly provided digital repository services, author copyright advice, digitization services, and management of research datasets, as well as metadata creation, cataloging, and digital preservation [11].

V. USE CLOUD BASED TOOLS AND THEIR APPLICATIONS

Cloud based tools and technology, like many new technologies are transforming business, education, society and

libraries, is gaining significant traction. Cloud based tools are enabling rapid innovation across educational environments.

Services such as YouTube, Google Apps, and others which are almost free or very inexpensive have become pervasive and enabling students and researchers to instantly share media files and collaborate on their working projects from where ever there is Internet access, no matter office, classroom or home. Due to the feature of sharing files and accessing it from different geographical locations, collaboration among users is enhanced in cloud. Using means like Google Docs or DropBox the material can also be distribute to co-researchers. Apart from this, the content shared across cloud-based platforms can be re-mixed and embedded into all kinds of online learning environments. It means, for the organizations who do not want to have own hardware/software, and want to avoid huge upfront cost; cloud can be a solution for them.

The exponential growth in information sources and accompanying complexities, the limited resources and capacity of libraries to host their own in its entirety necessitates opting for alternatives in the cloud. That's why, worldwide, libraries are using the cloud for putting together user resources, i.e. using Software as a Service (SaaS), such as in library catalogues, WorldCat, Googledocs, and the aggregated subject gateways like SUMMON, and others; the web Platform as a Service (PaaS) as in the use of GoogleApp Engine; or Infrastructure as a Service (IaaS) as in the use of D-Space, FEDORA, and others [12].

While libraries are important consumer of cloud computing services, an understanding of their operations (advantages and disadvantages or challenges involved) is important for effective and efficient use. Potentially, the cloud computing gives access to the vast majority regardless of where they are geographically located, but the challenge in some developing and under developed countries is with poor IT infrastructure, data centers, and applications. Apart from this reliability, security, control, transparency, and privacy are the issues which are coming up with the use of cloud computing. According to a 2013 global survey conducted by CISCIO in partnership with Intel, titled "Impact of cloud on IT consumption models" data security is the number one concern about cloud, but also one of the top three business drivers for cloud adoption, indicating that respondents are cautiously optimistic that cloud providers can do a better job at securing their data than any single corporation can [13].

VI. OPEN EDUCATIONAL RESOURCES (OER)

The growing demand for higher education and the ongoing rollout of ICT infrastructure have created unique challenges for higher education institutions in an era of growing demand and budget crunch. Forecasts suggest that current global enrolments of 165 million graduates will grow by a further 98 million by 2025 [14]. To cater the academic needs of this huge student's population in the situation where every year demand is increasing and budget is decreasing or stagnant, is a big challenge for educational institutions and libraries. That's why many institutions around the world are incorporating ICT into their management, administration and educational programs so that they may serve their students more cost-effectively. In many developing and under develop countries; however, access to hardware; software and

connectivity remain the main challenges. It is therefore critical to adapt pedagogical approaches and learning materials to this environment while ensuring high quality and relevant educational opportunities.

The concept of openness like open resources, open data, notions of transparency and easy access to data and information is now becoming a value. In the last ten years it has become the most successful scholarly publishing reform movement, and it has begun to transform the scholarly communication system. Open Educational Resources (OER) are " teaching, learning and research materials in any medium, digital or otherwise, that reside in the public domain or have been released under an open license that permits no - cost access, use, adaptation and redistribution by others with no or limited restrictions. Open licensing is built within the existing framework of intellectual property rights as defined by relevant international conventions and respects the authorship of the work "[15]. The focus of OER is not only on textbooks, but also on, course materials, reference works, modules, journals, streaming videos, tests, software, and any other tools, materials, or techniques that are critical in the learning environment and support learning.

Currently, library community has sympathy with the open access because it has long suffered the debilitating effects of the serials crisis. However, libraries are cautious in their embrace of open access, its effects on the scholarly publication and communication, acceptance by the patrons and researchers and its ultimate impact on their budget and operations. As the open access movement is getting momentum and becoming popular among the academic community, libraries which face serious problems in the conventional scholarly communication are looking at it as potential solution for them. The time has come to encourage the people involved in decision making in governments and educational institutions to invest and share in the systematic production, adaptation and use of OER and to bring them into the mainstream of higher education in order to improve the quality of curricula and teaching and to reduce costs.

VII. INTERNET FOR EVERYTHING

In the network environment people want to work, learn, and study at their desired place with their choice of personal devices. There are a lot of challenges for the learners in the busy world where they have to make a balance between demands from home, work, school, family and learning. Work and learning are often two sides of the same coin, and people want easy and timely access not only to the information on the network, but also to tools, resources, and up-to-the-moment analysis and commentary. These multidimensional needs as well as popularity of social media and networks have raised the level of expectations of the library users and they are looking towards the academic libraries for it.

The idea here is that we are building on pervasive computing where cameras, sensors, microphones, image recognition, everything, is now part of the environment. Remote sensing of everything is now being part of the network, so users expect to have such facility for the library resources and services also. To fulfill the demands of the users, libraries all over the world have invested a huge amount of their library budget. In addition, increasingly intelligent

devices create privacy type sensitive issues for which librarians will have to have solutions.

VIII. MANAGEMENT OF BIG DATA

Management of huge amount of data has emerged as one of the significant challenges for ICT leaders and it may pose challenge to the library professionals in coming years. The term 'big data' became popular in 2009 and is interesting to note that a Google search on "big data" yielded 2.9 million hits in February 2011. Many vendors have entered in the market with their products and solutions to the big data challenge. The important thing library professionals have to realize is that, they just cannot store it all. New techniques have been evolved to handle extreme data, such as Apache Hadoop, but libraries are needed to acquire new skills to effectively use these technologies and manage Big Data keeping in mind the service to the user.

Now the question is why should the librarians bothered about the big data? Because of its prevalence and potential impacts, librarians need to know the basics of big data and how it affects academic research. Librarians in all disciplines, in order to facilitate the research process, will need to be aware of how big data is used and where it can be found. Librarians also need to embrace a role in making big data sets more useful, visible and accessible by creating taxonomies, designing metadata schemes, and systematizing retrieval methods [16].

IX. PATRON DRIVEN E- BOOK ACQUISITION

Collection development is one of the important activities of the librarian particularly in the print environment where librarians knew how much they were spending, but were unable to ascertain how their collections are being used or how to use the data they could collect to better inform purchasing decisions. That is why Galvin and Kent referred to the book budget in the academic world as "the most sacred of sacred cows" [17]. Even today, it is very difficult to predict the use of book before and after the purchasing.

The concept of Patron-driven acquisition (PDA) has been emerged recently and is being used for developing a library collection by using the collective knowledge and needs of users at a particular institution. Actually, the focus of PDA is on the needs of department, research, faculty and students which are changing over time, as opposed to the bulk-purchasing that has been the staple of the library budget for well over a decade. It means, in near future academic libraries will jettison "large collections of physical books in open stacks with low circulation," in favor of licensing agreements with e-book vendors that will enable libraries to purchase only those books that are in high demand. This model of acquisition may be helpful for libraries under pressure to prove that their expenditures are in line with their value.

X. DATA CURATION AND DATA PRESERVATION

The increasing inclusion of supplementary data in journal publications (audio and video), new models, and other projects have created a number of challenges for different stakeholder particularly for the libraries, repositories, publishers, and researchers. Data curation is going to be more challenging for

all the above in coming years as standards for all types of data continue to evolve; more repositories, many of them cloud-based, will emerge. Librarians and information scientists will have a vital role to play in helping their academic and research communities, design and implement a plan for data description, efficient storage, management, and its retrieval. However, several data repositories already exist, and include librarians as principal collaborators, data curation presents opportunities for "finding new ways to communicate the value of the skills librarians already possess and in developing roles that were previously not associated with librarians." [18].

The focus of academic libraries on the front of digitization will be the unique regional and national collections particularly in the field of literature, social sciences, history and philosophy, which have still not been touched by the commercial publishers due to uncertainty of its market value. However, worldwide academic libraries are trying to digitize their local collection and manuscripts, local and regional digital collections are at risk when the libraries lack a comprehensive preservation plan. They make their efforts only for preservation, not for its dissemination.

XI. CONCLUSION

Worldwide, academic libraries are changing. The use of internet for the academic and research purpose has increased this change and it is now happening at very low interval. This change has forced the decision makers at academic libraries, particularly the librarians involved in collection development decision and implementing ICT infrastructure, to be aware of the changes taking place at global level on the front of Information Communication Technology, publishing, cloud computing, data curation, preservation, management of Big Data, MOOC etc; so that they may develop their resources, collection and services to meet out the new generation users.

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