RE-ENGINEERING ACADEMIC AND RESEARCH LIBRARY SERVICES IN KENYA THROUGH SEMANTIC WEB

Tom KWANYA

Senior Lecturer. Department of Information and Knowledge Management
The Technical University of Kenya, Nairobi, Kenya
Email: tom.kwanya@gmail.com / tkwanya@tukenya.ac.ke

Abstract

Semantic web is the third generation of the Internet services that collectively comprise the intelligent web and is the foundation of Web 3.0. The emergence of the semantic web was influenced by several initiatives seeking to make the web better. Semantic web is location-aware, moment-relevant and intelligent web which is about describing and interconnecting existing data to facilitate its deeper use through ontologies, contextualisation, standardised languages and descriptions. Its power lies in the linking of data rendering the location of a resource irrelevant; it is a web of data, not just machines. Thus, Web 3.0 is envisioned to resolve the problem caused by the disorganisation of information on the web where the users now seem to do more searching than finding of relevant and usable information. Semantic web addresses this challenge by creating a web of meaning (semantics) rather than the web of links as exhibited by the earlier versions of the web. The information environment in which academic and research libraries in Kenya currently operate has changed drastically as a result of the impact of the emerging information and communication technologies on how library users seek, access, use and share information. Essentially, current library users find it easier to use search engines than drive to a library. Consequently, the use of library services has reduced. This scenario has brought the relevance of libraries to focus. To survive, academic and research libraries need to reengineer their services to meet the needs of the users more closely than they are doing now. This study investigated the potential of the semantic web in facilitating the reengineering of services of academic and research libraries in Kenya. Primary data for this study was collected through key informant interviews with academic and research librarians selected through information-oriented purposive sampling. Additional secondary data was collected through documentary analysis. The findings indicate that the semantic web can facilitate the reengineering of academic and research library services through enhanced library intelligence, organisation, federation, apomediation and personalisation. These findings can be applied by academic and research libraries to design and deploy services on semantic web platforms.

Keywords: Semantic web; Web 3.0; Academic library; Research library,; Library 3.0

1. Introduction

The emergence of the Internet and its related technologies has prompted a momentous change in the ways in which library users seek information, communicate and collaborate. Similarly, the scope and depth of what the library users are able to do with the emerging information and communication technology (ICT) applications are growing by the day. For instance, the new

tools and techniques have the potential to enable scholars and researchers to search, identify, select, manipulate, use, communicate and store more information easily, instantaneously and inexpensively. Thus, the tools offer a new and versatile means of satisfying the information needs of the academic and research library users. As these users become more aware of the possibilities of using technology and find it easier to go to Google than travel to the library, academic and research libraries face immense challenges on how to offer services to such users effectively.

The challenges and possibilities facilitated by ICTs have triggered new conversations on how to discover, invent and share knowledge. The emerging applications, possibilities and conversations are rapidly altering perceptions of the fundamental principles and concepts of librarianship and further complicating the situation. They have also created new expectations for better usability, faster response to customer needs with better products and have exposed the limitations of library services available at a physical building that is not continuously accessible because of limited opening hours, strict membership requirements, restricted information resources and often inadequate user involvement in influencing the level and quality of services provided. As the pace of this change accelerates, the greatest challenge, especially to the academic and research libraries, is how to keep up. Indeed, the latest library usage statistics show that there exists a dissonance between the environment and content that libraries provide and the environment and content that information consumers want and use (Kwanya, 2011). Preferences for self-service, satisfaction and seamlessness have been identified as some of the indicators of this dissonance. Therefore, library service characteristics that support self-service or disintermediation, increased user satisfaction and seamlessness such as ease of use, and convenience are now as important to the modern library user as the quality and trustworthiness of the information products.

The change in the current infosphere has been gradual but steady. In fact, more than ten years ago, a study by OCLC (2005) on library users revealed very unflattering perceptions of the modern library user about the library and its resources in the light of the digital revolution: 1) A large number of users begin their information searches with search engines, not librarians or library catalogues; 2) People who have used both search engines and librarians for information searches admit that both approaches yield results of more or less similar quality; 3) Libraries are about the provision of outdated, dirty, bulky and often not immediately-available books, rather than information; 4) The library is not the first or only stop for many information seekers and, although this is not an entirely new finding, the situation is worse now because more alternatives to the library exist; and 5) Information seekers are not satisfied with the library experience and desire that it should stretch beyond books, crowded noisy reading areas, limited parking, bureaucratic limitations on the use of resources, need to travel, as well as unfriendly, unavailable and inadequate library staff. As libraries struggle to cope with the new demands and challenges, available evidence indicates that they are rapidly relinquishing their place as the main point of enquiry. Indeed a sizeable number of current academic and research library users indicate that they will reduce their library use in due course (Kwanya, 2011). This change can be attributed to the constantly shifting expectations of users, especially revolving around time and convenience of use of library services and collections. Fundamentally, modern library users expect to be able to access any information they want anytime anywhere. They want the library service to fit their lifestyle and not vice versa (OCLC, 2005). All these trends demonstrate that the expectations that libraries, regardless of their typology, will be able to deliver high quality, comprehensive, user-friendly, new generation services have grown tremendously in the recent years. To survive, academic and research libraries have to re-engineer their services to fit closely to the needs and wants of their users.

2. Understanding service re-engineering

Hammer and Champy (1993) explain that reengineering involves fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical measures of performance such as cost, service, and speed. It involves a thorough rethinking of all processes, job definitions, management systems, organisational structure, work flow, and underlying assumptions and beliefs. The main objective of reengineering is to break away from old ways of working, and effect radical (not incremental) redesign of processes to achieve dramatic improvements in critical areas such as cost, quality, service, and response time through the in-depth use of information technology.

Emerging information and communication technologies have historically played a critical role in service reengineering. According to Hammer and Champy (1993) technologies which have contributed in business process reengineering include shared databases, making information available at many places; expert systems, allowing generalists to perform specialist tasks; telecommunication networks, allowing organisations to be centralised and decentralised at the same time; decision-support tools, allowing decision-making to be a part of everybody's job; wireless data communication and portable computers, allowing field personnel to work office independent; interactive videodisk, to get in immediate contact with potential buyers; automatic identification and tracking, allowing things to tell where they are, instead of requiring to be found; and high performance computing, allowing on-the-fly planning and revisioning.

3. Semantic Web – The 3.0 intelligent Web

This is the third generation of the Internet services that collectively comprise the 'intelligent web' (Hendler, 2008; Jastram, 2008). While some scholars refer to it simply as the semantic web, others describe Web 3.0 as the location-aware, moment-relevant (sensitive) and intelligent web (Lucier, 2009). It is about describing and interconnecting existing data to facilitate its deeper use through ontologies, contextualisation, standardised languages and descriptions. The power of Web 3.0 lies in the linking of data rendering the location of a resource irrelevant: Web 3.0 is a web of data, not just machines (Berners-Lee, 1998), aimed at taming the web (Marshall and Shipman, 2003). Giustini (2007) describes Web 3.0 as the evolution of the web and people's responses to it, in finding and organising new information. Ideally, the users of Web 3.0 systems are able to ask questions in natural language and receive consistently good answers from machines acting as "intelligent agents" (Wahlster and Dengel, 2006; Robu, 2008; Evans, 2009). Web 3.0 is envisioned to resolve the problem caused by disorganisation of information on the web where the users now seem to do more searching than finding of relevant and usable information (Giustini, 2007; Feigenbaum *et al*., 2009). Web 3.0 proponents assert that it creates a web of meaning (semantics) rather than the web of links as exhibited by the earlier versions of the web (Wahlster and Dengel, 2006).

Web 3.0 uses Resource Description Framework (RDF) to describe web resources as opposed to Extensible Markup Language (XML) and Hypertext Markup Language (HTML) used on the Web 2.0 and Web 1.0 respectively. The RDF enables databases to update automatically when there are changes in the information resources of which they are constituted (Feigenbaum *et al*., 2009). It also enables Web 3.0 to unify information from different sources and formats. This is how Web 3.0 attempts to manage the information overload resulting from duplication, spam, remix and re-use. The RDF enables Web 3.0 to create and maintain interlinked information pathways making

information retrieval easier (Cho and Giustini, 2008). The development of information pathways is partly done by the isolation, ordering, linking and sharing of authoritative information (Marshall and Shipman 2003). Marshall and Shipman (2003) further explain that the language of representation, communication protocols, access control and authentication are critical to the semantic web. They add that the semantic web enables computers and human beings to work together in organising and retrieving information.

Web 3.0 presents enormous opportunities for academic and research libraries. The libraries which apply Web 3.0 tools, techniques and principles to offer effective services are generally described as Library 3.0. Belling *et al.* (2011) explain that the term Library 3.0 refers to the use of emerging technologies, such as the semantic web, cloud computing, mobile devices, and established tools, like federated search systems, to facilitate the development, organisation and sharing of user-generated content through seamless collaboration between users, experts and librarians. They add that the main goal of Library 3.0 is to promote and make library collections widely accessible, searchable and usable. They explain further that the end result of Library 3.0 is the expansion of the borderless library, where collections can be made available readily to library users regardless of their physical location. Critically, they aver that Library 3.0 is a virtual complement to the physical library space, and should ideally work seamlessly within established library systems, services and collections. Though the concept is still evolving, Chauhan (2009) explains that speed, accuracy, precision and systematic organisation of information available on the web are some of its key elements.

Library 3.0 is aimed at turning the unorganised web content into a systematic and organised body of knowledge. It seeks to establish a semantic relationship between all available web content, including the so-called "invisible web", to ensure seamless accessibility, searchability, availability and usability (Chauhan, 2009). The invisible web is known to constitute the majority of web resources and comprises unlinked collections and databases which are not accessible through ordinary search engines (Lewandowski and Mayr, 2007). Nonetheless, the basic objective of Library 3.0, as with the library service models before it remains giving the right information to the right user at the right time (Kwanya *et al.*, 2014).

Schultz (2006) explains that Library 3.0 reinstates the librarians in the information value chain. She emphasises that with the vast mass of information in the infosphere, great premium is now attached to sifting and repackaging, the roles which librarians play, so as to meet specific customer information needs. She explains that in the milieu of Library 3.0 library users do not merely select books (products) but also engage with librarians who have the ability not just to organise, but also to annotate and compare books and other information sources, from a variety of perspectives useful to them. She further argues that Library 3.0 has the potential of creating a compelling experience defined by an environment which is authentic, humane, experiential, impassioned, relevant and participatory.

Library 3.0 seems to fulfil the prediction of Libner that by 2012 libraries would have moved from "a single library to a network of libraries; from one collection to distributed collections; from the catalog[ue] interface to multiple interfaces; from books and journals to information fields and streams encompassing traditional and non-traditional forms of scholarly communication" (2003:2). Libner (2003) further explains that such libraries would hold massive collections including diverse forms and genres of preprints, traditional publications, informal commentary, research data sets, software applications, maps, video clips, listserv archives, and web pages

which will all be accessible anytime and anywhere. Breeding (2008) explains that Library 3.0 introduces a full-text, fully integrated and comprehensive search environment which is deep: comparable to searching within a book as opposed to searching for the book. Library 3.0 is like having a personal assistant who, together with the librarian, knows everything about you. Web 3.0 search engines do not just give you the correct answers to your questions. They also interpret and provide the context to your request.

4. Rationale and methodology of study

The promise of the application of the semantic web to deliver better services in academic research libraries in Kenya is great. However, there is limited literature on the subject. This study investigated the potential of the semantic web in facilitating the reengineering of services of academic and research libraries in Kenya. The study was designed as an exploratory survey. This is a methodological research approach used to investigate emerging research problems which have not been clearly defined (Saunders et al., 2007). The cardinal purpose of exploratory research is to gain familiarity with a phenomenon or acquire new insight into it without necessarily making conclusions about it (Brown, 2006). The researcher found this approach appropriate for the study because semantic web is a new concept.

Primary data for this study was collected through key informant interviews with 21 academic librarians selected through information-oriented expert purposive sampling. The researcher used this sampling technique so as to obtain in-depth expert information on the topic of study. This technique did not lay emphasis on representativeness but the richness and relevance of information received from the expert respondents. The interviews were conducted online using an open-ended questionnaire hosted on SurveyMonkey. The open-ended approach was used to enable the expert respondents to provide as much information as possible on the topic of study. Secondary data was collected through documentary analysis of relevant literature. The collected data was analysed using descriptive statistics. This analysis technique was chosen because it enabled the author to summarise, interpret and describe the data in a way that reveals their meanings within the context of the study.

5. Findings and discussions

The findings of the study indicate that most academic and research libraries in Kenya are facing myriad challenges relating to recognition and relevance. The respondents pointed out that in the midst of all these challenges, the number of users visiting the libraries has reduced drastically; budgets and other resources allocation for the libraries has dwindled; and executive support for library programmes has waned. The respondents explained that although it is not said bluntly, they have begun getting the impression that a growing number of patrons no longer depend on the library or librarians for their information needs. These findings concur with the general global trends which indicate that libraries are losing their pivotal position in the information sphere in academic and research institutions. The respondents expressed apprehension that the situation may get worse in the next few years. Therefore, they asserted that there is an urgent need for a remedial intervention.

All the respondents said that academic and research libraries have to reengineer their services because of the consistently changing technological advancements; emerging unique users' information seeking behaviour and consumption patterns; the ever-increasing information overload making the identification of usable information more difficult; the growing user

competencies in and reliance on technology to create, search, use and share information; the need for instant and unlimited access to information resources; dwindling budgetary and other resource allocations necessitating the need for cost-effective approaches to information service design and delivery; as well as the growing competition between libraries and alternative sources of information facilitated by pervasive information technology.

The respondents explained that nearly all library services require reengineering so as to best meet the needs of the users. Nonetheless, they pointed out the priority areas include current awareness services, selective dissemination of information, reference services, information outreach services, user education and information literacy, remote information access services, and customer support services. The respondents explained that although academic and research libraries currently offer these services, their impact is limited by inadequacies in the way they are conceived, designed or delivered. They pointed out that if they are not reengineered then their usefulness to the users will be greatly jeopardised in the next few years. They clarified that the services are not necessarily bad but pointed out that the challenge lies in the way they are being offered.

The majority (62.5%) of the respondents stated that they have come across the term semantic web while the rest answered in the negative. Those who knew about the semantic web had encountered it in their day-to-day work, class or virtual information resources. Those who had not encountered the concept expressed an interest in knowing what it is and applying it in their libraries. Although the findings of the study indicate that only one library is currently implementing services using the semantic web, the majority (75%) of the respondents held the view that the semantic web can be used by academic and research libraries in Kenya to reengineer their services. Nonetheless, they were cognisant of challenges such as inadequate technology facilities and infrastructure in the academic and research institutions; lack of adequate funding; incompetent staff; technophobia; resistance to change; as well as a lack of commitment of top library management to reengineering processes. The respondents explained that these challenges can be addressed through capacity building, resource mobilisation and effective change management. These findings indicate that academic and research librarians in Kenya are willing reengineer their services using the semantic web.

6. Conclusion

Academic and research libraries in Kenya, just like in the other countries, face myriad challenges brought about by advancements in information and communication technology which have changed the way library users seek and use information. To remain relevant and continue meeting the information needs of library users more effectively, academic and research libraries in Kenya need to reengineer their services. Semantic web is one of the pillars which these libraries can use to reengineer their services.

In the words of Kwanya *et al*. (2014) the author proposes that academic and research libraries in Kenya adopt the following five Library 3.0 principles to reengineer their services:

The library is intelligent – This entails embracing artificial intelligence to offer intelligent services such as natural language information searching; automation of core library services such as lending and returning of information resources; intelligent library buildings capable of responding to the needs of the specific users efficiently and effectively; enhanced security solutions based, for instance, on biometrics and radio frequency identification technology; and location-aware information systems.

The library is organised – Most information users experience infobesity and acutely low information attention. This situation is a result of the current information explosion. Academic and research libraries must help their users to identify, assess, access, use and share credible information with ease. This can be achieved through ontology-rich semantic systems that facilitate intelligent and targeted information searching and discovery. Findability of information resources may also be enhanced through content curation and aggregation.

The library is a federated network of information pathways – This implies the application of Library 3.0 tools to draw together diverse information sources and platforms to create a robust information network working seamlessly to facilitate fast, accurate and systematic information searching and retrieval. The semantic web platforms integrate disparate information channels, formats and environments to ensure availability, accessibility, searchability and usability of credible information. The search environment thus created is not only integrated but also comprehensive.

The library is apomediated – Apomediation is a scholarly socio-technological term used to describe the social mediation of information. The term, which originated in the health discipline, is derived from a combination of Latin words 'apo' which means to stand by or next to, and "mediare" which means to be in the middle (Eysenbach, 2008; O'Connor, 2010). Apomediation is an information search strategy where users bypass formal intermediaries but instead of acting completely independently, are guided by peers and web tools to find credible and relevant information (Eysenbach, 2008). The concept of apomediation emanated from the view that intermediaries, as middlemen or gatekeepers, often stand in between the library users and the information they need. This situation is undesirable because it restricts direct access to information. Intermediation also affects the quality of the information users receive because it is influenced heavily by the qualities of the intermediary. Apomediation seeks to bridge the gap created by disintermediation, the elimination of intermediaries in the information demand and supply chain, which implies that users may get lost in the vast reservoirs of information available in infosphere. Users who lose their way in the infosphere may end up accessing inaccurate information, leading them to wrong conclusions and application. Apomediaries offer guidance to users to obtain trustworthy information using less traditional methods or sources. Essentially, apomediation is a shift from the reliance on gatekeepers to networked approaches for identifying, locating and using trustworthy information (Kwanya *et al.*, 2014).

The library is "my library" – Semantic web can facilitate academic and research library users in Kenya to personalise library services. The need to personalise library services, as a means of satisfying user needs effectively, has been constant in the history of libraries. Due to the relatively small number of users they served, librarians in the previous generations perhaps just tried to remember the faces and interests of each user and endeavoured to offer as much personalised services as was then possible. However, the need for deeper personalisation has become more apparent in the recent past due to the emergence of information technologies which have provided greater opportunities for the librarians to tailor services and products to the tastes of the users. Semantic web platforms can enable academic and research libraries to personalise library services through the design, management and delivery of content based on known, observed and predictive information (Kwanya *et al.*, 2014).

7. Implications

The findings of this study can be used by academic and research librarians in Kenya to reengineer library services by streamlining processes, creating new library services and products as well as developing user participation frameworks. They can also be used by training institutions to develop curricula which equip the librarians with the requisite skills to design, deploy and manage services on semantic web platforms. Academic and research institutions in Kenya can also use these findings to formulate information policies which support or can benefit from the semantic web.

References

Belling, A., Rhodes, A., Smith, J., Thomson, S. & Thorn, B. (2011) 'Exploring Library 3.0 and beyond'.http://www.libraries.vic.gov.au/downloads/20102011_Shared_Leadership_Program_Presentation_Day_/exploring_library_3.pdf [Accessed 9 April 2012].

Berners-Lee, T. (1998) 'Semantic web roadmap'. http://www.w3.org/DesignIssues/Semantic.html [Accessed 24 July 2011].

Breeding, M. (2008) 'Beyond Web 2.0: taking the social read-write web to the enterprise level'. http://www.librarytechnology.org/docs/13320.ppt [Accessed 21 August 2011].

Brown, R.B. (2006). *Doing your dissertation in business and management: the reality of research and writing.* London: Sage Publications.

Chauhan, S. K. (2009) 'Key 2 information: Library 3.0'. http://key2information.blogspot.com/2009/09/library-30.html [Accessed 21 June 2011].

Cho, A. & Giustini, D. (2008) 'Web 3.0 and health librarians: an introduction', *Journal of the Canadian Health Libraries Association,* 29(1), 13–18.

Evans, W. (2009) *Building Library 3.0*. Oxford: Chandos.

Eysenbach, G. (2008) 'Medicine 2.0: Social networking, collaboration, participation, apomediation, and openness' *Journal of Medical Internet Research* 10(3):e22. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2626430/ [Accessed 28 July 2011].

Feigenbaum, L., Herman, I., & Hongsermeier, T. (2009) 'The semantic web in action'. http://www.scientificamerican.com/article.cfm?id=semantic-web-in-actio&;page=1 [Accessed 20 July 2011].

Giustini, D. (2007) 'Web 3.0 and medicine', *British Medical Journal* 335, 1273–1274. http://www.uv.es/previnfad/Web%203.0%20and%20medicine.pdf [Accessed 8 April 2012].

Hammer, M. & Champy, J. (1993) *Reengineering corporation: a manifesto for business revolution*. New York: Harper Business Books.

Hendler, J. (2008) 'Web 3.0: Chicken farms on the semantic web' *IEEE Computer,* 41(1), 106–108.

Jastram, I. (2008) 'Library 3.0'. http://pegasuslibrarian.com/2008/08/library-3–0.html [Accessed 21 August 2011].

Kwanya, T. (2011) 'The potential for Library 2.0 for research libraries in Kenya' http://researchspace.ukzn.ac.za/xmlui/bitstream/handle/10413/5025/Kwanya_Tom_Joseph_Mboya_2011.pdf?sequence=1. [Accessed 5 March 2016].

Kwanya, T., Stilwell, C. & Underwood, P.G. (2014) *Library 3.0: intelligent libraries and apomediation*. Oxford: Chandos Publishing.

Lewandowski, D. & Mayr, P. (2007) 'Exploring the academic invisible web' http://arxiv.org/ftp/cs/papers/0702/0702103.pdf [Accessed 29 August 2011].

Libner, K. (2003) 'Working the network: a future for the academic library' http://alpha.fdu.edu/~marcum/libner.doc [Accessed 12 August 2011].

Lucier, T. (2009) 'What is Web 3.0 definition'. http://www.tourismkeys.ca/blog/2009/01/what-is-web-30-definition/ [Accessed 14 July 2011].

Marshall, C.C. & Shipman, F.M. (2003) 'Which semantic web?' http://www.csdl.tamu.edu/~marshall/ht03-sw-4.pdf [Accessed 24 July 2011].

OCLC Online Computer Library Center (2005) 'Perceptions of libraries and information resources'. http://www.oclc.org/reports/2005perceptions.en.html. [Accessed 5 March 2016].

O'Connor, D. (2010) 'Apomediation and ancillary care: researchers' responsibilities in health-related online communities' *International Journal of Internet Research Ethics* 3(12). http://ijire.net/issue_3.1/7_OConnor.pdf [Accessed 23 August 2011].

Robu, I. (2008) 'Semantic web applications in biology and medicine' *Journal of the European Association for Health Information and Libraries,* 4(1), 39–42.

Saunders, M., Lewis, P. & Thornhill, A. (2007) *Research methods for business students*. Harlow: Pearson.

Schultz, W. (2006) 'Web 2.0: where will it take libraries'. http://www.oclc.org/nextspace/002/6.htm [Accessed 12 March 2012].

Wahlster, W. & Dengel, A. (2006) 'Web 3.0: convergence of Web 2.0 and the semantic web' *Technology Radar,* 2 (June), 1–23.