



Advances in Search Engine Technology and Their Impacts on Libraries

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Abstract: *Libraries see themselves as central information providers for their clientele, at universities or research institutions with the development of the World Wide Web, the “information search” has grown to be a significant business sector of a global, competitive and commercial market. Powerful players have entered this market, such as commercial internet search engines, information portals, multinational publishers and online content integrators. If libraries do not want to become marginalized in a key area of their traditional services, they need to acknowledge the challenges that come with the globalization of scholarly information, the existence and further growth of the academic internet.*

Keywords: *Library, Information Search, Globalization, Information Portals*

Introduction

With today's instant anywhere-anytime access to Google, Bing and Wolfram Alpha, where searching for information takes a few micro seconds via an internet connected device, some people regard physical libraries as a quaint relic of a forgotten age. Looking at the practice of today's digital library portals we get the impression that the internet is almost non-existent in the academic resource discovery environment. What we find are online library catalogues, electronic journals and (sometimes) e-books, which are mainly digitally converted print materials that have traditionally been the focus of library acquisition policies. Also, databases have been well known for a long time. Content is generally delivered through well-established service channels by publishers, book-houses or subscription agencies. The digitization of publishing and the advent of the World Wide Web have resulted in the proliferation of a vast amount of content types and formats that include, but are not limited to, digitized collections, faculty and research groups' websites, conference web servers, preprint/e-print servers and, increasingly, institutional repositories and archives, as well as a wide range of learning objects and courses.

There are challenges still facing libraries in Nigeria today despite the availability of computerization and automation of library resources. Nok (2006) explains that, some of these challenges include: unreliable WAN/LAN connections that are usually exposed to effects of fire, storms and vandalization, shortage of computer literate staff in the libraries, poor state of power generation, poor maintenance and update culture and poor funding of libraries. Adegboro (2010)

further explains that hardware breakdown, software problems, unreliable and epileptic power supply, inadequate funding, staff training deficiency and planned obsolescence of commercial software are part of the challenges facing automation of libraries. Gbadamosi (2012) posits that band with subscription, daily and routine maintenance of computer set and lack of steady funding of library services are some challenges facing library automation.

This study examined the advances in search engine technology and its impact in NOUN library and how its adoption has help solve the challenges of automation and management of physical resources. And to also find out how NOUN library is able to adopt the use of search engine in its library despite the budgetary issues, as fear of eliminating staff and concerns over high subscription of search engine adoption.

Objectives of the study

The broad objective of the study is to examine the advances and impact of search engine technology on use of libraries. The specific objectives are to:

1. Determine the existing computer networks available in NOUN Library.
2. Determine the Rationale for adopting search engine by students.
3. Determine the Information services provided using search engine.
4. Proffer solutions and recommendation to the impacts of search engine technology on library usage.

Literature Review

Conceptual framework

Yahoo Dictionary Define

“A software program that searches a database and gather and reports information that contains or is related to specified terms.” “A website whose primary function is providing a search engine for gathering and reporting information available on the internet or a portion of the internet.”

Wikipedia

“A **web search engine** is a software system that is designed to search for information on the World Wide Web. The search results are generally presented in a line of results often referred to as search engine results pages (SERPs). The information may be a mix of web pages, images, and other types of files. Some search engines also data available in databases or open directories. Unlike web directories, which are maintained only by human editors, search engines also maintain real-time information by running an algorithm on a web crawler.”

\Work of Search Engine

Content development and optimization - Backed with skilled and talented content developers, Search Engine Optimization companies are responsible for creating rich and quality content and its optimization. The content written is grounded on the keywords suitable for that website. The content optimization is done by placing relevant keywords in the search engines, so that when anyone searches your company with the help of those keywords, he/she can reach your website through search engine results.

Link building - Directed in the form of extra information in several websites, search engine optimization companies build links for a particular website. The links can be reciprocal or non reciprocal in nature.

Directory submission - Directory submission is quite an innovative and different approach used by search engine optimization companies to create online presence and high visibility of websites amongst directories.

Popular search engine:

A very important point to keep in mind is that there are in actuality; very few search engines that are worth bothering with. There are dozens of laser search engines out there that you might consider submitting to but usually they aren't worth your time. Submitting to a search engine is easy- simply find their 'Add URL' link, and you have land on their site submission page.

Google (www.google.com)

Universal search was launched by Google on May 16, 2007. It was an idea which merged the results from different searches into one. Prior to Universal search, a standard Google search would consist of links to different websites. Google quickly become the most used search engine on the web due to its accurate result and a massive index. Some of its features include a definition link for most searches including dictionary words, the number of results you got on your search, links to other searches (e.g. for words that Google believes to be misspelled, it provides a link to the search results using its proposed spelling), and many more.

Yahoo (www.yahoo.com)

Yahoo Search also provided their search interface in at least 38 international markets and a variety of available languages. Yahoo has a presence in Europe, Asia and across the Emerging Markets. Yahoo Search indexed and cached the common HTML page formats, as well as several of the more popular file-types, such as PDF, Excel spreadsheets, PowerPoint, Word documents, RSS/XML and plain text files. For some of these supported file-types, Yahoo Search provided cached links on their search results allowing for viewing of these file-types in standard HTML. Yahoo search result pages also include WebPages from a search engine's index.

Lycos (www.lycos.com)

Lycos Europe was a joint venture between Lycos and the Bertelsmann transnational media corporation, but it has always been a distinct corporate entity. Although Lycos Europe remains the largest of Lycos's overseas ventures, several other companies also entered into joint venture agreements including Lycos Canada, Lycos Korea and Lycos Asia. Lycos started as a spider-based engine but in '99 changed to a directory, getting listing from the open Directory, with secondary result coming from FAST and Direct Hit.

FAST Search (www.alltheweb.com)

Also known as 'ALL THE WEB', FAST has always intended to index as much of the web as possible. It has a consistently large index and was the first search engine to break the 200 million result mark. FAST offered an enterprise search product, FAST ESP. ESP is a service-oriented architecture development platform which is geared towards production searchable indexes. It

provided a flexible framework for creating ETL applications for efficient indexing of searchable content. Fast also offered a number of search-derivative applications, focused on specific search use cases, including publishing, market intelligence and mobile search.

ASK (www.askjeeves.com)

This smart search engine launched in '97, and used to be known as "Ask Jeeves", featuring a gimmicky butler who should answer your questions. The secret to the accuracy of Ask Jeeves is human intervention. About 30 people work full time creating the knowledge base of questions, which currently numbers about 7 million. They come up with ideas on their own, especially for popular topics, and they also watch what people are actually searching for. A good engine and popular with new web users.

Go To (www.goto.com)

To get a good listing in Go To, you have to pay, which is becoming an increasingly popular way for the search engine to make money.

AltaVista (www.altavista.com)

AltaVista used to be one of the most popular search engines on the web, due to a consistently large index and many advanced tools for searchers. AltaVista service had two innovations that put it ahead of other search engines available at the time: it used a fast, multi-threaded crawler (Scooter) that could cover many more web pages than were believed to exist at the time and it had an efficient back-end search, running on advanced hardware. AltaVista's site was an immediate success. Traffic increased steadily from 300,000 hits on the first day to more than 80 million hits per day two years later. The ability to search the web, and AltaVista's service in particular, became the subject of numerous articles and even some books.

Netscape Search

The search engine offered to Netscape users at Ntescape.com. many results come from the open directory, with paid listing also making an appearance.

HotBot

HotBot became a popular tool with search results served by the Inktomi database and directory results provided originally by LookSmart and then DMOZ since mid-1999. Hotbot also used search data from Direct Hit for a period, which was a tool that used click-through data to manipulate results. It was launched using a "new links" strategy of marketing, claiming to update its search database more often than its competitors. It also offered free webpage hosting, but only for a short time, and it was taken down without any notice to its users. It was one of the first search engines to offer the ability to search within search results.

DogPile (www.dogpile.com)

Dogpile is useful search engine because the result you see are actually search result it gets from other search engines.

Library and online content

Libraries see themselves as central information providers for their clientele, at universities or research institutions. But how do they define academic content? Looking at the practice of today's digital library portals we get the impression that the internet is almost non-existent in the academic resource discovery environment. What we find are online library catalogues, electronic journals and (sometimes) e-books, which are mainly digitally converted print materials that have traditionally been the focus of library acquisition policies. Also, databases have been well known for a long time. Content is generally delivered through well-established service channels by publishers, book-houses or subscription agencies.

Library online web content

While libraries concentrate on the building of local digital library portals and simultaneous searches across a selected number of licensed and free databases, do they see the incredible volume of academic content that is already available on the web? Although there are no reliable figures on the overall volume of web content there have been some studies that give estimations. Already published in 2001, a white paper from Michael Bergman on the "Deep Web", highlights the dimensions we have to consider. Bergman talks about one billion individual documents in the "visible" and nearly 550 billion documents on 200,000 web sites in the "deep" web. The exponential growth since 2001 can be read from the fact that in May 2004 Google gives the size of their index (i.e. visible web content) with more than 4,2 billion web pages (compared to 3,3 billion web pages in 2003).

Online Consortia

The explosion of information and inadequate library urged the libraries to adopt new philosophies and technologies for collection development and reduce the costs information. Library Consortium is an Association of a group of libraries to achieve mutually the common objective. It is felt that the concept of E-Journals consortia can work well the libraries without requiring additional fees to access the e-journal.

Like INFONET by UGC, ICMR, CSIR by DSIR, NList.

The impact of internet search engines on libraries

It is a fact that with the advent of the World Wide Web, the information "search" has grown to be a significant business sector of a global, competitive and commercial market. Libraries are only one player within this market. Other stakeholders include, but are not limited to, publishers, online content integrators and commercial internet search engines.

In any market situation it is of paramount importance to take a close look at potential customers and their usage behavior. For librarians this might sound obvious as it is their genuine perception that they consider implicitly the demands of users—or rather what they consider to be the demands of their users. But the new, competitive situation forces libraries to see things much more from the perspective of the user. First of all, this is an acknowledgement that, particularly at universities, libraries deal with a range of users with often different usage behaviors'. It almost goes without saying that an undergraduate has other demands for information than a qualified researcher, and their usage behaviors' can vary substantially. Young undergraduates will try much harder to transfer their general information seeking behavior (using internet search

engines) to the specific, academic environment, while established researchers have better accommodated the use of specific search tools. Before the WWW had been developed, this differentiation was, from the librarian's point of view, only relevant with respect to the level of training that various user groups required in order to use the library's resource discovery tools (printed catalogue, online catalogue, digital library portal). Today, with a whole range of general search engines available, users have the opportunity to use other catalogues (public or academic), and portals than those found in the library. Library users have been "empowered" by Google-like search engines to make their own choice about a search tool and to approach the world of information without any training. While librarians are mainly worried about the quality of information resources that are covered by mainstream search indexes, their users love these new tools and they would like to use them for any type of information search.

Information indexes and Academic Libraries

The discussion among libraries about their strategy for discovering the academic web has only started. Some institutions have decided to expose segments of their "invisible" content to Google (such as library catalogue records and institutional e-prints), a very pragmatic and cost-saving way to make quality content "visible" and at the same time searchable through this popular search service. While one can see the rationale in simply using existing internet services, libraries should not at this point omit to draft their own strategy and technical concepts for the academic internet.

Apart from the obvious limitations that libraries should be aware of, there are also some myths around that should be named—and immediately dismissed. "Search engine technology can't handle structured, high quality data" is as wrong as "Search engine technology comes only with simple (i.e. simplistic) search boxes". When statements like those described come up, people are simply mixing up some implementations with the actual potential of this technology.

Building of Digital Library/Repositories

Search engine can only be efficient in a digital library, digital library is not an offshoot of search engine but search engine provides an opportunity for libraries to use a cost effective platform to build a functional and efficient digital library. It has been observed that search engine is not all together a new technology but an adaption of existing technologies and paradigms. Dhanevandin & Tamizhcheven (2014) provided the following as the characteristic of digital library:

- Digital object that include video, audio, and multimedia,
- Numeric components automated knowledge discovery tools.
- Access from user's desk
- Remote to rare and expensive material.

For these authors, digital library is only a step away from virtual library. It has its deficiencies which search engine can provide remedy for. Kumar et al (2012) highlighted the problems of digital library that is housed in the server and maintain by Library locally thus:

3 Data resources of various libraries are relatively independent and therefore lead to building of redundant projects.

4 Uneven economic development in different regions causes DL's resources to be relatively short. The cost of procuring, maintaining, installing and so on is high to solve this problem; they advocated an improvement in the user services model in libraries which includes the adoption of cloud technology in digital library.

Search engine provides library the opportunity of building digital library in the cloud, digital library built in the cloud makes resources, information, and services, at an efficient level, accessible via the network. Kumar et al (2012) posited that although there are OPAC (Online public access catalog) and ILL (Inter-library Loan) services already, library users still cannot access platform. However, search engine provides an integrated library resource that supports distributed uniform access interface. Simultaneously, the uniform access platform can promote library resources, guide and answer user's questions by using high-quality navigation. They further stressed that since library, by nature stores, processes, and spreads knowledge, the knowledge service model could provide users with efficient transmission of information and knowledge services. Kaushik and Kumar (2013) submitted that in connection to cloud based digital library software, Duraspace has two software's; namely, Dspace and Fedora Commons but Duraspace is widely used for building digital libraries/ repositories with standard interfaces and open source codes for the both software.

Search Library Data

Digital library build on cloud infrastructure provides a unified search service this enables users to search a pool of library data through any device with internet connectivity.

Search engine provides an integrated library resources opined Kumar et al (2012). Kaushik and Kumar (2013) suggested that OCLC is one of the best examples for using search engine for sharing libraries data for years. OCLC, they stressed further, offers various services, pertaining to circulation, cataloguing, acquisition and other library related services on cloud platform through the web share management system. Web share management system facilitates an open and collaborative platform that allows each library to share their resources, services, ideas, and problems with the library community on the cloud.

Website Hosting

Breeding (2012) noted that many libraries rely on institutional or commercial hosting services for their websites. Thus, library's web presence is not provided directly by the library itself but by its parent organization. With search engine, libraries have the forum to host their own website on a third-party service provider's services. This takes the responsibilities of hosting and maintaining their own servers. Google sites serve as an example for hosting websites outside of the library's servers and allows for multiple editors to access the site from varied locations.

Searching Scholarly Content

Cloud based research platform facilitates the discovery and sharing of scholarly content. Kaushik and Kumar (ibid) cited Knimbus as a knowledge cloud which is dedicated to knowledge discovery and collaborative space for researchers and scholars. Started in 2010 by entrepreneurs Rahul Agarwalla and Tarun Arora to address the challenges faced by researchers in searching across and accessing multiple information sources, currently, Knimbus makes use of over 600 academic institutions and R & D labs by scholars, researchers and scientists as well as over 50,000

researchers. According to Buyya (2009), the cloud based new generation of ILS allows many libraries to share useful data. For instance, sharing of full-text journal titles from electronic databases where many libraries subscribe to the same databases. In acquisitions section, all the data bases are listed in a pull down menu. A library can highlight a database for purchase and activate the journal list by clicking on the button.

File storage

Data storage in cloud is necessitated by the inherent fragility of all physical storage devices. A USB flash drive can be misplaced, a laptop or desktop could crash, or even be hacked; there are also incidences of hardware failures, software malfunctions, and malware attacks and so on. File storage capacity provided in the cloud is virtually limitless in addition to a much higher level of reliability than most libraries can accomplish within their own data center according to Breeding (2012 cited in GbajeAliyu 2014). Mayodza (2012) also noted that backups are much easier to create and risk associated with hardware failure is minimized with search engine.

Research Methodology

Research Method

This study will adopt the qualitative methodology approach. Qualitative research is defined as “any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification” (Mayodza, 2012). According to Creswell (2003), qualitative research takes place in the natural setting. He states that the qualitative researcher often goes to the site (office) of the participants to conduct the research. This enables the researcher to develop a level of detail about the individual or place and to be highly involved in actual experiences of the participants.

According to Denzin and Lincoln (1994), qualitative methodologies include “interviewing; observing; artifacts, documents, and records; visual methods; personal experience methods; data management methods; computer-assisted analysis; and textual analysis”. All of these methods may be useful in gaining an insight into the adoption of search engine technology for library services.

Population of the Study

The population of this study consists of five (5) members of National Open University of Nigeria Library. The target population of the study includes the University Librarian and the (4) staff of the Information Technology (IT) unit of the National Open University of Nigeria Library who are responsible for the administration of search engine technology.

Sample and Sampling Procedure

Purposive sampling technique will be used to select four (4) staff of the Information Technology unit and the University Librarian of the National Open University of Nigeria Library. According to Crossman (2012), “a purposive sampling is very useful for situations where you need to reach the targeted sample quickly and the sampling is not proportional in nature”. Therefore, the subject of the study is made up Four (4) Information Technology (IT) staff and the University Librarian of the National Open University of Nigeria Lagos Main library.

Instruments for Data Collection.

The instruments used to collect data for this study were direct observations, semi structured, unstructured interviews and the use of digital recorder to record the interview process. The semi-structured interview involve the researcher personally interviewing staff of the Information Technology (IT) unit, based on a structured set of questions that have been prepared before the interview. This enabled the researcher to explain or elaborate on any question that is not well understood by the respondents.

Interview

The semi-structured interview was directed at finding out the existing computer networks available in NOUN library; the rationale for the adoption of search engine in NOUN library; the information services provided through search engine in NOUN library; the implications in terms of staff, costs and maintenance of the adoption of search engine in NOUN library.

The other question was directed towards finding out the level of the adoption of search engine in NOUN library, areas that NOUN have implemented search engine in its library; any positive effect of the adoption of search engine in NOUN library; devices that NOUN Library use for search engine; layers of cloud services in NOUN library; search engine deployment model in NOUN library, cloud services provided in NOUN Library; cloud based library services for NOUN library; In conclusion the Interviewees was asked to comment on how NOUN library feel in storing data online.

The unstructured interview emanated from follow-up questions in response to some of the structured questions as well as observations during visit. The response was captured using digital recorder and analyzed thereafter.

Observation

Observation involves the use of eyes of the researcher rather than ear and voice (Lofland and Lofland 1995). Direct observation on the facilities that is available for cloud adoption, such as computer hardware and software. A condition of storage medium was also conducted to provide additional information that may be needed for the research.

Focus Groups

The researcher systematically questioned the University Librarian and staff of the Information Technology (IT) unit of NOUN Library as a focus group. The focus group was unstructured and semi-structured questioning techniques in order to elicit information on the adoption of search engine technology for library services in NOUN library and the strategies adopted for long-term cloud solutions, (Fontana & Frey, 2003). The focus group interview was used to build on data collected from individual interviews by verifying and elaborating on information supplied by the informants individually. The interview was audio taped and transcribed verbatim. Lofland and Lofland (1995) recommended considering focus group interviews as a supplement to intensive, one-on-one interviews if the topic is reasonably public and not something that would cause embarrassment to participants. They believe that the focus group offers “the advantage of allowing people more time to reflect and recall experiences.

Validity and Reliability of the Instrument

The instruments to be used for collecting data will be validated by the supervisor(s), academic staff, research experts and colleagues in the Department of Library and Information Science, Faculty of Education, Ahmadu Bello University Zaria. Corrections, vetting and suggestions by the aforementioned were incorporated in the final copy before administering it. The reliability of the instrument was established by conducting a pretest within two weeks at the Kogi State University Library with the following purpose: To test the method of data collection, and into pre-test the interview schedule. Reliability deals with the face validation of the interview and questions; some questions were used to ascertain the reliability of the result. This is because reliability deals with the consistency of measure and stability. According to Bryman (2008), reliability of instrument is very important as it deals with consistency, stability and detail treatment of issues using appropriate techniques.

Procedure for Data Collection

The researcher personally visited the site selected for this study, and conducted the semi-structured and unstructured interviews, examined appropriate documents and conducted observations. The researcher spent three days in the selected site observing the process and strategies of cloud adoption as well as examining relevant documents. Procedure for Data Presentation and Analysis

The data collected from the research instruments will first be organized for analysis and transcribed into different types, depending on the source of information. The data was then tabulated and discussed descriptively.

Data Presentation and Analysis based on the Research Questions

Research Question: To what extent do students utilize search engines for information retrieval in library?

Table 1: Mean and standard deviation scores on the extent to which Student Study utilize search engines.

S/No	Item	NA	LE	HE	VHE	X	SD	Decision
1	Yahoo Search	21	53	53	172	3.36 0	0.95	High Extent
2	Bing	64	67	67	58	87	2.61	High Extent
3	Google search	27	29	27	193	3.40	1.02	High Extent
4	Dog pile	140	88	45	3 1	68	0.78	Low Extent
5	Ask.com	75	71	77	53	2.39	1.08	High Extent
6	DuckDuckgo	155	75	23	23	1.69	0.94	Low Extent
7	Msn	134	134 66	37	39	1.93	1.09	Low Extent

8	Alta vista	133	133 89	35	19	1.78	0.92	Low Extent
9	Lycos	149	105	19	3	1.55	0.67	Low Extent
10	Infoseek	143	88	22	23	1.73	0.93	Low Extent

The overall mean of 1.93 with a standard deviation of 0.91 is below 2.50, indicating that the extent of utilization of various search engines by Student information retrieval is low.

Discussion and Findings

1. The result on the extent to which students of are aware of search engines for information retrieval indicated that the students to a low extent are aware of search engines for information retrieval. Also, the search engines most of these students are aware and use in information retrieval are yahoo search, Bing, Google search and Ask.com. The findings agree with the findings expressed by Akparobere & Oghale(2015) and Imeniwe (2018) that undergraduate students of Delta State University Abaraka are only aware and use Google and Yahoo search engines for their information retrieval.

2. The result presented above on the extent to which student utilize the various search engines shows that Students use only yahoo search, Bing, Google search and ask.com for their information retrieval. This result is in line with the result of the research conducted by Akparobore & Oghale (2015) on awareness, use and impediments of search engines by undergraduate students in Delta state university, Abraka Nigeria which shows that the students utilize Google search and yahoo search regularly for their information retrieval.

3. The finding also indicated that highest search engine used by these students is Google search the result is in agreement with similar researches carried out by Akparobere & Oghale (2015), Imeniwe (2018) on the undergraduate of Delta State University Abaraka and Msurshima (2010) on awareness and use search engines by undergraduates of University of Agriculture, Makurdi, Benue State which revealed that these undergraduate are similar with Google search and use it frequently for information retrieval.

Conclusion

The uses of search engines in the retrieval of information help in keeping students abreast of current information from the internet for study and research. The results of this study have vital educational implications on research and study being carried out by these undergraduates. It implies that these undergraduates may not be aware of current information existing in their area of study. So there is an urgent need to include digital information literacy content into the curriculum for all the students, faculties and researchers. The librarians should create awareness on the use and skills needed for the use of search engines in information retrieval using different channels such as posters, library websites, library orientation and library week.

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