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Examining Privacy Issues Associated with Cloud Computing Practices in Kenyan Public Libraries

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ABSTRACT

Libraries are currently operating under a very technologically savvy environment characterized by continuous innovations in information access preferences. The adoption of cloud computing services in modern libraries is ecstatic, given the effective use of mobile technology. Data security is at stake and it gets particularly critical when a third-party is involved. The main objective of this study was to assess key privacy issues associated with Cloud Computing Services in Kenya. The Study was undertaken at Kenya National Library Services, Nakuru County. The study adopted a descriptive research design in its research methodology. The study target population comprised of library staffs and users. A sample of 80 respondents was selected using stratified sampling technique and purposive sampling technique. Data was collected using questionnaires which were analyzed both qualitatively and quantitatively. The findings were presented in tables and graphs. Based on the findings of this study, library users are not aware of privacy threats when accessing library services through cloud computing. According to this research, patrons trusted providers of cloud computing services with all their information unknowingly. The users displayed a dire need for training on implications of privacy infringement and measures to take when using cloud computing services. The study indicates a magnitude of privacy threats associated with access to information materials through the cloud and poor safely measures within the cloud computing systems. The study recommended that the management should focus more on training users frequently, upgrade their technological measures and create more awareness on privacy issues among library patrons.

KEYWORDS: Cloud Computing, privacy, infringement of privacy, cloud computing services, privacy issues, Data security, Privacy threats

1. INTRODUCTION

In the wake of technological advancement, users are experiencing effective use of computers and mobile phones. Access to information is effective and efficient both within and without the library. With this pool of enlightened users, technology is posing as a threat on privacy and use of information. Public libraries are called upon to boost

their service delivery by taking advantage of prevailing technological solutions such as cloud computing. This premise, invokes a sense of responsibility on library professionals and users regarding privacy and security of private information. Suman and Singh (2016) observed that technology is slowly moving towards cloud hence it is the transition from traditional software to complete dependence of the internet. Cloud computing looks promising especially when it comes to collaboration through mobile devices.

Cloud computing is an outsourcing concept where computer programs, infrastructure, and services are virtually held. The implication of cloud computing is where libraries can make use of any computer program, infrastructure, and services without installing them within their institutions. As such, the technology exempts libraries from incurring the financial and fiscal cost of installing and maintaining cloud computing facilities. It offers on-demand usage of computer services over the internet. Users of the technology worry less about storage, they only need to access the required software, infrastructure, or service when required.

Initially, traditional applications were complicated and expensive since the hardware, software and experts would configure and test them before letting it run. With cloud computing, the process is simpler and easier given that the burden of managing hardware and software is completely eliminated (Yee, 2012). Cloud is more or less like a utility where there is shared infrastructure hence users only pick what they need. Cloud-based applications cost less yet users can browse for long. Through the cloud, there is room to customize applications based on the needs of the user. Currently, organizations are moving their programs into the cloud.

Public libraries have also implemented the concept of cloud computing through cooperation by extensively making use of the web and making it freely available to users. The approach is meant to save time on tasks and more so improve access to information regardless of time and space. Modern libraries have popularized cloud computing in their operations through automation. Computer technology is crucial in running functions of the library (Winkler, 2011).
The software used to manage libraries is quite expensive hence prompting libraries to adopt cloud computing technology which is free and less demanding in terms of cost.

Incidences of software and hardware failure have necessitated the use of cloud computing to store and use data. The use of Online Public Access (OPAC) is a way in which cloud computing has been maximized by all modern libraries. The OPAC stores all bibliographic details of information materials hence users can effectively search and access them. Through the Boolean logic operators users can combine terms to reach expected search results. The OPAC has the ability to incorporate other features and details such as the list of borrowed materials, fines and reservations are accessible to the staff (Camenisch et al., 2011).

2. STATEMENT OF THE PROBLEM

Kaushik and Kumar (2013) observe that cloud computing is a new direction towards efficient and cost-effective use of computer systems by libraries. System changes are enhanced through cloud computing in order to provide users with better and timely services. Hashizume et al. (2013) assert that cloud computing technology offers a great deal of computing benefits to any institution that is seeking to improve the quality of its services. Yuvaraj (2015) forecasted that libraries are bound to increase their early adoption of innovative technologies deemed effective for streamlining management and delivery of information services to their users.
Adoption of cloud computing solutions in public librarianship is likely to be on the increase in Kenya based on the changes. Public libraries in Kenya including Kenya National Library Services have adopted cloud computing in their services to boost cost-effective delivery of quality services

Paquette *et al.,* (2010) says library services such as access to electronic resources and storage of patron profile is very sensitive when they are outsourced to a third-party like providers of cloud computing services. As much as adoption of cloud computing seems to be a suitable strategy for improvement of library services, such libraries also need to ensure security and privacy of their users (Suman & Singh, 2016).

According to observation, minimal studies have been done to ascertain the specific privacy issues being experienced. This has been experienced in regard to public libraries' adoption of cloud computing, especially in the context of Kenya National Library Services in Nakuru County. Therefore, this study intends to bridge the mentioned knowledge gap by examining privacy issues associated with Cloud Computing in Kenya National Library Services within Nakuru County.

2.1 Conceptual Framework

Figure provides a graphical illustration of the relationship between major variables of the study; cloud computing practices within Nakuru branch of KNLS and privacy of their users. Privacy in the use of cloud computing services at KNLS, Nakuru branch is conceptualized as a factor of system vulnerabilities occasioned by outsourcing computer programs, storage services, and communication services from a provider of cloud computing services. Such practices are understood to open the system for intruders, hackers, and other malicious users of the same platform to spy on the library users' data. Additionally, unscrupulous vendor of cloud computing services may maliciously access users' data for commercial purposes.

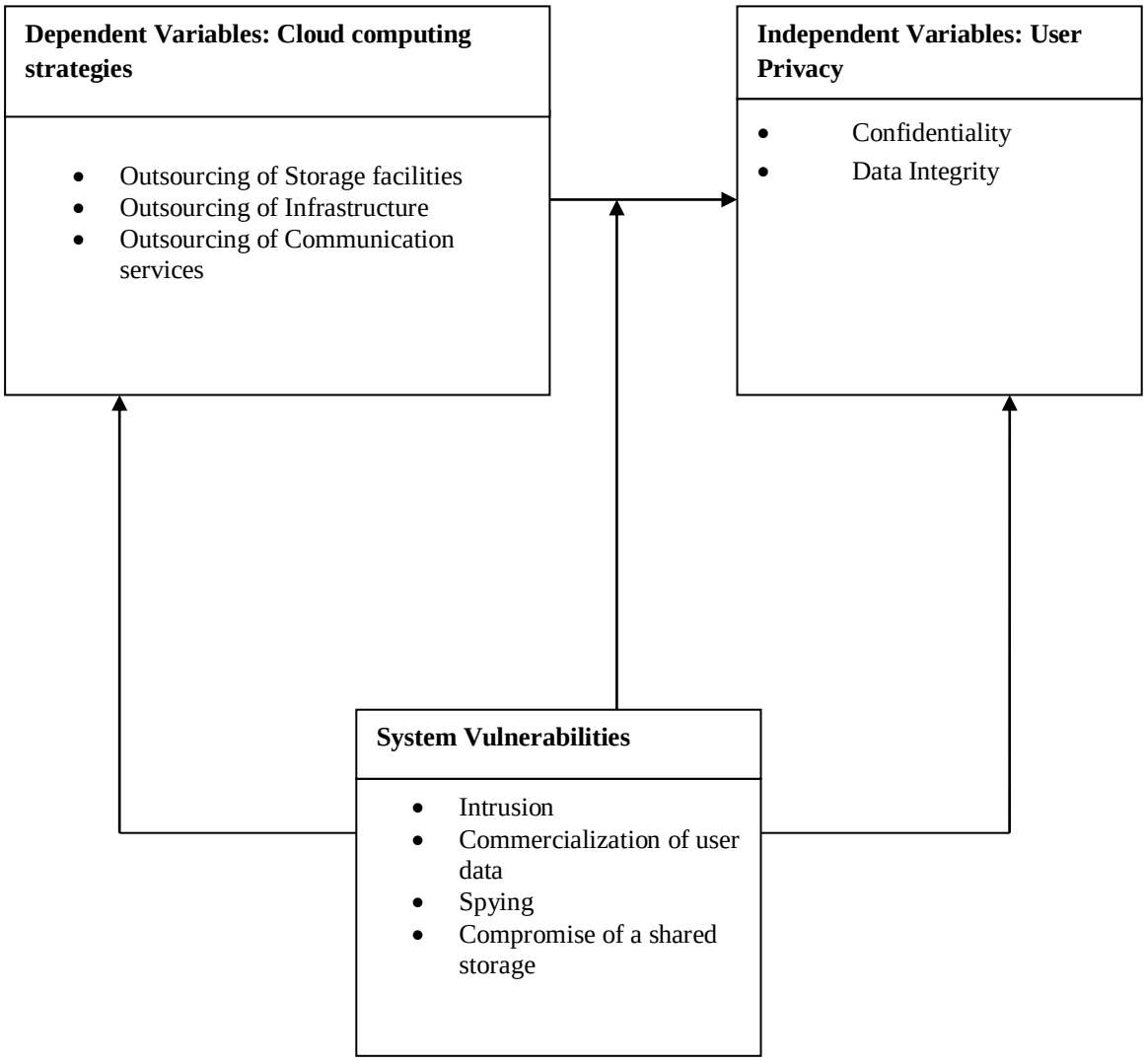

Figure : Provides a graphical illustration of the relationship between major variables of the study

2.2. Aim of Study

The aim of the study was to examine the effect of Cloud Computing and Practices on Privacy in Public Libraries at Kenya National Library Service (KNLS) Nakuru County.

2.3 Objectives of Study

i. Assess key privacy issues associated with Cloud Computing Services in Kenya National Library Services, Nakuru County.

ii. Evaluate extent of user education on privacy in cloud computing as practiced by KNLS, Nakuru County.

3. LITERATURE REVIEW

Cloud computing an on-demand service offered to the clientele. Within the cloud computing environment users can effectively manage library services over the internet. The library personnel ensures that services over the cloud are managed and facilitated with the right guidelines. The patrons utilize these services for endeavoring their businesses and make payment to the service provider accordingly. The cloud computing environment offers two main functions; data storage and computing. Within this environment, cloud consumers only need internet access to do their daily computing tasks. In the process of access, users are not even aware that the source of data storage is all virtual (IGI, 2019).

Data protection is the primary mode of gaining user's trust within the cloud technology. Data protection techniques were proposed within the field of research to aid in cloud computing. Cloud computing services have been provided across the world where organizations and companies strive to extend their services to many users at a minimal cost. Cloud computing is an effective concept for all IT applications however, there are a few areas to rectify in cases of privacy of personal users (Yuvaraj, 2015).

Challenges in adoption of the cloud computing concept are related to data security which is engulfed in the overall aura of compliance, security, privacy, trust and legal matters. Public libraries hosts all kinds of clients from young children to adults hence there is more to learn and adopt in terms of privacy (Zimmer, 2015).

Data security is a major concern that any institution faces especially when it comes to cloud computing environment. Data is likely to scatter in different storage devices, servers, mobile phones, wireless sensors and machines. Data security is complicated if proper measures to secure private information is not taken seriously (Victor, 2015).

Adoption of cloud services depends on the service providers such as Google Apps, Azure, Amazon and Microsoft. Public cloud services are provided by cloud service companies such as Google and Amazon. In the public cloud, anybody can make use of the services while hybrid incorporates both private and cloud attributes. Cloud computing services are beneficial to public libraries given that it saves time and money in terms of access and use of information materials and resources (Rittinghouse & Ransome, 2016).

Cloud computing issues in a public library are linked to resource management, unauthorized access, resource security and resource monitoring. The fact that no rules and regulations in access and use of cloud services exists, makes it hard to control and standardize cloud services. Other issues are related to governance, management, tracing and confidentiality. The threat of malice is deeply rooted in the access and use of cloud services. Information service providers are expected to educate users on security threats and ways of mitigating them (Bento, 2012).

Esse (2014) describes user education as an educational programme offered to library users for their effective use of library services and resources. The power of information in people's lives is a central theme of the field of library and information science. Security and privacy of every library user depends on the kind of knowledge they acquire about the subject of online security.

Bhatti (2007) observed that the need for user education within public libraries has increased with the complexity and changes in technology. The technological dynamics, change in education systems, and social adjustments have made it necessary for public library managers to revamp their user education programmes in content and scope. Public libraries such as KNLS have a great need to ensure that their users are well educated on how to safeguard their privacy when accessing cloud computing services.

Even though user education is a classic concept in the field of librarianship, minimal focus has been laid on technical issues such as cloud computing and associated privacy concerns. Major focus of user education has been on the access and use of print materials held within the library. Nevertheless, it has been noted that proper education of library users prepares them to be lifelong learners and independent members of the society (Bhatti, 2007).

Data integrity is a critical subject in information systems that stipulate how information should be protected from unauthorized access, modification, deletion and fabrication. KNLS needs proper access policy that outlines how resources should be managed. Data integrity is managed based on matters of database constraint and transactions. This is done through the Database Management System (DBMS) while all transactions are carried through the Atomicity, Consistency Isolation and Durability (ACID) systems (Kaur & Kaur, 2013).

Techniques on data integrity, privacy and intrusion are made available within the public library. Storing data in multiple clouds and databases is a measure towards ensuring data security (Paquette et al., 2010).The service provider has the mandate to ensure data security is assured based on integrity and confidentiality measures. The users should be assured of data safety and more so confidentiality when accessing and using data. Data management include measures such as data confidentiality, Data encryption, distributive storage, hybrid technique, data concealment, deletion confirmation, Data availability and reliable data availability (Sangroya et al., 2010).

Data availability means ensuring that users can access their documents even when they have challenges such as damage of their machines and network failures (Kirlappos, 2016). Updated data should be maintained and regularly checked based on data encryption (Zimmer, 2015). Similarly, data encryption is a good storage remedy that supports modification of data by users without compromising on their integrity.

Privacy of library users stands out as a major concern to users as well as managers of public libraries across the globe, especially in the context of cloud computing. Different aspects of cloud computing have been adopted by KNLS and they are assessable to users in every branch, including Nakuru branch (KNLS, 2017).Intrusion, hacking, and access by unauthorized entities are some of the privacy issues likely to be faced by users of cloud computing. However, there is a glaring lack of literature on such issues in the context of library and information services offered by public libraries in Kenya. The identified literature gap makes it necessary for this study to be carried in order to bridge it.

4. RESEARCH METHODOLOGY

The study was located in Kenya National Library Services public library situated within Nakuru town. Nakuru town is one of the fastest growing towns in Kenya in terms of human population and revenue collections. The town's strategic location makes it a prime consumer of library and information services. The study used quantitative and qualitative methods to collect primary data from study respondents. Questionnaires were used to collect data from managers and users of library and information services from KNLS within Nakuru County. The study aimed at collecting data from members of KNLS staff in Nakuru branch and regular users of the same library. The two sampling techniques were also used to get frequent users of different library services to give well-informed opinion on the study topic. The data collected would be good sourced of giving recommendations and conclusions for the study.

The researcher committed to uphold maximum standards of ethics throughout the research process. The researcher obtained approval to conduct research from National Council for Science and Technology (NACOSTI) with permit number NACOSTI/P/20/6576.

5. RESEARCH FINDINGS

This subsection presents the demographic information of the library staffs who were involved in the study.

The study aimed at collecting data from 30% of KNLS library staff members in Nakuru branch, especially those dealing with ICT components of the library and 30% of library users, especially the frequent users. The study's choice of 30% sample size was informed by Mugenda and Mugenda (2013) which recommended 10% of the total population as the minimum threshold.

The details are summarized in table below.

Table 1: Demographic Information of the Staff

	Category	Frequency	Percentage
Gender of the Respondent	Male	2	40
	Female	3	60
	Total	5	100
Highest Academic Qualification	PhD	1	20
	Masters' Degree	1	20
	Bachelors' Degree	2	40
	Diploma	1	20
	Total	5	100
Position in the library	Chief Librarian	1	20
	Deputy Librarian	1	20
	Systems Librarian	1	20
	Senior Library Assistant	1	20
	Library Assistant	1	20
	Total	5	100
Duration of work	1 -5 years	1	20
	6 -10 years	3	60
	11 -15 years	1	20
	Total	5	100

Awareness of cloud computing	Yes	5	100
	No	0	0
	Total	5	100

As illustrated in table 1 above, 60% of the library staffs were females while 40% of them were males. On academic qualifications, most of the staff (40%) had Bachelors' degree as their highest academic qualification while those who had PhDs, Masters' degree and Diploma each constituted 20% of the staff. There was an equal representation of each position in the study. The positions represented included the Chief Librarian, Deputy Librarian, Systems Librarian, Senior Library Assistant and a junior Library Assistant. On duration of work, most of the staffs (60%) have been in their current position for a period of between 6 years and 10 years. All the library staffs who were involved in this had a knowledge of cloud computing.

Table 2: Demographic Information of the Users

	Category	**Frequency**	**Percentage**
Gender of the Respondent	Male	28	46.7
	Female	32	53.3
	Total	60	100
Highest Academic Qualification	PhD	4	6.7
	Masters' Degree	23	38.8
	Bachelors' Degree	19	31.7
	Diploma	9	15.0
	Certificate	5	8.3
	Total	60	100
Profession	Education	12	20
	ICT	10	16.7
	Business	15	25
	Law	6	10
	Medicine	5	8.3
	Agriculture	6	10
	Librarianship	3	5
	Banking	3	5
	Total	60	100
Frequency of library attendance	Daily	13	21.7
	Weekly	29	48.3
	Monthly	10	16.7
	Rarely	8	13.3
	Total	60	100

Based on the findings in table 2 above, 53.3% of the users were females while 46.7% of them were males. On academic qualifications, most of the users (38.8%) had Masters' degree as their highest academic qualification, 31.7% of them had Bachelors' degree, 15% of them had diplomas, 8.3% of them had certificates and 6.7% of them had PhDs. On profession, majority of the users (25%) were in the field of business, 20% of them were in education,

16.7% were in ICT, 10% were in agriculture with a similar percentage in law, 8.3% were in medicine and 5% were in library with a similar percentage also in banking. On frequency of library visits, most of the users (48.3%) visit the library on a weekly basis, 21.7% of them visit on a daily basis, 16.7% of them visit on a monthly basis and 13.3% of them visit the library rarely.

The library services offered by KLNS through cloud computing included user registration, electronic resources access, electronic mailing, storage of user profiles, social interactions, current awareness service, document download service, collection development, document sharing, file sharing and information literacy/user education among others. On privacy issues associated with cloud computing, users displayed lack of awareness of privacy threats when accessing library services through cloud computing. Majority library freely allow providers of computing services to access their profile hence putting them more vulnerable to privacy infringements.

On user education, most of the users had been trained on privacy threats associated with cloud computing similarly on how to detect privacy infringement. On policies and technological measures, some of the policies which the library management had put in place to protect the users from privacy infringement included policy on handling of privacy threats associated with cloud computing, policy on accessing information without infringing into another user's privacy, policy on sharing information without putting their privacy at risk, policy on training of users on privacy issues associated with cloud computing and policy on measures to be taken upon detection of privacy infringement when using cloud computing services.

The extent to which the users adhered to policy on handling of privacy threats associated with cloud computing and policy on measures to be taken upon detection of privacy infringement when using cloud computing services was generally low. Technological measures put in place lacked the capacity to detect threats associated with cloud computing with ease. The measures also lacked the capacity to ward off system hackers. The measures lacked the capacity to allow easy sharing of information without violating user's privacy.

6. CONCLUSIONS AND RECOMMENDATIONS

The library services offered by KLNS through cloud computing included user registration, electronic resources access, electronic mailing, storage of user profiles, social interactions, current awareness service, document download service, collection development, document sharing, file sharing and information literacy/user education among others. On privacy issues associated with cloud computing, users displayed lack of awareness of privacy threats when accessing library services through cloud computing.

Majority library freely allow providers of computing services to access their profile hence putting them more vulnerable to privacy infringements. On user education, most of the users had been trained on privacy threats associated with cloud computing similarly on how to detect privacy infringement. On policies and technological measures, some of the policies which the library management had put in place to protect the users from privacy infringement included policy on handling of privacy threats associated with cloud c

The aim of the study was to assess key privacy issues associated with Cloud Computing Services in Kenya. According to the study, it can be concluded that the Kenya National Library Service (KNLS) has implemented cloud computing services in the delivery of their services however, it has not fully educated the users on its privacy threats. Then study indicates some degree of laxity among the staff to implement the policies put in place to mitigate privacy threats.

The technology applied on data protection is also not effective in achieving maximum privacy. From the findings of the study, recommendations offered to the library regard to adoption of effective training programmes and strict adherence to policy measures. The research recommends acquisition of up to date technological measures with the capacity to put at bay privacy threats. Employment of skilled technical staff would solve major challenges relating to effective access and use of cloud computing services.

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