TRANSFORMATIVE ASPECTS OF WIRELESS INNOVATIONS IN ACADEMIC LIBRARIES IN KENYA: CASE OF THE UNIVERSITY OF NAIROBI LIBRARY

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DECLARATION

This research project is my original work and has not been submitted for examination to any other university.

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DEDICATION

This work is dedicated to my supervisors Dr. Makori and Dr. Irura, my parents-the Nyabutos, my husband Mr. Haron Timo, children Megan, Legan and Keegan for the support during the entire period.

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ABSTRACT

The aim of this study was to investigate the transformative aspects of wireless innovations in academic libraries in Kenya with reference to University of Nairobi library. Objectives were to: find out the extent to which wireless innovations have promoted use of digital information resources in academic libraries, examine how wireless innovations have transformed delivery of services in academic libraries, establish applications of wireless innovations in academic libraries, and propose effective strategies to enhance wireless innovations in academic libraries. The research was a descriptive survey with certain aspects of qualitative methods. The research instruments used in the study were questionnaires and interview schedules. In total 16 staff at the library were purposively selected on merit out of which 10 staff participated in a face to face interview. Questionnaires were issued to 96 postgraduate students from the College of Humanities and Social Sciences. Personal interview guides and questionnaires were administered to the respondents. Collected data were coded and analyzed using Statistical Package of Social Science and Microsoft Excel and presented by use of tables, charts, percentages and narratives. The major findings from the research revealed: that wireless innovations have enabled flexibility with presence of portable devices; that with the changing users' needs and demands, academic libraries are creating digital libraries with e-resources, e-repositories with authentic, authorized and quality online resources for online and distance learning, e-learning and e-publishing; that contrary to academic libraries in developed countries, JKML libraries have neither embraced nor popularized use of wireless innovations for online library lending of materials, internet of things, connectivity beacons, virtual library cards and loaning hotspots; and that presence of firewalls as a form of security was not enough as there were cases of sharing of passwords with outsiders which made the number of users to overpower the bandwidth. Recommendations include: sensitization to encourage more library users to explore use of wireless innovations to access digital information resources; development of mobile smart applications by library professionals to offer users self-service; increase security and hiring expertise for continued upgrade and regular maintenance of wireless technologies. Besides, academic libraries need to create mobilization programmes to adjust to the trends and user demands and take information services to another level such as digital repositories, electronic information resources, remote access, interactive websites, and social networks among other technologies. Suggestion for further research is recommended on potential capabilities of wireless innovations in academic libraries to maximize utilization of information resources.

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LIST OF ABBREVIATIONS AND ACRONYMS

AL	:	Academic Libraries
CC	:	Cloud Computing
CDs	:	Compact Disks
CHSS	:	College of Humanities and Social Sciences
DVDs	:	Digital Video Discs
GIS	:	Global Information Systems
IEEE	:	Institute of Electrical and Electronics Engineers
ICT	:	Information Communication Technology
ICTs	:	Information Communication Technologies
IoE	:	Internet of Everything
IoT	:	Internet of Things
JKML	:	Jomo Kenyatta Memorial Library
LiFi	:	Light Fidelity
LTE	:	Long Term Evolution
MAC	:	Mobile Access Control
MCC	:	Mobile Cloud Computing
MSN	:	Mobile Sensor Networks
RFID	:	Radio Frequency Identification
UoN	:	University of Nairobi
VLC	:	Visible Light Communication
VPN	:	Virtual Private Network
VPN	:	Virtual Private Network
Wi-Fi	:	Wireless Fidelity
WiMAX	:	Worldwide Interoperability for Microwave Access
WLAN	:	Wireless Local Area Network

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Various technological innovations such as wireless innovations provide platforms for libraries and other information organizations to explore opportunities in the digital environment to complement efforts in service delivery. Wireless innovations and ubiquitous networks have provided seamless internet connectivity thus changing the way users' access and consume information resources and services from the libraries. The world is moving too fast into digital media and so are wireless innovations becoming more important especially to users with portable devices like laptops and smart-phones. Tomer (2016:1) notes that, almost all types of libraries started providing access to the internet through wireless networks since the turn of the 21st century thus facilitating continued use of digital and electronic library resources.

Academic libraries in developed countries provide wireless ready libraries to clients including laptops and wireless cards to their clients. In a world where most library users have shifted to a bookless library; manufacturers, content creators and educators are working in unison to create better delivery of information and services to students as noted in Ramaiah, (2014). This study was inspired by the fact that in this digital era of internet of everything where wireless technologies have taken greater part in people's lives and academic libraries across the globe are making changes to tap this potential. This chapter constitutes background information on wireless innovations, context of the study, and statement of the problem, aim and objectives of the study. It also has research questions, assumption of the study and scope of the study, significance, limitations, and definition of terms.

1.2 Background to the study

The need to connect buildings, vehicles, home appliances and other physical appliances to the internet of everything (IoE) or internet of things (IoT) has made wireless innovations a must need (Gubbi, Buyya, Marusic, & Palaswami, 2013:1646). New developments in information communication technologies (ICTs) allow objects, not necessarily computers, to be fitted with radio frequency identification (RIFD) tags and sensor network technologies to connect to the internet and be able to communicate to each other by generating, exchanging and consuming data without human intervention (Internet Society, 2015:1). These wireless innovations have extended to libraries where the born-digital generation and environment has increased desire for internet connections and online information where collaborations, communications, discussions, online transactions and online leisure and entertainment are carried out.

In the early development of wireless innovations, users' laptops and smart phones could be configured to seamless connectivity of wireless networks and authentication system known as virtual private network (VPN) (Smith & Pietraszewski, 2004:251). Since then, libraries adopted VPN authentication system for seamless connectivity. In that case, library staff in some sections could be given portable gadgets such as laptops and tablets to carry on library services effectively. Today, most reference collections are largely online hence now reference librarians have a greater interaction with patrons in helping them to know how to locate resources online without personal contact with librarian (Gisolfi, 2015).

A research carried out by Canuel and Crichton (2011:111) on Canadian academic libraries concerning the mobile web found out that 8 libraries had already established

mobile web site for their users and two had a downloadable mobile app that was customized for users and the app could give access to mobile library content and services. If librarians facilitated access to library's authentic resources as well as client services through Wi-Fi and VPN, patrons could get access to a world of resources and virtual assistance (Canuel and Crichton, 2011:116). Wireless internet is used to access networked information resources such as bibliographic databases, remote library catalogues, bulletin boards, discussion groups, downloading remote files, communication and many more (Krishnamurthy & Rajashekara, 2011:42). However, there seems to be challenges due to the rapid changing technologies and libraries are at confused state on what system to adapt to suit the changing user needs and preferences. Given that the area covered by Wi-Fi is limited, new technologies like light fidelity (Li-Fi) which can be stretched to a larger area are being invented (Singh & Vaish, 2018:112).

In Africa, Tertiary Education and Research Network (TENET) in South Africa turned on eduroam Wi-Fi service to 57 public libraries in June 2019 to facilitate free access to the internet to the research and education community globally, a service which could help both students and staff from any university to access their institution's resources irrespective of location (TENET, 2019:1). Institutional libraries are working on making users comfortable to accessing online information as noted in (Baker, 2016:17). Although the telecommunication infrastructure in Kenya had been wanting since connection to the internet in the year 1996 to the early 2000's (Odero & Mutula 2007:468), most academic institutions have tried to uncover the use of the versatile handheld devices in the libraries because most patrons have smart-phones and laptops which have applications that can use wireless connections (Pujar & Satyanarayana, 2015:186).

To bridge the gap of technological innovation, academic libraries needed to respond to the technological changes and advancement such as e-learning, online platforms, video streaming and chat rooms (Commission for Higher Education, 2012). Academic libraries are perceived to be serving people whose education is a bit higher and who can use the internet more regularly to support research work and related advanced activities (Yankelevich et al., 2017:211). There has been a significant change in use of technology especially in libraries ranging from provision of access to digital libraries, electronic books, electronic journals, electronic databases, connection to the internet and other digital connections.

This study will seek to unveil transformative aspects of wireless innovations in the modern academic information organizations where current trends in social media, hand-held gadgets and cloud computing (CC) are making a new twist to the space needs of an academic library. The perception users had that with everything on the internet and availability of world-wide web, there is no need of physical library; has been erased by provision of free wireless internet access.

1.2.1 Context of the Study

The University of Nairobi (UoN) was established in the colonial period as a commercial institute in Nairobi in 1947 and became fully-fledged university in 1970 (University of Nairobi, 2018). The university is made up of six colleges with many schools, faculties, institutes and research centers. The university colleges include College of Humanities and Social Sciences, College of Health Sciences, College of Architecture and Engineering, College Agriculture and Veterinary Sciences, College of Education and External Studies and College of Biological and Physical Sciences. The main campus is located in Nairobi

city with its main library - Jomo Kenyatta Memorial Library (JKML) and departmental libraries like the Institute of Development Studies library. The University of Nairobi is the top leading public institution of higher learning in Kenya and the East African Community and top in the webometrics ranking.

The University of Nairobi Library has a mission of providing quality education through information services that will enable the university carry out its core activities of teaching, learning, research and development. The College of Humanities and Social Sciences (CHSS) has eighteen computer laboratories created to enhance learning activities as every effort is made to connect all lecturers to the internet (University of Nairobi, 2018). The CHSS libraries are equipped with both print and electronic resources. Given the increased use of electronic resources, the library subscribes to online databases via consortium which are made available to its users both within the library and remotely.

Due to the demand for infrastructure to facilitate the internet connection, library has various ICT centers/computer laboratories which support student access to the internet. The laboratories are serviced by wireless internet which is made available to students to deal with challenges such as student to book ratio, lecturer and classroom space, decongest computer labs by accessing online information resources via their personal devices such as laptops and smart-phones (University of Nairobi, 2014). The wireless LAN deployment started as a pilot project way back in 2009 according to University of Nairobi Annual ICT report 2015. The main aim was to decongest computer labs hence enable students to access internet and intranet from the comfort of their rooms in the hostels. To enable students get connected to the libraries' electronic resources, the college has launched hot spots within a radius of 200 meters in all the campuses to

enhance Wi-Fi internet connectivity (University of Nairobi, 2018). As many other academic libraries which have provided wireless network connection and innovations to their users, CHSS libraries have adopted this trend to ensure that the needs of its users are met.

It is also notable that, university of Nairobi library has improved the online resources by creating a digital repository, encouraging open access to resources and subscribing to leading online databases for e-resources, (University of Nairobi, 2018). The study sought to find out the wireless innovation aspects in the library with focus on how staff and all other library users institutionally and beyond, are accessing and utilizing the massive library resources and services in the digital environment to facilitate learning, research and development. The study also examined the ways in which wireless innovations have transformed delivery of information services at the University of Nairobi's library in relation to the current trends. Additionally, find out the innovative applications of wireless innovations as well as effective strategies to enhance wireless innovations to remain sustainable in the dynamic political and environmental changes.

1.3 Statement of the Problem

Exponential growth of digital information, new wireless technologies and high penetration of the internet has increased the need for wireless innovations. Born-digital generation want connection to computing where all devices ranging from phones, televisions, music players and vehicles keep track of what is happening. This includes: viewing, reading and listening to, throughout the day irrespective of the location and time (Borne, 2014). To grab this opportunity of digital technologies, librarians could open up opportunities to world resources as well as assistance to the clients through Wi-Fi,

WiMAX, Li-Fi, IoT, IoE, VLC and other wireless technologies including virtual private networks (VPN) that allow access to the library subscribed e-resources (Canuel & Crichton, 2011:115-116). The authors further argue that; irrespective of the difference in devices that the users have, the operating systems could provide access to most library services and resources if the devices have Wi-Fi capability. As noted by Baker (2016:8), libraries have to come up with various innovations to transform the face of the libraries by use of the new wireless technologies and innovations.

As users strive to make use of the digital transformations availed by wireless innovations in research and development, study and learning, library professionals need to use all the opportunities presented by wireless technologies like CC, mobile services and RFID to promote library services. There is limited literature on how wireless innovations has promoted the use of digital information resources, facilitated delivery of services in academic libraries, innovative applications and strategies in place to ensure wireless technologies and innovations are effective in academic libraries in Kenya. No specific study on the Jomo Kenyatta Memorial Library at the University of Nairobi. Therefore, this study focused on the transformational aspects of the wireless innovations in the library to support the learning, study, teaching and research activities of the academic institution, and therefore fill in the existing gaps in literature.

1.4 Aim of the Study

The aim of this study was to investigate the transformative aspects of wireless innovations in academic libraries in Kenya with particular reference to the University of Nairobi Library.

1.4.1 Objectives of the Study

The objectives of the study included to:

i. Find out the extent to which wireless innovations have promoted use of digital information resources in academic libraries.
ii. Examine how wireless innovations have transformed delivery of services in academic libraries.
iii. Establish innovative applications of wireless technologies in academic libraries.
iv. Propose effective strategies to enhance wireless innovations in academic libraries.

1.5 Research Questions

i. To what extent have wireless innovations promoted effective use of digital information resources in academic libraries?
ii. How has wireless innovations transformed delivery of services in academic libraries?
iii. What are the innovative applications of wireless innovations in academic libraries?
iv. What are the effective strategies to enhance wireless innovations in academic libraries?

1.6 Assumptions of the Study

The study made the following assumptions:

i. Wireless innovations are applied in academic libraries as part of information services for clients.
ii. Wireless innovations have transformed the information environment and landscape in academic libraries.

1.7 Justification of the Study

The study intended to bring out new insights as per wireless innovations aspects in the modern digital information environment specifically in academic libraries. University of Nairobi being the leading academic institution in Kenya, with both print and modern digital information environment and a comprehensive ICT policy; offered a perfect opportunity for this study to unveil the effective use of wireless innovations in digital information resources, transformation in service delivery, innovative applications of wireless innovations and effective strategies to enhance wireless innovations in academic libraries. Research and teaching being the core functions of the university, library users have to be offered that opportunity to know how to utilize technological innovations brought about by wireless technologies with all its advantages in order to communicate, collaborate and share positively.

1.8 Significance of the Study

The significance of this study is to help information professionals and other interested parties to understand the transformative aspects of wireless innovations in academic environment and be able to create solutions to the daily problems in their job. The study will add to the available literature on wireless innovations and open doors for further research by identifying gaps. The findings from the study is likely to give an insight to relevant stakeholders in academic libraries to realize the impact the wireless innovations are bringing and tap the potential benefits. Students and other library users will be educated on how to take advantage of the wireless innovative applications in accessing useful information sources and resources to make adequate decisions and develop innovative ideas.

The study can as well serve as a guideline to other libraries which are not academic to incorporate wireless innovations in their information services. Besides, most aspects of wireless innovations will be unearthed possibly stimulating relevant effective strategies to make maximum exploitation of library resources. The findings from the study may be used as an incentive to start other wireless innovations programs in libraries that have not started the same. The results from the study can be used by the government since they are the financiers of higher education to know how to allocate resources for wireless innovations in academic libraries and if there are other institutions which do not have the services yet, they can be guided on the way forward. The results are also likely to give a cost benefit analysis to this wireless innovations venture.

1.9 Scope and Limitations of the Study

The University of Nairobi has six colleges although this study specifically focused on respondents from the College of Humanities and Social Sciences. University of Nairobi has other two CHSS satellite campuses in Mombasa and Kisumu each with fully-equipped library but the Jomo Kenyatta Memorial Library located at the main campus in Nairobi was the only focus. University of Nairobi library services a diversified number of users through wireless innovations but the focus was only on postgraduate students from CHSS's School of business, School of Education, School of Journalism & Mass Communication, Institute of development studies, Institute of diplomacy & international studies, Population studies and Research institute and faculty of arts. Besides, the study covered 10 library staff among them ICT staff in charge of system support and wireless configuration out of the targeted 16 staff of the total population of 160 staff. Other restrictions included non-return of questionnaires, and respondents' attitude although the

researcher personally made follow-ups. Besides, there could be other transformative aspects in academic libraries brought about by other factors, but this particular study was limited to aspects of wireless innovations.

1.10 Operational Terms and Concepts

Academic Library

A library attached to a higher institution of learning intended to service the purpose of supporting education programs of that institution and research activity of the university faculty and students.

Cloud Computing

This is a technology that allows connection of massive information to the clouds; where, this information can be offered as a service to multiple external customers using internet technologies. Some of the services include: development of digital libraries, corporate cataloging, acquisition, storages and sharing the resources on virtual environment on the web.

Internet of Things

Scenario where objects not necessarily computers can be fitted with sensors and connected to have computing capability. IoT allows the connected devices to generate data, exchange and consume data with minimal human intervention.

Mobile Cloud Computing

This is a combination of innovative technologies and wireless networks that help mobile users, for processing data and storage where these data is moved from the users' mobile device to powerful, centralized computing platforms in clouds which can be accessed later over the wireless connection based via a web browser on the user's mobile devices.

Radio Frequency Identification

Technology that uses electromagnetic or electrostatic spectrum to wirelessly identify object, animal or person in a unique way.

Wireless Innovations

These are technologies used for connecting devices without them being in touch with each other. In this research study, wireless innovations mean utilizing all the ICTs available in the teaching and learning to connect users to library information resources and services virtually.

1.12 Chapter Summary

This chapter is an introduction and background information on wireless innovations aspects in information services in academic libraries, context of the study, statement of the problem, objectives of the study, research questions, and assumptions of the study, justification of the study, significance of the study, scope and limitations. It also highlights operational definition of terms and concepts used in the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This Chapter is a review of literature related to wireless innovations in academic libraries. It therefore focuses on the four objectives of the study which are: extent to which wireless innovations have promoted use of digital information resources, how wireless innovations have transformed delivery of services in academic libraries, innovative applications of wireless innovations and effective strategies to enhance wireless innovations. It also provides the conceptual framework of the study.

2.2 Wireless Innovations in Academic Libraries

The Introduction of wireless fidelity (Wi-Fi) as a technology for wireless local area network (WLAN) in 1998 and proliferation of new technologies in library has changed teaching, learning and research (Krishnamurthy & Rajashekara, 2011:42). The ubiquitous nature of mobile phones, the manner in which learning and education is taking place has changed greatly (Barnhart & Pierce, 2011). With the change in technology and availability of wireless innovations, academic libraries should responsibly provide literature and information for research, teaching, study and learning. Libraries of today are not only for quiet study and doing research but for web surfing, group work conversation via social media, watching You-Tube clips for fun and education among other activities. With IoT, digital users need a smart linking of objects and uninterrupted connections with battery charging facilities to keep their batteries on.

Change of attitude in the library profession to make a library a destination in campus, propelled libraries in the USA to introduce information commons in 1990s with some changes such as providing access to technology and allowing food, drinks and comfortable furniture (Seal, 2015:560). As a result, libraries now offered an environment for long and intensive concentration. Today, most academic libraries are warm, hospitable, attractive places which offer a conducive environment to do serious work and at the same time get entertained and socialize in online platforms irrespective of time or geographical location, (Seal, 2015:560). Seamless and convenient access to information resources, hardware and software to do research, write papers, undertake projects, opportunities to interact with the right people and technology experts; makes wireless innovations in academic libraries indispensable in this time and era of digital natives.

With the current upgrade to newer and faster technology solutions in libraries and use of various personal handheld gadgets to access online resources, wireless internet connections are becoming a necessity in various academic institutions in private or public (Krishnamurthy & Rajashekara, 2011:41;Yuvaraj, 2016:2). In their study, Ellis and Charnigo, (2005:17) suggested that, to encourage patrons to continue visiting them, academic libraries needed to meet the demand for wireless access. Libraries have established Wi-Fi hotspots as access points to users with Wi-Fi-enabled devices to get connected to the internet. Even as students get connected to wireless internet, it may not be necessarily that the visited websites are for academic purposes. Many might be using it for social communication and entertainment.

2.2.1 Wireless Innovations and Digital Information Resources and Services

In line with the libraries' ambitions to avail information resources anywhere anytime, mobile devices and laptops have made the libraries to be at ease (Barnhart & Pierce, 2011). The availability of the web and the internet has compelled libraries to advocate for open access to information. Most libraries have put up digital libraries with electronic resources, digital depositories and access to online content via websites to ensure that as users utilize the wireless innovations they are able to access all authentic, authorized and quality library and online resources (Canuel and Crichton 2010:115-116) at the right time irrespective of the location within the campus or virtually at home (Baker, 2016:8).

Although libraries subscribe to online databases for electronic resources, it is notable that these e-resources are inadequately utilized. The innovative products and transformative aspects have to be reflected in the lives of the intended audience in academic libraries. As most academic libraries have made efforts to put up digital resources/libraries, it is upon the management to develop digital library programs that enable users to only access what is relevant to their study. This study will focus on the how academic libraries are using wireless innovations to develop digital library programs in aid of access to the digital information resources and services.

2.2.2 Wireless Innovations and Information Landscape

Technology has enabled mobile cloud computing (MCC) combining with CC and mobile computing (MC) as well as wireless networks has enabled mobile users to access mass online resources to solve their issues instantly from anywhere irrespective of time or location as noted by Albolfazil et al., (2013:7). Academic librarians are at a task of understanding how users access information for research on their hand-held devices so

that they can tailor-make content which matches their search, (Canuel & Crichton 2011:110). The authors added that, in this age of M-learning users prefer to be joint participants rather than passive recipients of information. Hence, the wireless innovations and networks should aid them to be more collaborative and have accessible learning opportunities which facilitate anywhere anytime learning outside the classroom. Academic librarians and information officers ought to develop innovative strategies which stress the wireless networking presence so that users can take advantage of it to apply the knowledge gained.

2.2.3 Wireless Innovations and Library Space

Academic libraries are facing constant transformations as a result of change of technology which dictates change in space arrangements. As noted by Seal (2015:558) location of library services, storage of materials, display and accessibility to these materials and services are some of the space challenges of academic libraries. The need for user satisfaction calls for space that accommodates users who use technology, with comfortable workstations, seamless and convenient access to information resources. Most libraries have realized the increased lack of space and work stations, prompting information professionals to take advantage of portable devices such as laptops, tablets, mobile devices and other wireless gadgets to connect users to wireless innovative applications to help users receive digital information services within the shortest time possible at cheaper prices.

Digital media has influenced the architectural design of libraries and consequently the way users occupy space in libraries (Baker, 2016:8). Libraries have now moved to spaces which attract users with technology. In this era, libraries should be, comfortable,

attractive places where as students do serious work, they will as well have the opportunity to meet with their friends, work on research papers, meet with professors, make video presentations for class, contribute to databases and e-journals, work on group projects, use social media among other interactive activities as pointed by Seal (2015:562). With increased use of digital media, the architectural design of library buildings is changing to accommodate digital users who need charging facilities to keep their batteries on all through as they access the internet. Consequently, these impacts the way users occupy space and arrangement as there might be need for more open space to accommodate these gadgets as well as cabling of power outlets.

2.3 Wireless Innovations and Transformation in Academic Libraries

With the introduction of the World Wide Web in the early 1990s, people taught that it was the end of libraries since "everything could be found on the internet." However, the change of attitude and perceptions by the profession led to inclusion of comfortable furniture, access to computers and free internet through wireless innovations which users can access from the comfort of their rooms in the hostels (Tomer, 2016:7). The fact that ubiquitous wireless supports multiple portable devices, has given users an immense opportunity to access different forms of technology be it online spaces for group work, digital media, electronic collection, access to both the librarian and technology for communication and information exchange. This calls for academic libraries to keep on updating their technology infrastructure more often to meet the needs of the millennial students who have proved to expect fast, continuous access to information for class work. The users opt for self-service in finding information and access to technology anywhere anytime (Seal, 2015:565).

Academic libraries are now using the wireless innovations for marketing and branding to help curb brain drain to minimize a scenario where students can leave for greener pastures to institutions which offer seamless wireless innovations package. On the other hand, combining other wireless technologies such as CC, libraries use wireless innovations to come up with digital libraries, corporate cataloguing, acquisitions, storage and resource sharing on virtual environment on the web thus facilitating sharing of resources via the internet (Kaushik & Kumar, 2013). Due to limited resources such as lack of enough wired connected computers, reading spaces and high cost connection cables; libraries have taken advantage of the users' portable devices to connect to internet wirelessly so as to access information resources from various locations within campus (CTIA-The Wireless Association, 2012:15-16). This is intended to ease congestion and the struggle to access computer terminals and modernize the traditional library structures which were feared as only reading spaces to the 'few individuals.'

2.3.1 New Information Products and Delivery of Services

With every new technology, libraries have always been perceived to be at the forefront of technology adoption (Canuel & Crichton 2011:109). Wireless innovations have defined new roles for information professionals where librarians have been freed by technology to have greater interaction with patrons. It is easier to update resources and communicate the same to patrons within a span of reduced period through use of platforms such as Wireless OPAC given that most reference collection are largely online (Gisolfi, 2015). Similarly, the digital age is defined by new gadgets such as tablets, iPhone, smart-phones, laptops streamlining information and news. Hence, librarians ought to set aside spaces for digital instruction on how to access digital information (Gisolfi, 2015).

Changes in customer expectations as technology, the library and information professionals ought to give customer care high priority by helping them to connect, collaborate, and create new knowledge and research through online communities (Seal, 2015:562). As noted by Tomer (2016:10-11), provision of access to the internet through wireless networks helps users to be in contact with a reference librarian virtually without having to physically visit the office which could be located on a different floor. Alternatively, the reference librarian could be moving around with their devices held at hand to be answering users' questions via chat-rooms as they carry on with other duties (Gisolfi, 2015).Wireless technologies provide instant communication irrespective of the place, time or geographical barriers enabling the ability to connect people around the world through sharing and collaboration (CTIA-The Wireless Association, 2012:4 and Ellis & Charnigo, 2005:18).

2.3.2 Research, Learning and Development

Institutions of higher learning introduced e-learning where learners connect to an online learning network. As a result, academic libraries are required to deliver content to learners who have shifted from textbook to tablet to help support learning, study and research activities in their parent institutions as pointed out in (Ramaiah, 2014). He further noted that, use of animations and games keeps the tech-savvy generation engaged and entertained resulting into increased knowledge retention. As a reaction to attract learners through emerging learning technologies, mobile learning, SaaS, BYOD and numerous learning management systems, library professionals should make use of the wireless innovations and technologies to provide enough e-content suitable for both traditional teaching and virtual learning.

According to Sutar (2019:80-81), previous studies suggested use of Wi-Fi in the libraries and reading areas to facilitate access to relevant information resources. The author adds that, post-graduate readers need effective training to help them make use of search strategies in adequately retrieving relevant information since most of these readers have come to the library to utilize the Wi-Fi to download research materials. In most cases they use this Wi-Fi to access electronic books, electronic journals, institutional repositories and other web-based information resources through their laptops and smart-phones. Therefore, creation of Wi-Fi zones in academic libraries and reading areas is necessary since it facilitates virtual learning.

2.4 Innovative Applications of Wireless Innovations in Academic Libraries

Wireless innovations have numerous applications in libraries such as wireless networking, internet, OPAC, social media and CC which provide easy access to databases, online catalogue, and other digital information. In using wireless innovations access to digital information becomes faster, hence better service and increased user satisfaction. Library users can easily share peripherals and multimedia databases. Also, access to digital resources irrespective of being physically close to printed materials is possible thus minimizing movements. Wireless innovations can be used to enhance libraries whose buildings were built long time ago because new installation could be impossible or very expensive as noted in Tomer, (2016:19).

Libraries are moving to smart digital shelves which promote content based on the users' search history on the internet. Besides, borrowing history will enable real-time notifications of new arrivals on their particular area of study (Pujar & Satyanarayana, 2015:189). Further, through users' smart-phones, mobile applications can be developed

by libraries to enable use of virtual library cards in accessing the library's information resources and services. The mobile app can help the user with the location of the resources and any other useful additional information such a connection to sites such as Amazon.

2.4.1 Virtual Library Access and E-Learning

Wi-Fi wireless broadband internet connection saves users' time greatly as it allows them to do typically anything on the internet that could be done at home or from office. To mention but just a few, (Krishnamurthy & Rajashekara, 2011:45) pointed out that users had freedom in surfing the web, checking and sending emails, connecting to their corporate networks, making free voice over IP phone calls, playing online games, updating their blogs and instantly messaging their friends. Access to the web OPAC has been made easier as users could access library information on data available in the library through wireless networks (Krishnamurthy & Rajashekara, 2011:48).

As noted by Bawack (2019:2-3), with the shift from traditional information environment to an e-environment where e-books, e-journals, open access, digital repositories and online databases are occupying the virtual spaces of academic libraries; academic libraries should not lag behind. Instead these libraries should look for ways to adjust to the changes brought about the new information and learning methods. This is because most universities and other institutions of higher learning are introducing new methods of teaching to conform to the technology in the market. Academic libraries should support the parent institutions to successfully accommodate the new teaching methods such as online learning, distance learning and Massive online courses (MOOCs) (Bawack, 2019:4).

2.4.2 Online Lending of Materials

Strover, (2018:1) noted that some libraries in the US have positioned themselves to curb the access problems in the library as well as digital literacy. Libraries found a new role of digital inclusion in serving users satisfaction in terms of users' attitudes and behavior. The academic libraries started establishing loaning hotspots to cater for lower income population who move in search of better paying jobs and improved houses while seeking educational opportunities. They provided numerous movable gadgets and incorporated loaning audio and video items, providing computers and internal Wi-Fi, e-books, and now hotspots in an effort to bridge digital inclusion gap.

2.4.3 Online Notifications of New and Relevant Materials

In this era of digital information resources most postgraduate students depend on online databases in the learning and research activities as noted by Islam & Sheikh (2019). This implies that users need to be constantly informed whenever materials in their line of study or interest are available. With the combination of mobile smart-phones and other gadgets, data on what they mostly access should be saved and notifications enabled so that whenever any material of interest is available they are aware and they can open the links easily.

2.4.4 Wireless Beacons

Libraries have the capability of setting up beacons like wireless devices at various sections of the library so that as users come to the library to that specific section the mobile phones should play a video or audio to explaining more about resources or services in that section and how one can benefit maximally out of it (Pujar & Satyanarayana, 2015:189). On the other hand, library staff can take advantage of wireless

innovations and other technologies such as IoT to transform the library buildings into smart buildings where users can virtually get all kinds of information using their portable devices. These authors further noted that, library staff can get statistics of library usage, frequently used resources, user satisfaction experience and other sites used to access information.

2.4.5 Advanced Technological Innovations as a Result of Wireless Innovations

Wireless internet has saved a lot of time and financial costs in academic environments as can be drawn from instances such as electronic and document delivery systems (Ani, Edem & Ottong, 2010 and Baker, 2016:17). The same authors noted that, in order to better realize these cost benefits, academic libraries need to be on Wi-Fi as part of technological innovations to ease cable internet connectivity and allow seamless connectivity to users moving around without having to be restricted to physical locations.

Given that most libraries are already using RFID to interact with machines, tags and updates of library management systems, wireless innovations will enable physical items like books, CDs and DVDs, journals, et cetera to be connected to the internet by use of IoT technology (Pujar & Satyanarayana, 2015:188). It is however argued that, use of wireless technologies in academic libraries especially in technical services such as inventory was low on scale of benefits (Ellis & Charnogo, 2005:17) who added that, the technology is rarely applied in instruction even though that is what students expected to keep up with technological innovations.

With RFID technology, labour intensive activities such as circulation, inventory management and item processing become more efficient. Additionally, IoT through use of the RFID technology guards against loss of physical items, misplacement or theft (Tomer, 2016:22 and Pujar & Satyanarayana, 2015:188-189). Wireless innovations are enhancing collection management by integrating the RFID tags in to Members' cards to rationalize circulation of items and fine collection. This is because users can be notified about overdue and fine so that they can pay online without physically queuing to make payments (Pujar & Satyanarayana, 2015:188-189.

2.4.6 Internet of Things

As noted by Nag and Nikam (2016), IoT is a combination of various technologies which are fitted with Wi-Fi technologies and can help greatly improve services in academic libraries. For instance, monitoring the patrons' frequency to certain sections in the library, the materials they access thus improve in collection development in that area, link to related titles, and development of intuitive user interfaces by library professionals. These technologies include CC, Magic Mirror, Pressure pad sensor and WSN. As libraries look forward to developing their new next generation catalogues CC is indispensable as it improves the visibility of library collection and management hence effective services. The magic mirror fitted with camera, sensor and Wi-Fi enabled, supports interaction between people and computers hence helping with location of materials and content, browsing through databases to help users locate the desired item.

In addition, librarians are at a position to develop intuitive user databases. Pressure pad sensor enabled with Wi-Fi technology connected to processing unit records and controls number of users to a certain section providing sufficient information which can help in

collection development. In addition this technology has an automatic turn-on and turn-off of light bulbs thus saving energy making the library a smart library. In a similar way, WSN performs various functions such as collection development, analyzing, processing and distribution of useful information gathered in diverse environments.

2.4.7 Automation of Information

With the growing power of ICTs, Libraries have opportunity to use these technologies together with the internet to transform the means of research, teaching, learning, assignments and scholarly communication (Ibrahim, Asiedu & Aikins, 2017:98-99). Free Wireless internet to library users makes them appreciate the services of a library. Most academic libraries are making available digitized collections so as to make wider access especially through their digital repositories. From this study we will find out whether the Wi-Fi technology applications is helping library users to access the online databases and digital repositories as intended by the library professionals.

2.4.8 Mobile Smart Applications

Academic libraries can develop Mobile Smart Applications that can be tied to personal information through the use of wireless networks (Kaladhar & Rao, 2017:31). These Apps are able to gather information on what library users access frequently so that they can help direct them to where they can find related content. The Apps normally contain direction to open information platform, cloud computing platforms, service support platforms among other applications. This will save the time the patron spends in looking for specific information. Librarians on the other hand have the opportunity to serve their users in a more relevant way.

2.4.9 Social Media

Restrictions in some places like not to converse or hold discussions in the library have not hindered users as they can still communicate through the online communities using applications such as twitter, Facebook, Messenger, Instagram, Snapchat, WhatsApp, You-Tube and other applications that communicate wirelessly (Ng, 2016). This multiple sources of information and platforms for communication (Facebook, Blogs, Chats, short text messages, Instagram pictures, CCTVs, RFIDs, barcode scanner, geographic information systems (GIS), You-tube, Internet) provide silent active communication. This implies that products of Wi-Fi technology have to be applied up to maximal levels since the world is evolving into a global network infrastructure with several WLAN getting connected. Information organizations more so academic libraries have taken advantage of wireless innovations in the quest to cope with technological transformations in digital information world.

2.5 Strategies to Enhance Wireless Innovations in Academic Libraries

One of the Kenyan National government strategies for infrastructure and access policy as outlined in the ICT policy 2016, is to make available spectrum for and ensure orderly deployment of ultra -high speed wireless technologies such as long-term evolution (LTE)/4G and other advanced mobile communication networks (Ministry of Information Communications and Technology, 2016:16). In order to achieve the vision 2030, the Government started deploying the national optical fiber backbone infrastructure (NOFBI) to cover many places including learning institutions. At the University of Nairobi, wireless network is provided to support teaching, research or related academic activities at the University and not any other purpose or activities (University of Nairobi, 2018).

This study will seek to unveil strategies that have been put in place to enhance the wireless innovations and how effective these strategies are in academic libraries.

2.5.1 Technology Investment

Higher education community keeps on investing in technology infrastructure hence institutions are also expected to continue refining and updating the networks Ellis & Charnigo (2005:13). Effects which can be experienced include internet of things, development of various applications which can be downloaded and used such as mobile banking, online businesses and other services. Among the innovative strategies in the education sector, includes connecting students to one another, providing easier ways to learn, inclusivity and tailor-made services such as AsKaLibrarian not forgetting fun and entertainment of quiet conversations (CTIA-The Wireless Association, 2012). Given that technology keeps on expanding and wireless connection is at the forefront of social and academic changes, the world of learners has been globalized in as they communicate as if they see each other face to face (Ng, 2016).

2.5.2 Policy Formulations

Institutional policy on funding of wireless technologies and ICTs in general could help propel the wireless innovations. Management support is a key ingredient in enhancing the adoption, implementation and maintenance of a workable wireless connection. Budget restrictions can derail proper functioning of the wireless connections hence failure to meet the required bandwidth for the huge number of users. Additionally, librarians have to choose on whether to filter internet information or keep to their ethics and offer unlimited access.

2.5.3 Adequate Funding

Not every library adopts the wireless innovations changes so quickly since it requires adequate funding (Ilako, 2013). Given that technologies and their integration have a shorter lifespan, (Baker, 2016:33) adequate funding is needed for continued upgrade to next generation systems. Some libraries are moving from the wired internet connections to the wireless connections and are required to give proper explanations on how the process of wireless connections is going to be cost effective. Parent institutions and the government may take long before the procurement processes are successful and funds released which might not catch with dynamism in the technology pace. The study will seek to unveil how academic libraries are coping with funding issues in the quest to strategize on maximum benefits of wireless connectivity.

2.5.4 Information Infrastructure

Traditionally, libraries have been using wired cables to provide access to the internet, library resources and library network. But with portable devices such as laptops and smart-phones, library users are moving freely within the library and still remain connected. The need to save on costs of space, new wired internet cables, location has compelled libraries to be at par with technology by incorporation of wireless technologies. Every user either within or outside the library is able to access the library OPAC with minimal movements hence resulting to user satisfaction as more services are accessed at minimal cost. Information is accessed faster compared to the past where users could literally queue to access a computer terminal in order to access online information. Sharing of files, multimedia resources and databases are easier with the available networks such as social media platforms, Bluetooth, and online collaboration tools such

as Google docs. This increases chances of collaboration and communication since databases are shared and managed responsibly. Tomer, (2016:21-22), further adds that libraries can make use of wireless technologies such as Bluetooth to help them become more visible and more useful. Bluetooth chips could be put in computers, printers, keyboards and mice to support IoT connections hence users can access virtual information resources even when they are seated next to print resources. This implies that libraries could develop mobile applications and avail them to users to help them perform all library functions.

2.5.5 Management Support

Academic libraries need management support to run an effective wireless innovation programme. Libraries being the central organs of an institution, Raghu (2019:7), notes that the libraries need good and adequate information resources; good budget; qualified, trained and skilled library staff; good infrastructure facilities, and best practices by library managers. The author further notes that, for quality of library services to improve it is necessary for management to follow up on users' feedback, automation of library services and insist on searching information resources using web-based OPAC. By doing this way, there is surety that knowledge transformation can take place.

2.5.6 Uninterrupted Wireless Connections

Most of the millennial users' frustrations when using Wi-Fi arise from abrupt interruption or downtime of the internet. Growth in digital libraries and digital repositories compelled libraries to provide seamless access through internet connectivity. Every internet user wants to connect to ubiquitous networks where there is no interruption of internet connections so that they can complete downloads within the shortest time possible.

2.5.7 Privacy and Security

Privacy and security continues to be a challenge in using wireless technologies. As noted by Krishnamurthy & Rajashekara (2011:44-45), the designers of wireless technologies implemented measures to prevent hackers from intercepting data despite the high security issues. Some of this measures included use of encryptions, VPN access, MAC access, use of passwords and key distributions to only authenticated users. Other techniques include: antivirus software, firewalls, content filtering and hard drive encryption which can help minimize risks. Connecting to the internet through public Wi-Fi such as a library could be risky in cases such as conducting mobile transactions over the network (Krishnamurthy & Rajashekara, 2011:44-45 and NG, 2016) as this can expose users to frauds. As a result, these authors recommended good security measures to be put in place to protect individuals or organizational resources from hackers. Wireless networks should be rejecting connections from unknown MAC addresses and employ Radius Authentication and Authorization by use of logins and passwords or Kerberos. Some of the security measures can be combined for better security.

It is also good to put restricted access to ensure that only legally allowed users could access the wireless internet (Krishnamurthy & Rajashekara, 2011:44). Some of the strategic measures which have applied in other settings and can be employed in a library setting include requesting users to have a registered account on which they will be provided a login procedure; having users to register as a guest or customers of that facility or asking survey questions as part of login process. In his study, (Ng, 2016) identified that it was necessary to provide internet connectivity which was reliable and secure. The author further adds that Wi-Fi accessibility, enough power outlets for

charging batteries and printers in case one needed to print something, adequate space and comfortable seating should be provided to encourage clients to stay or visit.

The study is aiming at examining ways in which the favorability of the support system infrastructure to users protect them against malicious intentions by hackers and fraudsters. It will seek to unveil whether connection to wireless networks is restricted or open access and what measures are in place to guard against hacking information. Users need access to quality information which can help them penetrate the market of re-using and generating new information for development.

2.6 Conceptual Framework

Graphic presentation of the conceptual framework includes independent variables, dependent variables and outcomes. Wireless innovations and information services are independent variables as indicated in Figure 2.1 below.

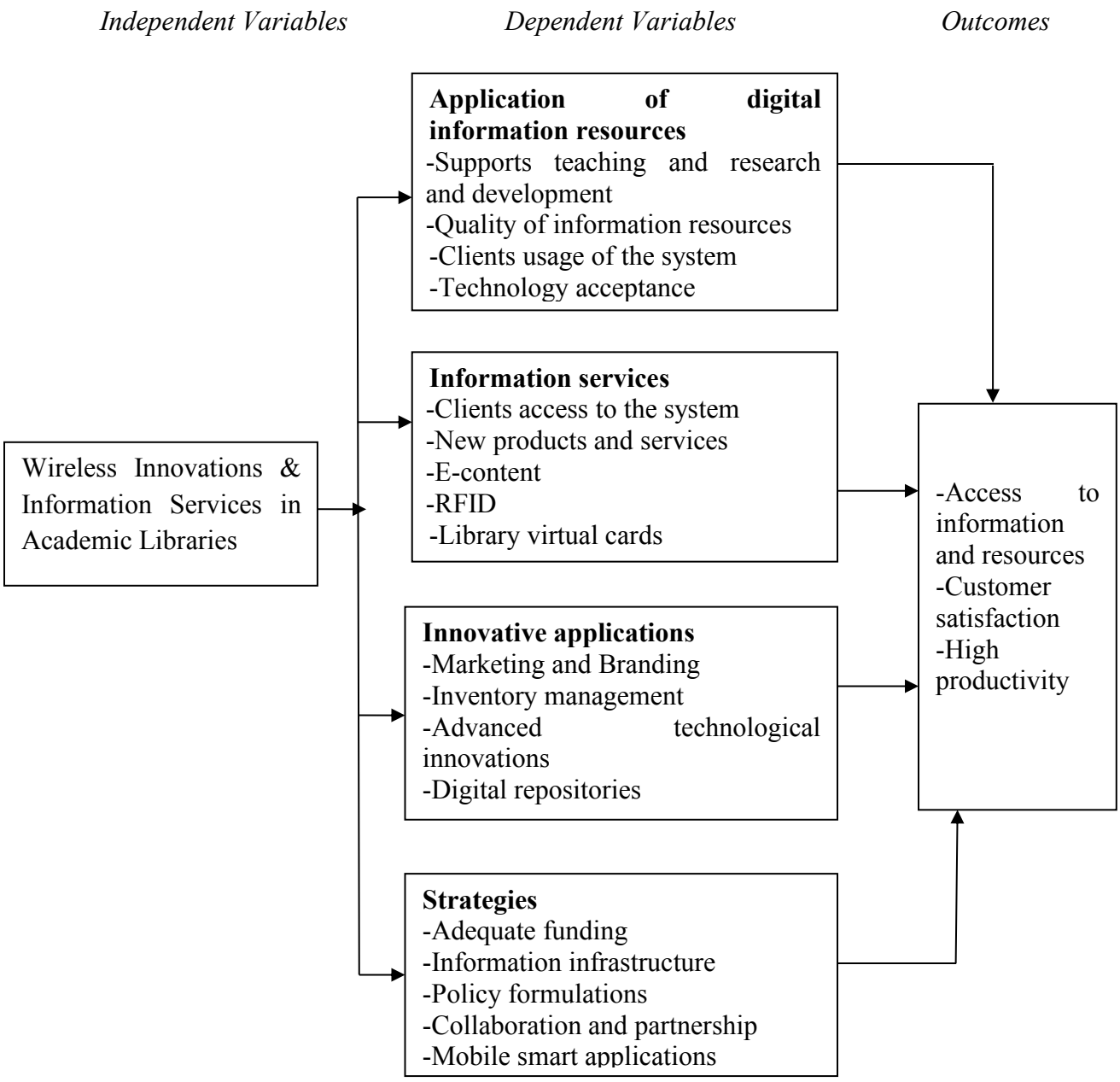


Figure 2.1: Conceptual Framework

2.7 Knowledge Gap

Library professionals ought to address information management from the perspective of wireless innovations to be able to give information effectively to the digital natives and compete favorably. Seamless wireless connections in this century are an integral part as is open access to library users. With all the electronic devices available to users such as laptops, tablets, smart-phones and other movables gadgets, academic libraries are challenged to stay current in order to support these electronic devices and software. Therefore, it is of great concern that as libraries use wireless innovations, there is need for the high usage to be reflected through academic purposes especially the e-resources to which libraries subscribe to.

2.8 Chapter Summary

This chapter is a review on the transformative aspects of wireless innovations in academic libraries, the available literature based on the objectives of the study. The literature covers the aspects in the four objectives of the study, the conceptual framework and the gaps in knowledge.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the process for data and information collection for this research. The chapter therefore focuses on: research design, area of study, target population, sampling strategies and techniques, sample size, data collection methods, research instruments, data collection procedures, data analysis and presentation, and ethical considerations.

3.2 Research Design

The study adopted a descriptive survey design using both quantitative and qualitative research method to analyze the collected data. The approach was appropriate because of its complimentary benefits. Qualitative research was executed through use of interviews on library and ICT staff who gave information on concepts of wireless innovations, hence permitting the researcher to go beyond statistical results from quantitative research to explore and try to understand people's beliefs, experiences, opinions, attitudes, behaviors and interactions regarding wireless innovations. The qualitative research design enabled the research to gather information from ICT and library staff on transformation aspects of wireless innovations in academic libraries.

Quantitative research was executed by use of paper questionnaires to postgraduate students to help gather comprehensive information on wireless innovations from the client point of view. Besides, the study utilized content analysis to gather relevant data and information. Structured closed ended questionnaires were administered to respondents where the researcher used Likert scales to measure the extent to which

various wireless technologies are applied in academic libraries, the perceptions on how the wireless innovations have supported the research, teaching, learning and development and opinions on strategies that can enhance wireless innovations in academic libraries. Data gathered from the quantitative approach was analyzed using SPSS and it was used in drawing the tables, pie charts and graphs. Data gathered from qualitative approach was used in narrative form to compliment the information from quantitative data.

3.2 Area of Study

The study was carried out at Jomo Kenyatta Memorial Library at the University of Nairobi. The targeted population included 16 ICT and library staff purposively selected and 96 postgraduate students from CHSS. The area was suitable for study because it carried the bulk of scenarios needed for the study such as Wi-Fi technologies and wireless OPAC; the researcher was at ease in data collection; and the fact that no other specific research on this topic had ever been addressed in this locale. The JKML library also serves the largest number of postgraduate students who are likely to use wireless innovations.

3.3 Population

The target population included ICT and the library staff and postgraduate students from the College of Humanities and Social Sciences both masters and PHD levels. This study reviewed Jomo Kenyatta Memorial Library, the main library of the University of Nairobi which is an academic institution with professionally qualified librarians, staff and intellectuals who are involved in managing of wireless technologies and library information services.

As a result, the researcher expected these respondents were in a position to know more about aspects of wireless innovations in application to modern digital information services. The targeted postgraduate students were identified by help of a library staff and requested verbally thus ensuring they were from CHSS. The students were issued with questionnaires to fill and return at their own time during their study within the library building. To obtain the sample size, the researcher wrote a request letter through the faculty of arts to the registrar to get the population size. The office responded by providing the information from which the sample size was calculated using Slovin's formula. The sample frame for the population is as outlined in Table 3.1 below.

Table 3.1: Sample Frame

RESPONDENTS	**POPULATION SIZE**	**SAMPLE SIZE**
Library staff and ICT staff	**160**	**16**
Postgraduate Students -School of Business -School of Education -School of Journalism &Mass Communication -Institute of Development Studies -Institute of Diplomacy And International Studies -Population Studies and Research Institute -Faculty of Arts	**2,177**	**96**
Total	**2,337**	**112**

3.4 Sampling strategies and Techniques

The process of sampling outlines the framework on how the researcher selected the required representative sample from the total population in the study.

3.4.1 Sampling strategies

Both probability and non-probability sampling techniques were applied in selecting the respondents. The researcher used probability sampling to select postgraduate students while non-probability sampling was used to select the ICT and Library staff.

3.4.2 Sampling Techniques

Purposive sampling, stratified random sampling and simple random sampling techniques were preferred in selecting the sample frame. University of Nairobi was purposively selected due to its nature of being the largest university in Kenya with a huge population of students and well equipped with facilities. The university library was selected purposively based on its large size and the ability to fairly represent academic libraries on matters wireless innovations. The researcher purposively selected 16(10%) library staff (systems and wireless configuration sections) of the targeted 160 library staff. These staffs were believed to be directly involved in administration of internet connection, wireless configuration and system administration.

Stratified random sampling was used to select the College of Humanities and Social sciences because it serves diversified postgraduate student population. Postgraduate students are perceived to conduct serious studies hence contributing to research, study, learning and development which are the core functions of a library and the institution. With the information obtained from the CHSS, the study used sample size of 96 students comprising of postgraduates' students from the CHSS's 3 schools, 3 institutes and the Faculty of arts as outlined in Table 3.1 sample frame above.

Simple random sampling technique was used to calculate the sample size for postgraduate students using Slovin's Formula for precision. The Formula was chosen because it gives a precise sample since the researcher had no idea of the targeted population's behavior in using wireless technologies and innovations. Questionnaires containing both closed ended and open ended questions were administered to students to fill and return at their own time during the study within the library building. The users were given questionnaires on the basis of availability in the library during the period of data collection.

3.5 Data Collection Methods

Closed-ended questionnaires with some aspects of open ended questions were administered to postgraduate students and face to face interviews conducted for library and ICT staff in collecting data, and a voice recording device together with a notebook to record for reference purposes. The researcher believed that combination of these methods resulted in collection of all-inclusive and consistent data which could be easily be analyzed. A semi-structured interview guide was used to allow for flexibility so that questions were answered to the best of knowledge.

3.5.1 Questionnaire

The researcher, with the aid of library staff in charge personally distributed the questionnaires thus ensuring high level of etiquette in the whole process. Structured questionnaire which were used to collect data were drawn guided by the research objectives and questions. The questionnaires comprised of five sections which were; bio data, application of wireless innovations, wireless innovations in academic libraries, wireless innovations in research, learning and development, wireless innovations and transformation in academic libraries and sustainable strategies of sustaining wireless innovations. The questionnaires were administered to postgraduate students in the library

with the help of a staff in charge who helped identify those from the targeted population by verbal request. The questionnaire was structured with a proper introduction and background information to facilitate the study and used together with a data collection research letter from the department of library and information science.

3.5.2 Interviews

Interviews are recommended when collecting information that cannot be directly observed or information the respondents may find difficult to put down in writing. The primary data collection was done using semi-structured interviews with library staff in line with wireless innovations. The semi-structured interview schedule guided the researcher in ensuring consistency by pursuing same line of questions enquiry with each person. A list of questions which were covered was derived from the objectives and the research questions. The themes and sub-themes in the interview questions included; bio data, wireless innovations in academic libraries, wireless innovations and delivery of services, innovative applications of wireless innovations and strategies that enhance wireless innovations. Data was collected by both note-taking and voice recording where necessary. The interviews were conducted in the respondents' workplaces so that they could be observed in their conducive/natural environments and also not to distract them from their job activities.

3.5.3 Content Analysis

The researcher referred to the relevant documents for any additional or updated information in relation to wireless innovations in academic libraries. The researcher obtained some information from the department of library formally and the other from the university website through login credentials. Information from journals, books, websites and related sites were referred to, including reference to institutional policy documents managing the information technology and wireless innovations. Any

additional documents such as reports that provided evidence of wireless innovations at University of Nairobi library were also reviewed. Content analysis enabled the researcher to obtain more information which could not be released by the unwillingness of respondents to give out certain information. Content analysis was done to provide additional and essential information regarding wireless innovations in the university's JKML library.

3.6 Research Instruments Testing

The researcher carried out a pilot study prior to the actual research using interview guides, and questionnaires to collect data in order to test for validity and reliability of the instruments. The pilot study was conducted at Kenyatta University's Post-modern library which the researcher believed is a public university with similar settings as those of Jomo Kenyatta Memorial Library.

3.6.1 Pilot Study

The purpose of the pilot study was to test on the validity and reliability of the research instruments. A small sample of library users from a different university (Kenyatta University) was served with the questionnaires to test for any errors and also interview guides tested on some staff from that similar environment. This sample was picked using a purposive sampling technique. Kenyatta University's Post Modern library was chosen because it has characteristics similar to the population under study. Views from the pilot study were taken by the researcher and acted upon before carrying out the actual data collection. The findings from the pilot study indicated the presence of wireless technologies in academic libraries and the transformations. The wireless innovations have great potential to change the libraries both public and private.

3.6.2 Validity

The structured questionnaire for postgraduate respondents was designed based on the research questions and objectives of the study to ensure validity. Interview guides were designed according to objectives and research questions of the study and applied to gather information from the ICT staff and library staff respondents.

3.6.3 Reliability

The data collection tools were pre-tested before deploying them to make sure the questions posed in the questionnaire and interview guides were clearly understood. This helped address issues that would have affected the data and information collection process. The purpose of pretesting was to ensure effectiveness and accuracy of the questionnaire in the process of data and information collection. A cover letter was done to Kenyatta University's library management to allow and participate in pre-testing.

3.7 Ethical Considerations

The researcher attached an introductory and authorization letter from the university to the questionnaires and interview schedules which were given to the respondents to assure them that information shared was treated with confidentiality and only used purposely for academic research. The researcher sought clearance from the institution under study. To ensure respect, integrity and privacy of the respondents, the researcher sought consent of the respondents verbally to respond to the interview guides and questionnaires voluntarily without any reward in monetary terms or any kind. The respondents were given an opportunity to remain anonymous for confidentiality purposes. The privacy of all the respondents was maintained and the researcher to be accountable of the impact of the research. All works cited and used were acknowledged to avoid any forms of plagiarism.

3.8 Data Collection Procedures

The research was carried out in the natural settings of the respondents. The researcher collected data from postgraduate library users and library and ICT staff using questionnaires and interview schedules as well as making notes and recordings during the interviews. The interviews were recorded using a notebook and a recording device where permitted to do so.

3.9 Data Analysis and Presentation

The collected data from the questionnaires were coded and analyzed using Statistical Package of Social Sciences software and Microsoft Excel Spreadsheets for completeness, consistency and coherence. The presentation of data was done through use of tables, percentages, charts and narratives. The qualitative data from the interviews that is: opinions, attitudes and perceptions of the study were reviewed, put into themes and sub themes and merged according to the study objectives. The themes and sub-themes included: application of wireless innovations in academic libraries, wireless innovations in research, learning and development, innovative applications, strategies that wireless innovations and challenges of wireless innovations in academic libraries. The qualitative data was presented in narrative form as complimentary with quantitative data.

3.10 Chapter Summary

This chapter is an outline of the approach used in conducting the research. It therefore discusses the area of study, the target population, the sampling design, sample size, sampling techniques, the tools used for data collection, data collection procedures, data analysis and presentation and the ethical considerations.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter is an outline of the data presentation, data analysis, results and discussion of the data collected from the research study that investigated the transformative aspects of wireless innovations in academic libraries in Kenya with reference to University of Nairobi library. The study used questionnaires, interview schedules and content analysis to obtain data and information. The results were analyzed in relation to the research objectives which included: to find out the extent to which wireless innovations have promoted use of digital information resources in academic libraries, examine how wireless innovations have transformed delivery of services in academic libraries, establish innovative applications of wireless innovations in academic libraries, and propose effective strategies to enhance wireless innovations in academic libraries. This chapter covers areas of study based on the four research questions.

4.2 Distribution of the Respondents

The University of Nairobi's Jomo Kenyatta Memorial Library was purposively selected for this study. The study adopted a simple and stratified random sampling using Slovin's Formula for precision to get postgraduate respondents' sample size; and purposive sampling for the ICT and library staff as shown in earlier Chapter three. The total targeted sample size for this study was 112 respondents consisting of (96) postgraduate students and (16) library and information professionals. The researcher distributed 96 questionnaires to postgraduate respondents in the CHSS who were using JKML library and the response rate was 73 questionnaires.

An interview schedule targeted to collect data from 16 library and ICT staff but managed to get data from 10 staff. The post graduate students who responded to the questionnaires were 73(88%) of the sample size and 10 library staff were available for interviews as shown in Table 4.1 below. This indicates that majority of the respondents were postgraduate students. The response rate was attributed to the willingness and availability of the respondents to take part in the study.

Table 4.1: Response Rate

Respondents	**Frequency**	**Percent%**
Library and ICT Staff	10	**12**
Postgraduate Students	73	**88**
Total	**83**	**100**

4.3 Background Information of the Respondents

All the respondents were drawn from University of Nairobi's JKML. The study sought demographic information based on department, postgraduate programme, age bracket; and for the library and ICT staff the demographic information was for department and occupation. The postgraduate respondents were distributed as follows: 36(49.3%) of the total respondents came from School of Business, 11(15.1%) School of Education, 5(6.8%) School of Journalism, 4(5.5%) Institute of Development Studies, 1(1.4%) Institute of Diplomacy and International Studies, 2(2.7%) Population Studies and Research Institute, and 14(19.2%) were from Faculty of Arts. The distribution of the postgraduate respondents cut across most of the schools in the college of humanities and social sciences (CHSS) which was a well representation of the participants.

Additionally, 10 library and ICT staffs were available for interviews and these were from: graduate research library, circulation section, ICT and digital content unit, circulation section and technical services which were a well representation of the targeted participants.

The study found out that 69.9% of the postgraduate respondents were masters' degree students while 30.1% were PHD students, an indication that all those who responded majority were masters' students showing that a small number of PHD students frequent the library. All respondents were from the targeted group as shown in Table 4.2 below.

Table 4.2: Degree Programme

RESPONDENTS	FREQUENCY	PERCENT (%)
Masters	51	69.9
PHD	22	30.1
Total	**73**	**100.0**

As shown in Figure 4.1 below, most of the respondents (33) were between the age bracket of 21-30 years representing 45.2% of the total respondents; 16(21.9%) between the age bracket of 31-40 years; 19(26%) the age bracket of 41-50 years and 5(6.8%) the age of 50 years and above. This is an indication that majority of those who use wireless innovations are young people age bracket of 40 and below. The bar graph below illustrates the age distribution.

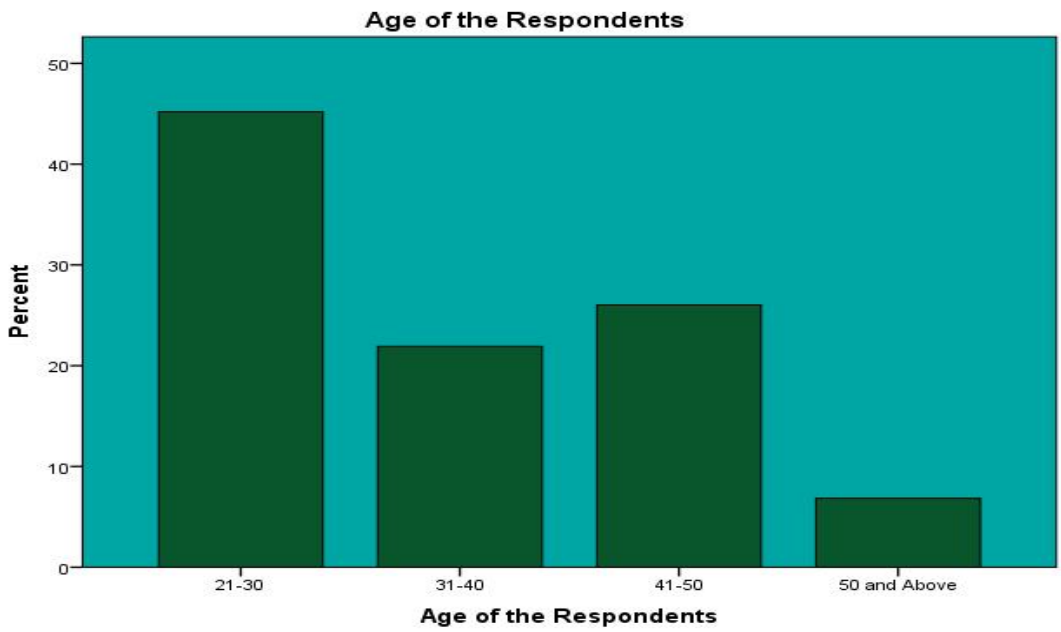


Figure 4.1: Age Bracket of the Respondents

From Figure 4.1 above, majority of the users of wireless networks are young people between the age of 21-30 years while age 50 years and above make the least users. This shows that the user needs in the library have changed with the millennial population who frequent the library.

4.4 Application of Wireless Innovations

The study sought to find out for how long the postgraduate respondents have used the wireless innovations at the JKML. The results showed that majority of the respondents, that is, 60.3% have used wireless networks in less than 2 years, 35.6% 3-5 Years and 4.1% 6 years and above as shown in Table 4.3 below. This reveals that students who have used wireless innovations for 6 years and above at JKML were less in number.

Table 4.3: Duration on Use of Wireless Connectivity

RESPONDENTS	FREQUENCY	PERCENT
0-2 Years	44	60.3
3-5 Years	26	35.6
6 Years and Above	3	4.1
Total	**73**	**100.0**

The respondents were asked to state on how they learnt about wireless connections. Results from the study indicated that majority of the postgraduate respondents (45%) learnt about wireless innovations from fellow students, 32% from library staff, 14% from university website, 7% from the notice board, 1% from lecturer and another 1% from both the fellow student and library staff as shown in Figure 4.2 below. This indicates that majority of the respondents learnt through interactions with fellow students followed by library staff and then university website at 14%.

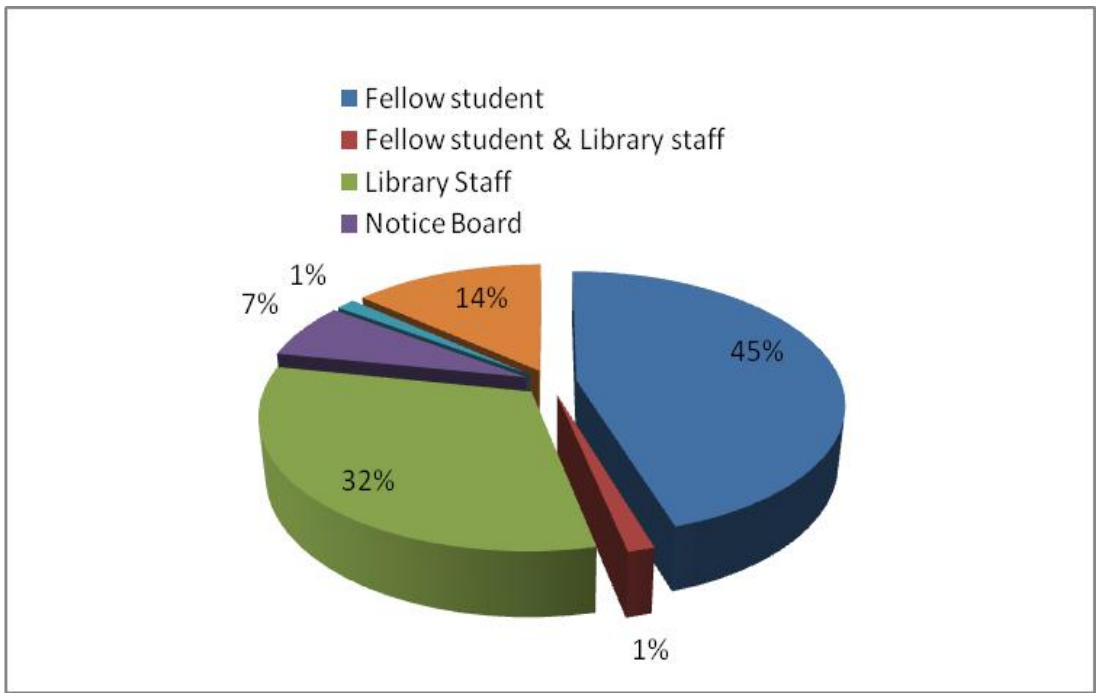


Figure 4.2: Responses on Knowledge of Wireless innovations

On which devices the respondents used to access wireless innovations, the results showed that 23.29% of the respondents' accessed by use of laptops, 19.18% used both laptops and handheld devices, 13.70% used desktops, and 16.44% purely handheld devices while another 16.44% used the three: laptops, desktops and handheld devices as shown in Figure 4.3 below. This is an indication that BYOD is dominated when it comes to using wireless technologies. As suggested by Tomer (2016:4-5), academic libraries in developed countries have encouraged the use of wireless innovations by allowing clients' access via various types of gadgets with some libraries providing the gadgets in their libraries for short-term loan to clients. From this study, the researcher sought to find out the relationship between gadgets and wireless innovations. The capability of these devices in availing information anywhere anytime has made academic libraries to be at ease (Bernice & Pierce, 2011).

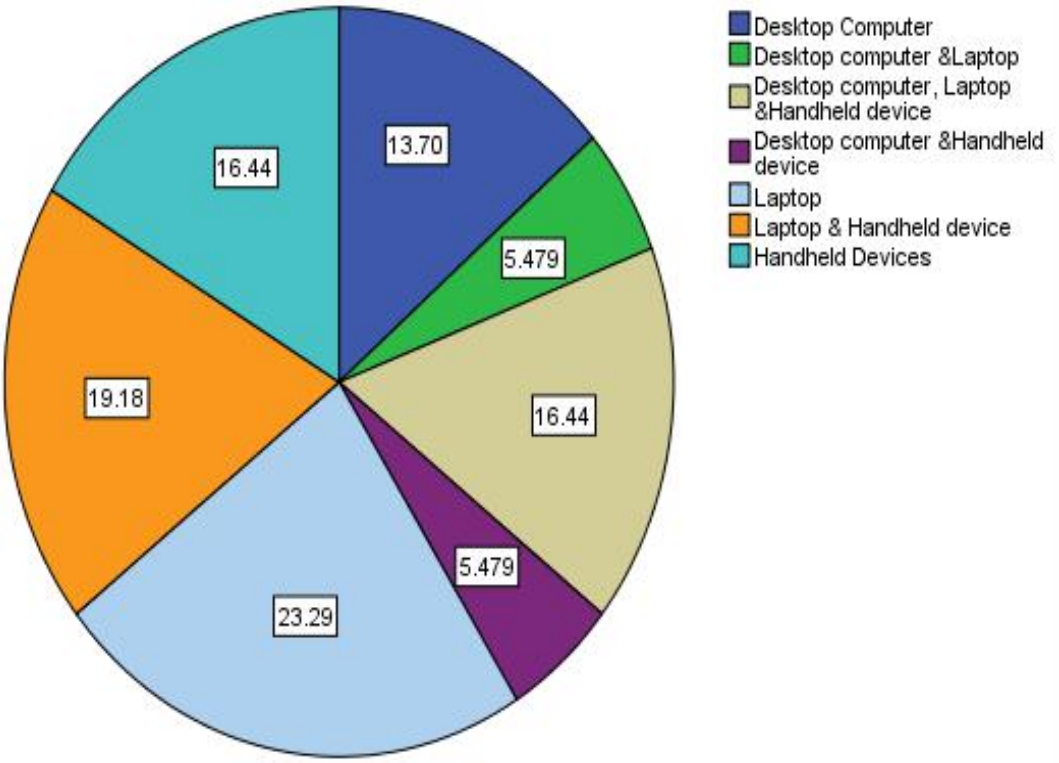


Figure 4.3: Gadgets Respondents used to Access Wireless Innovations

4.5 Wireless Innovations in Academic Libraries

In respect to the wireless innovations in academic libraries, various aspects were analyzed as follows: digital information resources and services, quality information resources and services, information landscape, library space, access to more literature, seamless instant communication, ample environment for intensive concentration, virtual contact with library staff and online sharing and collaboration. The aspects of wireless innovations in the JKML library were expressed as in Table 4.4 below.

Table 4.4 Wireless Innovations in the Library

Wireless Innovations in the Library	Respondents Percent%					
	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree	Total
Transformed access to digital information resources	65.8%	23.3%	9.6%	-	1.4%	100%
Facilitates greater access to quality information resources	49.3%	37%	12.3%	-	1.4%	100%
Helps meet the needs and demand of users	41.1%	41.1%	11%	5.5%	1.4%	100%
Helps to solve the space issue	53.4%	23.3%	15.1%	5.5%	2.7%	100%

Findings confirm that wireless innovations have indeed transformed access to digital information resources in ALs. As from Table 4.4 above, more than half of the respondents 65.8% strongly agreed 23.3% agreed that there is access to digital information resources through wireless networks at JKML whereas 9.6 % were neutral and only 1.4% strongly disagreed. This is in line with an observation by Tomer, (2016) on how wireless innovations have enhanced continued use of digital and electronic resources in academic libraries. The study also sought to find out the extent to which wireless innovations facilitate access to quality information resources where; 37% agreed, 49.3% strongly agreed and 1.4% strongly disagreed as shown in Table 4.4 above. This is confirmed in Baker, (2016:17) who said that with wireless innovations, libraries have been able to provide access to quality digital library and online resources.

In regard to whether wireless innovations have met the needs and demands of users in relation to information landscape, 41.1% of the respondents strongly agreed and another 41.1% agreed, 11% were neutral, leaving 6.8% of the respondents disagreeing. This shows that majority are comfortable the way wireless technologies and innovations are solving the user needs problems. This is in agreement with Canuel & Critchton, (2011) who opines that M-learning users prefer to be part of the main participants in terms of engaging and accessing the required content rather than being passive participants. On the issue of space utilization, the responses as shown in Table 4.4 above, 53.4% and 23.3% of the respondents affirmed that wireless innovations have indeed solved the space issue in academic libraries; 8.2% disagreed while 15.1% remained neutral as in Table 4.4 above.

4.5.1 Wireless Innovations and Research, Learning and Development

On whether wireless innovations supports access to more literature and quality information, 65.75% of the respondents strongly agreed, 26.03% agreed, 6.84% were neutral while 1.37% disagreed as shown in Table 4.5 below. Through use of Wireless networks, access to web OPAC is now easier hence access to more information on data and information available in the library (Krishnamurthy & Rajashekara, 2011). The study as well sought to find out whether wireless innovations resulted to seamless instant communication platforms where 47.95% of users agreed, 27.40% strongly agreed and 4.11% did not respond to the question as shown in Table 4.5 below. As shown in Table 4.5 below, 36.99% of the respondents strongly agreed that wireless innovations support an ample environment for intensive concentration, 38.36% agreed, 16.44% were neutral while 8.21% disagreed.

On the extent to which wireless innovations supports virtual contact with library staff to which 24.66% strongly agreed, 32.88% agreed, 21.92% were neutral, 9.58% disagreed, another 9.58% strongly disagreed while1.37% did not respond to the question as shown in Table 4.5 below.

Table 4.5: Wireless Innovations in Research, Learning and Development

	Respondents Percent %				
Wireless Innovations in Research Learning and Development	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Access to more literature and quality information	65.75%	26.03%	6.85%	-	1.37%
Seamless instant communication platforms	27.40%	47.95%	16.44%	2.74%	4.11%
Ample environment for concentration	36.99%	38.36%	16.44%	8.22%	-
Virtual contact with library staff	24.66%	32.88%	21.92%	9.59%	10.96%
Online sharing and collaboration	47.95%	35.62%	5.48%	6.85%	4.11%

On the aspect of wireless innovations supporting online sharing and collaboration 47.95% of the respondents strongly agreed, 35.62% agreed, 5.47% were neutral, 6.84% disagreed while 4.11% strongly disagreed as shown in Table 4.5 above. Majority of the respondents were in agreement with the tremendous contribution of wireless innovations in academic libraries on all the aspects sought on this objective.

4.6 Wireless Innovations and Transformation in Academic Libraries

Another objective of the study was to find how wireless innovations have transformed academic libraries. The following aspects were looked into: wireless technologies; (such as video/audio-visual instructions, e-learning, smart digital shelves, social media, and access to OPAC, bring your own device (BYOD) and digital information systems) and wireless connectivity factors.

4.6.1 Wireless Technologies

On the aspect of wireless technologies, the study sought to find out the extent to which video/audio instructions are applied in academic libraries. Majority of the respondents (28.77%) indicated they did not know whether they are applied, 24.66% indicated video/audio instructions were somewhat applied, 16.44% indicated not applied, 15.07% indicated applied, 12.33% indicated strongly applied and 2.74% did not respond to the question as shown in Table 4.6 below. This is an indication that more efforts need to be made to sensitize use of audio/video instructions applications. Findings on application of E-learning indicated 34.25% strongly applied, 35.62% applied, 15.07% somewhat applied, 2.7% not applied, 9.59% don't know and 2.47% missing. As suggested by Bawack (2019:4), majority of academic institutions have partnered with their library department to offer online courses as well as distance and e-learning. Libraries are therefore required to provide information and resources such as e-books and e-journals. On the extent to which smart digital shelves are applied in academic libraries 30.14% indicated did not know, 27.40% indicated somewhat applied, 13.70% applied, 10.96% indicated strongly applied, 9.58% not applied while 8.21% did not respond to the question as shown in Table 4.6 above.

This implies minimal efforts at JKML to embrace use of smart digital shelves although that is what most users could have wished for (Pujar & Satyanarayana, 2015:188). On the extent to which social media is applied in academic libraries where 32.88% indicated strongly applied, 32.88% indicated applied, 16.44% somewhat applied, 5.47% indicated not applied 9.58% indicated don't know and 2.74% did not respond to the question as shown in Table 4.6 below. This confirms that most users in the library are actively communicating and interacting in social media through use of wireless networks (Ng, 2016).

Table 4.6: Wireless Technologies

	Respondents Percent %						
Wireless Technologies	Strongly Applied	Applied	Somewhat Applied	Not Applied	Don't Know	Missing	Total
Video/Audio instructions	12.33%	15.07%	24.66%	16.44%	28.77%	2.74%	100%
E-learning	34.25%	35.62%	15.07%	2.74%	9.59%	2.74%	100%
Smart digital shelves	10.96%	13.70%	27.40%	9.59%	30.14%	8.23%	100%
Social media	32.88%	32.88%	16.44%	5.48%	9.59%	2.74%	100%
Access to OPAC	38.36%	28.77%	16.44%	2.74%	9.59%	4.11%	100%
Bring your own device	47.95%	27.40%	9.59%	5.48%	5.48%	4.11%	100%
Digital information systems	30.14%	23.29%	26.03%	6.85%	12.33%	1.37%	100%

The study as well sought to find out the extent to which OPAC is applied in academic libraries where; 38.36% of the respondents indicated strongly applied, 28.77% applied, 16.44% somewhat applied, 2.74% not applied, 9.58% did not know while 4.11% did not respond to the question as shown in Table 4.6 above. In this case, most users are able to access the library holdings irrespective of their location either within or outside the library making their work easier hence saving time (Krishnamurthy & Rajashekara, 2011). The study sought to find out the extent to which bring your own device (BYOD) is applied in academic libraries whereby 47.95% of the respondents indicated strongly applied, 27.40% applied, 9.58 somewhat applied, 5.47% not applied, 5.47% did not know while 4.11% did not respond to the question as shown in Table 4.6 above. This is echoed by Gisolfi, (2015) who noted that the digital age is defined by new technology gadgets hence the need for libraries to set aside spaces for digital instructions on access to information resources. Another aspect was the extent to which digital information systems are applied in academic libraries where 30.14% indicated strongly applied, 23.29% indicated applied, 26.03% indicated somewhat applied, 6.84% indicated not applied, 12.33% indicated did not know, while 1.37% did not respond to the question as shown in Table 4.6 above. The results imply that most users at JKML are able to access to the digital resources through utilizing the wireless connections as revealed by Baker, (2016:8).

4.6.2 Wireless Innovations and Delivery of Services

The study sought to find out the factors that show transformation of services in academic libraries whereby the following aspect were analyzed: access to library instructions via digital devices, self-navigation in the library via the help of video/audio simulation,

provision of up to date information via OPAC, automation of information resources and access to digital repositories as shown in Figure 4.4 below.

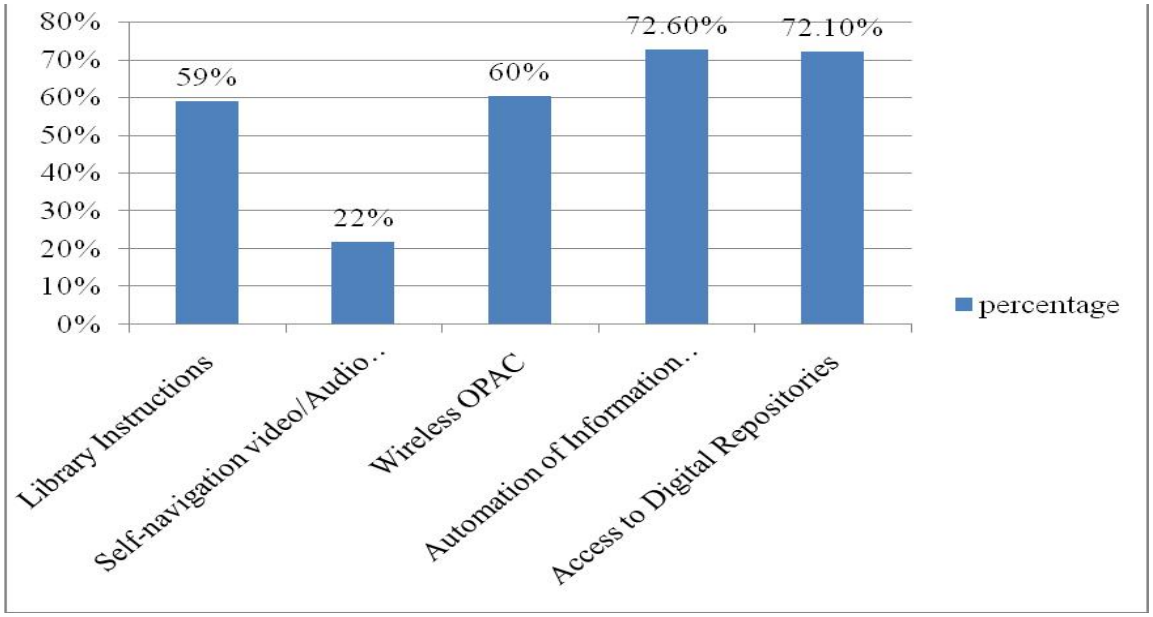


Figure 4.4: Factors that show transformation of services in Academic Libraries

The study sought to find out wireless innovations that show transformation of services at JKML where; use of digital devices to access library instructions had 58.9%, self navigation in the library through video/audio simulation 21.9%, wireless OPAC 60.3%, automation of information 72.6% and access to digital repositories via 78.1% as shown in Figure 4.4 above. From the findings, self navigation in the library had the lowest score at 21.9% an indication that limited efforts have been put to utilize this application. Pujar & Satyanarayana (2015:189) concurred that libraries can get maximum benefits if they had users' mobile phones play a video/audio once they are in the library to explain more about that section and the services available. The analysis reveal that if more effort is inserted in these technologies and sensitization done properly, great potential can be unveiled and services have an updated impact in the lives of the clients.

4.7 Innovative Applications of Wireless Innovations in Academic Libraries

The study sought to find out the innovative applications of wireless technologies and innovations in academic libraries. The respondents were asked to indicate whether virtual library access, online library lending of materials, online notification of new and relevant materials and e-learning influence wireless innovations in academic libraries. The results were as shown in Table 4.7 below:

Table 4.7: Innovative Applications that Influence Wireless Technologies

Wireless Technologies Influence	Percent %
Virtual library access	71.2%
Online lending of materials	49.3%
Online notifications on new and relevant materials	52.1%
E-learning	86.3%

Findings from the study on innovative applications that influence wireless technologies in academic libraries, respondents were asked a question to select all that apply where; 71.2% of the respondents selected virtual library access, 43.8% online lending of materials, 52.1% online notifications on new and relevant material and E-Learning 86.3% as shown in Table 4.7 above. E-learning received the highest percentage at 86.3% implying that it is what most clients would prefer, followed by virtual library access at 71.2%, online notification of new materials at 52.1% and online lending of library materials at 43.8%. The results show that there is a slow uptake of online lending of

materials through wireless networks and little notification of new and relevant materials. Islam & Sheikh (2019) opines that in this era of digital information resources, most post-graduate students depend on online databases in the learning and research activities. There is a need for academic libraries to grab the opportunity and cover that gap to realize full potential of wireless technologies' applications as this can help libraries with historic buildings to have attractive features to millennial users (Tomer, 2016:24). As explained in Chapter Two, a combination of mobile smart applications and other gadgets can collect data on what clients mostly access which could be saved and notifications made once the materials are available so that they can open the links easily.

4.7.1 Wireless Technologies in Facilitating Usability of Information Resources

The study as well sought to know whether wireless technologies facilitate the following aspects: wireless access to online resources, internet of things, automation of information mobile smart applications and social media. Findings aimed to unveil the practical applications of wireless innovations that facilitate usability of information resources at JKML. From the responses, 78.1% of the respondents indicated that wireless technologies is strongly applied in facilitating online access to information resources, 5.5% applied, 1.4% somewhat applied, 2.7% not applied 1.4% did not know while 11% did not respond to the question as shown in Table 4.8 below. The study as well sought to know whether internet of things facilitate access to information resources. From the responses, 24.7% indicated strongly applied, 19.2% not applied 6.8% of the respondents indicated somewhat applied 8.2% not applied, 19.2% don't know and 21.9% did not respond to the question. The researcher noted that the respondents had difficulties in understanding the term internet of things. The study as well analyzed whether wireless

technologies facilitate automation of information, 11% did not respond, another 11% indicated did not know and 4.1% indicated not applied while 9.6%, 23.3% and 41.1% indicated somewhat applied, applied and strongly applied. The results show that the respondents have seen the changes in automation since wireless technologies came into effect.

Table 4.8: Innovative Applications that Facilitate Usability of Information Resources

	Respondents Percent %						
Innovative Wireless Technologies Facilitate	**Strongly Applied**	**Applied**	**Somewhat Applied**	**Not Applied**	**Don't Know**	**Missing**	**Total**
Wireless Access to Online Resources	78.1%	5.5%	1.4%	2.7%	1.4%	11%	100%
Internet of Things	24.7%	19.2%	6.8%	8.2%	19.2%	21.9%	100%
Automation of Information	41.1%	23.3%	9.6%	4.1%	11.0%	11.0%	100%
Mobile Smart Applications	35.6%	13.7%	17.8%	5.5%	11%	16.4%	100%
Social Media	54.8%	15.1%	13.7%	2.7%	5.5%	8.2%	100%

The study further sought to find out whether wireless technologies and innovations facilitate development of mobile smart applications in academic libraries. From the responses 35.6% indicated strongly applied, 13.7% applied, 17.8% somewhat applied, whereas 16.4%, 11% and 5.5% provided no response, did not know and not applied as shown in Table 4.8 above. This indicates there is a lot which needs to be done to develop mobile smart applications that help users get the content they need in their mobile phones

such as connection to sites such as Amazon (Pujar & Satyanarayana, 2015:188). On application of social media, the results indicate 54.8% strongly applied, 15.1% applied, 13.7% somewhat applied, 2.7% not applied, 5.5% don't know while 8.2% never responded to that question. This shows that even though users can use the social networks to air their opinions through online platforms while still using the library (Ng, 2016) only an average percentage (54.8%) used social media while accessing wireless connectivity.

4.7.2 Wireless Connectivity Beacons

The library staff admitted that aside from the wireless OPAC close to the entrance there are no other beacons in place to notify users on where to find what, for instance the floor number, the kind of resources and new arrivals. The users purely rely on their own search skills provided they have internet access. This implies there is a gap in fully implementing the potential of wireless innovations. If the library for instance adopted the internet of things technology, it can help improve the services of the library. Internet of things technology gathers information by monitoring patron's frequency to a certain section in the library or online platform; the materials they access, hence helping in collection development or provides link to related literature in the area and development of intuitive databases by library professionals (Nag & Nikam, 2016).

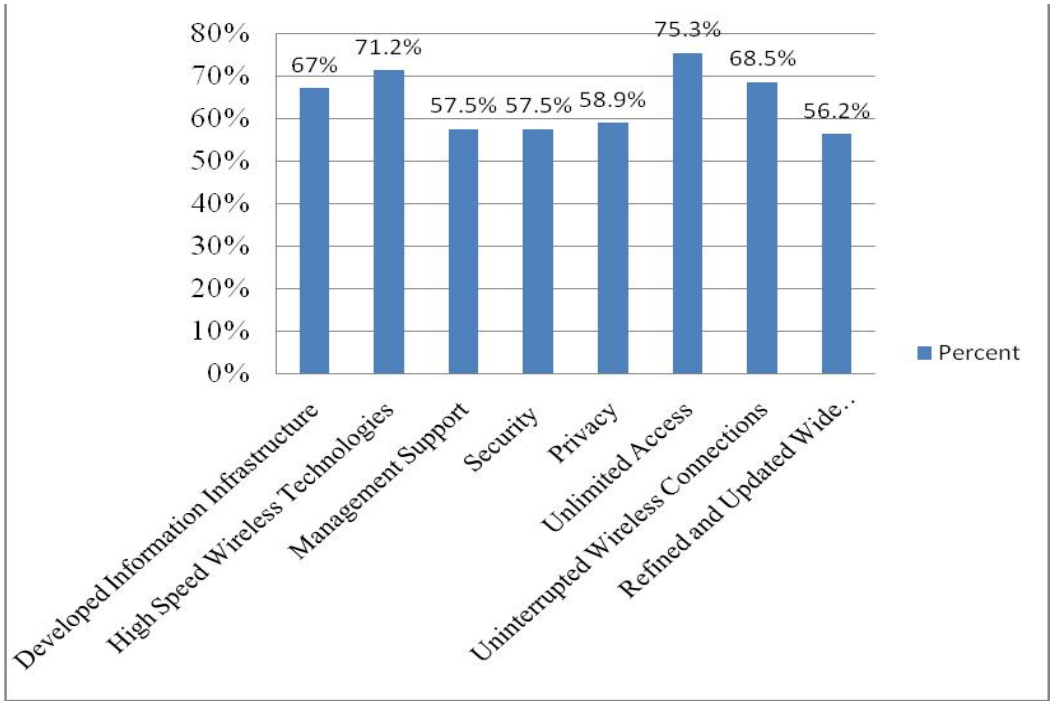
4.8 Strategies that Enhance Wireless Innovations in Academic Libraries

The study sought to find out strategies that could enhance wireless innovations in academic libraries where various aspects were analyzed including: high speed wireless technologies, refined and updated downloadable applications, adequate funding, information infrastructure, management support, uninterrupted wireless connection, unlimited access, privacy and security. The respondents were asked to select all strategies

that applied in managing wireless technologies and innovations and the results were as follows:

From the responses, high speed technologies got 71.25%, refined and updated downloadable applications 56.2%, developed information infrastructure 67.1%, management support 57.5%, uninterrupted wireless connections 68.5%, unlimited access 75.3%, privacy 58.9%, security 57.50% and refined and updated applications 56.20% as shown in Figure 4.5 below. From the analysis, users prefer high speed wireless technologies for faster downloads to complete their work activities in time. The study also indicates that users would be satisfied in having updated downloadable applications for library instructions on access to information resources.

Figurer 4.5: Strategies for Managing Wireless Innovations



As for developed information infrastructure, traditionally libraries have been using wired internet connections. The staff respondents agreed that wireless internet connections still needed wires to connect to computers but fortunately the existing wires were compatible and only needed expansion. The respondents needed digital literacy soon after they join learning institutions to help them maneuver through online resources well. Academic libraries are growing organisms hence they need for expansion. As explained in Chapter Two, libraries can insert Bluetooth chips into existing computers, printers and keyboards to support IoT connections for users to gain access to virtual information resources (Tomer, 2016:21). The ministry of Information Communications and Technology (2016:16), recommended ultra high speed technologies for faster download of information.

4.8.1 Adequate Funding

From the interviews with the ICT and library staff, the study found out that although the wireless technologies are perceived to cut down on the costs, it requires great investment hence adequate funding. The cost of information infrastructure, development of digital libraries, digital repositories, online access and hiring or training expertise is high. The library budget in most institutions is low compare to the expenses hence for wireless innovations to be effective, adequate funding from the government, parent institutions and other funding parties is required for it to be successful. Baker, (2016:22) recommends adequate funding to libraries to cater for the constant change and integration of new technology. Given that libraries are expected to be the first adopters of any new technology to enable users access information and appreciate library services lest they switch to ‘greener pastures’ adequate funding should be prompt in every institution and

should not take long procedures to avail. Management should also support wireless technologies by training and hiring enough expertise for installation and maintenance.

4.8.2 Sustainable Practices for Wireless Innovations

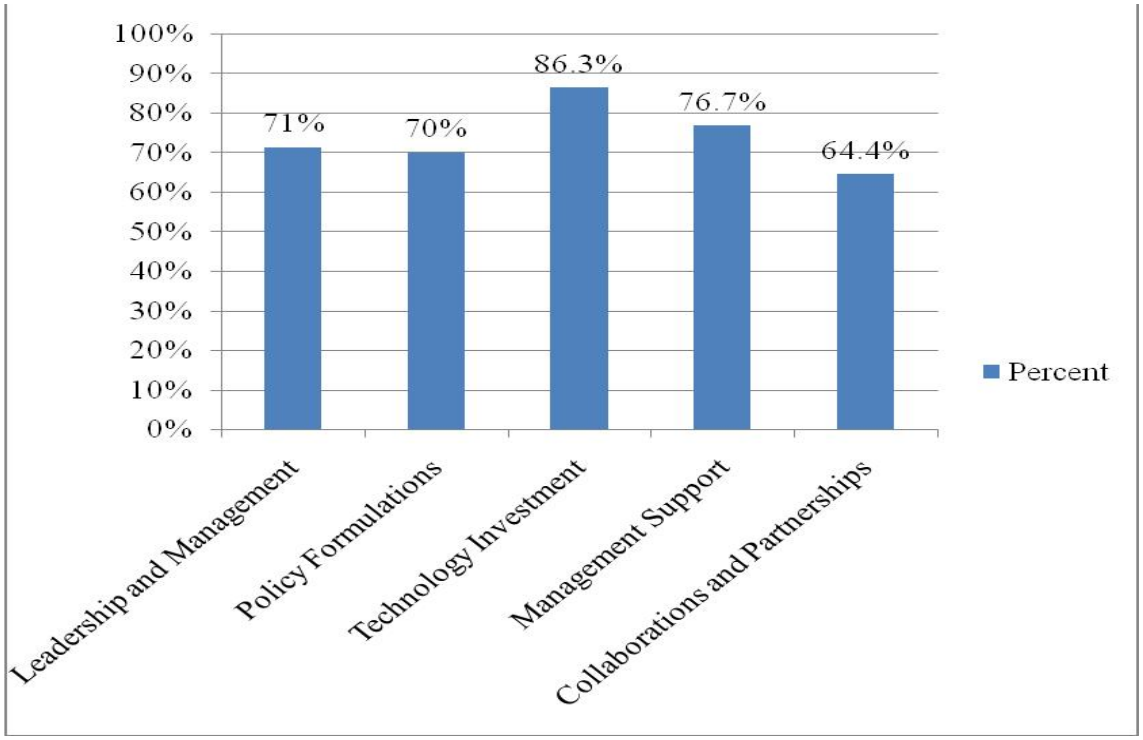
Another aspect of the study was to analyze sustainable practices for wireless innovations whereby; leadership and management, policy formulations, technology investment, management support, collaboration and partnerships were analyzed as in Figure 4.6 below.

Findings from the study indicate that leadership and management in sustaining wireless innovations was rated at 71%, policy formulations 69.9%, technology investment 86.3%, management support 76.7% and collaboration and partnerships at 64.4% as shown in Figure 4.6 below. Technology investment had the highest percentage, an indication that respondents needed to be abreast with the newest wireless technology in the market. Majority of the respondents were for the opinion that proper leadership and management was a key aspect in sustaining the wireless innovations.

Majority of the respondents as well ascertained that policy formulations are a contribution to wireless innovations as this could help maximize use of wireless connections to only authorized clients of JKML. The respondents also indicated that management support is critical in hiring the required staff able to teach clients on information and digital literacy; make users aware of wireless technologies and show them how to navigate through electronic resources. On collaboration and partnerships, millennial information seekers do not want to be passive users of information rather they want to be active contributors of knowledge. As a result, they want libraries to encourage

collaboration and partnerships with other institutions to give them an uninterrupted platform to actively contribute to knowledge. Figure 4.6 below is an analysis from the respondents on the sustainable practices of wireless innovations.

Figure 4.6: Sustainable Practices for Wireless Innovations



4.8.3 Issues That Wireless Technologies and Innovations Face in Academic Libraries

From the study, the respondents were given room to provide further comments in regard to wireless innovations in academic libraries. The study established issues regarding wireless innovations which included lack of sensitization on the benefits of using wireless innovations to access library information as the respondents cited that there are other potential users who are unaware of the availability of the wireless innovations.

Wireless internet downtime is another challenge as some respondents mentioned slow connectivity, unreliability of the networks and unavailability of staff to respond to online queries. Another issue is lack of expertise to unleash the potential capabilities of wireless innovations and inadequate funds to expand the services.

4.9 Chapter Summary

The chapter has analyzed various issues in regard to wireless innovations aspects in academic libraries. Each objective has been analyzed and the results presented in form of a table, bar graph or pie chart. The data was collected from a sample of postgraduate students from the College of Humanities and Social Sciences using questionnaires which were administered on a face to face basis. Qualitative analysis from the interview which was conducted on the library staff is also included in this chapter.

CHAPTER FIVE

SUMMARY OF THE FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of the findings resulting from the research objectives and questions. It therefore contains the summary of the findings, conclusions and recommendations based on the data analysis and presentations from chapter four. It also has suggestions for further research.

5.2 Summary of the Findings

The aim of this study was to investigate the transformative aspects of wireless innovations in academic libraries in Kenya with reference to University of Nairobi Library.

The objectives of the study were to:

1. Find out the extent to which wireless innovations have promoted use of digital information resources in academic libraries.

2. Examine how wireless innovations have transformed delivery of services in academic libraries.

3. Establish applications of wireless innovations in academic libraries.

4. Propose effective strategies to enhance wireless innovations in academic libraries.

The findings are summarized according to the four objectives of the study as follows:

5.2.1 Application of Wireless Innovations

The first objective of this study was to find out the extent to which wireless innovations have promoted use of digital information resources in academic libraries. The findings from the study confirmed that most of the respondents accessed wireless innovations through use of laptops, smart-phones or other handheld devices. This is an indication that wireless innovations enable flexibility as with the portable devices the respondents could access digital information resources irrespective of their location within the campus radius. Additionally, the study revealed that struggle for space issue to access the computer terminals has reduced since the wireless connections enabled internet access through personal handheld devices. The results from the study shows need to increase power extension cables and comfortable tables to enable users work from a conducive uninterrupted environment.

5.2.2 Wireless Innovations in Academic Libraries

With the uptake of online and distance learning, e-learning, competition from other institutions and introduction of e-books, e-databases and digital repositories, academic libraries are making efforts more so JKML are up in arms to support their parent institution to meet the client demands by providing wireless networks. It was confirmed from the interviews that e-portals for students and staff have relieved the library staff on the hustle of long queues and time taken to retrieve materials for visiting scholar from Africana section who could now access digital repositories irrespective of their location.

The study established that JKML is a member of Kenya library and information services consortium (KLISC) which is a consortium where libraries are able to affordably subscribe to e-resources at a reduced rate to various publishers of e-books. The library

staff felt that the wireless innovations are helping them to meet the users' needs and demands by creating digital libraries with e-resources, e-repositories with authentic, authorized and quality online resources. The study revealed that every user had a chance to access these online resources and get adequate navigation for quality information since due to free Wi-Fi. The study also revealed there is virtual contact with library staff through an online platform "AskaLibrarian" where users get instant communication on library issues. However, from the study, it was established that some users are not aware of some services and benefits they could get by use of wireless innovations. For instance, further comments provided by respondents suggested more sensitization on ICTs and other technologies and orientation on how to access quality e-resources. Most importantly, majority of the respondents admitted that by use of wireless innovations, they were free to do serious work, were free to penetrate the market of information and have free opinion and suggest solutions through online communication platforms.

5.2.3 Wireless Innovations and Transformation in Academic Libraries

The second objective of the study was to examine how wireless innovations have transformed delivery of services in academic libraries. Various aspects were analyzed under this objective. From the study, various wireless innovations are available for use in delivery of services in academic libraries. Majority of the respondents admitted using social media, wireless OPAC, BYOD, digital information systems and E-learning with high rating; whereas audio/video simulations and smart digital shelves were less used. This is an indication that although wireless innovations have a greater potential of transforming library services, the capabilities are underutilized and libraries need a constant upgrade of technology to maximize use of wireless innovations.

For instance, creation of Wi-Fi zones within the library could encourage virtual learning and use of video/audio simulations and tutorials to emphasize points during class sessions. With a library which serves users with different disabilities, these wireless innovations could solve issues like mobility especially for physically challenged users.

The aspect of e-learning where 35.62% admitted usage, shows that more emphasis need to be put for users to access e-learning tools and e-books especially those who cannot make it daily to the library but can access wireless connectivity. By use of social media, users showed that they could be connected to their friends, family and social opinion contribution while minimizing movements and keeping everything in order from just one location. Academic libraries should consider exhausting potential capabilities of social media since it is a platform which can be accessed by all irrespective of age so that people can create and utilize online communities and share opinions for research and development.

5.2.4 Wireless Innovations in Research, Learning and Development

Libraries have made an effort to expand library services by developing websites which can open wireless OPAC through mobile phones helping users to browse through library collection without being limited to just one location where 38.36% of the respondents admitted usage. In connection to the number of JKML users, this was a small percentage implying need to sensitize clients on OPAC access. Also, JKML has automated most of their resources, encouraged open access, provided up to date OPAC information, created access to digital repositories and encouraged BYOD because most respondents were either using personal laptops or other hand-held devices to access Wi-Fi.

On the other hand, there is an urgent need for libraries to develop smart mobile applications to help notify users immediately they are in the library on where to get certain services, which floor, which kind of information, related information and where to get assistance in case they were stuck. From the study, it was unveiled that self-navigation was a bit hard for the users since there weren't any audio/video simulation on how to access online resources. There was an indication that there are users who were making personal contact with librarians since they did not have any alternative to access the information they needed other than personal contact with the librarian whereby the users expressed concern that virtual library contact took long before they could get feedback.

5.2.5 Innovative Applications of Wireless Innovations

The third objective of the study was to establish innovative applications of wireless innovations in academic libraries. From the study, majority of the respondents agreed using wireless innovations for virtual library access, E-learning, social media and online notifications of relevant materials. This is an indication that majority of the clients preferred virtual access to information resources as they believed that online resources contain latest edition as compared to print resources. On the other side, the study revealed JKML libraries have neither embraced nor popularized use of wireless innovations for online library lending of materials, internet of things, connectivity beacons, virtual library cards, loaning hotspots and automation of information.

Results revealed that contrary to developed countries there is loaning of handheld electronic gadgets for library clients (Seal, 2015:565), in the Kenyan libraries few academic libraries can lend users even laptops to use while in the library if users have not

carried theirs. This means that if a user has a tight schedule and cannot afford to carry their own devices they can only rely on the fixed computer machines in the computer rooms which are available for a maximum of two hours. Similarly, in a situation where library users could check materials out for themselves using virtual library cards, the technology has not yet been implemented. Although, libraries have made an effort in automation of information resources and access to digital resources the numbers who utilize these resources is low compared to the investment.

5.2.6 Strategies that Enhance Wireless Innovations

The fourth objective of the study was to propose effective strategies that would enhance wireless innovations in academic libraries. From the study, it was revealed that there are various strategies for managing and sustaining wireless innovations. As part of management support, the library has increased bandwidth speed to help more users to access information quickly. The study also revealed presence of firewalls to bar users from accessing unauthorized sites such as pornographic sites. In addition, results from the study revealed an encouragement for online collaboration and partnerships for access to reliable, accessible and available information resources.

To keep up with privacy and security the library has an ICT policy, restricted access through use of restricted passwords and firewalls. The leadership and management ensure regular maintenance and such as electrical repairs, replacing of switches, bandwidth upgrade and adequate funding. The library also offers unlimited access to its users all the time irrespective of whether the library is closed or open. It was observed that respondents recommended more security to prevent sharing of passwords with outsiders

and hiring more expertise for continued update and maintenance of the wireless technologies.

5.3 Issues That Wireless Innovations Faces in Academic Libraries

The library staff cited high costs involved in the full implementation of wireless technologies especially the expertise for installation, maintenance and to exploit all the potential of wireless innovations. Also, it can be expensive because wireless internet connections need regular payments of which if not met the service provider can disconnect them anytime they feel like. The management on the other side neglects the use of wireless innovations in marketing information resources. Besides, there is also misuse of wireless innovations through personal gadgets. Security challenges as users sometimes share passwords with outsiders. Additionally, it was noted that Wi-Fi is not only within a limited range but also experiences downtime due to the high number of users at the same time. It was also notable that when using BYOBs especially the smart-phones, there is a lot of interference and distractions such as receiving calls and other applications.

5.4 Conclusion

The findings from the study show that wireless innovations are vital for any library and that libraries have taken the initiative to meet the needs of its users which have changed with technology. Most library services are now technology oriented whereby there is a drop in the use of computer stations where users used to flock and queue for long hours to access the internet. There is high demand for power socket as more users are now armed with personal gadgets which can access Wi-Fi and they need to keep them charged. Access to e-resources is increasing and demand to digital libraries is high hence creation

of digital repositories which has become a relief for Africana sections which was overwhelmed before and needed only 'special' people to have access to it. In conclusion, there is wider access and mobility of resources as even users who used to travel from other countries to just access JKML library can now access whatever information resource they need online remotely without having to travel all the way hence cutting down on cost. The library has integrated RFIDs and is looking forward for self checkouts as is the case with e-lending of e-resources such as e-newspapers. There is emergence of e-librarians and unlike in the past which involved transactions, the wireless technologies and innovations have encouraged interactions.

The results of this study are only restricted to the time when this study was conducted. Given that time changes and technology keeps on improving and libraries are the first ones expected to adopt any new technology, the same study conducted in a different time from the time these results were out may give different results. Also, this study was conducted in a number one institution in Kenya (University of Nairobi) located in the capital city, implying that if a similar study could be conducted in a different institution, circumstances might be different. Practically, every academic library needs to implement wireless connectivity and uncover all its potential since most aspects covered in this study revealed a good number of advantages.

5.5 Recommendations

Based on the findings of this study, there are issues which need to be addressed. In view of the findings the research recommends the following:

1. Concerning extent to which wireless innovations have promoted use of digital information resources, academic libraries ought to develop discovery tools to be able to serve users from any location. Management should embrace vibrant use of wireless technologies and innovations such e-mail notifications to market information resources and services. Budgetary allocation to hire enough expertise to exploit all potential capabilities of wireless innovations so as to fully realize the benefits. To top it all, regular orientation for users is recommended and sensitization workshops to fully exploit usage of digital information resources.

2. On how wireless innovations have transformed delivery of services in academic libraries the study recommends that the libraries develop mobile smart applications which can collect user information and help identify their needs by tracking their information search records. Besides, the library management can organize to put up wireless beacons in every floor or selected corners of the library to help in self-navigation using audio/video simulations. It could also be beneficial if the moment users log in to the Wi-Fi connections using their personal devices, they are notified on any new and relevant materials in their line of study based o their search history.

3. Regarding innovative applications of wireless innovations in academic libraries, the study-in comparison with developed countries-recommends academic that libraries consider budgeting for handheld gadgets or laptops for loaning to users who might not afford or have carried theirs to use within the library. The study also recommends inclusion of technologies such as IoT for inventory management, wireless beacons for audio/video simulations among other technologies.

4. On effective strategies to enhance wireless innovations in academic libraries the study recommends political support such as reduction of taxes on ICT equipment and fiber cable, adequate funding, leadership and management support by hiring and training enough qualified expertise, power back-up systems, information infrastructure and ICT support.

5.6 Suggestion for Further Research

Wireless innovations are applicable in all spheres of life hence the study suggest further research on wireless capabilities in an academic library. Having Wi-Fi connections installed is not enough since it was evident from the study that most applications have not been exploited as compared to academic libraries in developed countries. There is need for further research to maximize utilization and connection to the web. This area needs more attention since technology keeps on changing and it determines the capability of libraries to prove their worth to its users.

5.7 Chapter Summary

This chapter contains the summary of the findings, conclusions and recommendations based on the data analysis and presentations from chapter four. It also has suggestions for further research.

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APPENDICES

Appendix I: Letter of Consent

UNIVERSITY OF NAIROBI

FACULTY OF ARTS

DEPARTMENT OF LIBRARY AND INFORMATION SCIENCE

Telephone: +254 20 318262, Ext. 28095
Telegram: Varsity
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dnjiraine@uonbi.ac.ke

P.O. Box 30197- 00100 GPO
Nairobi, Kenya.

Our Ref: UON/CHSS/FOA/DLIS/303 **14th June 2018**

To whom it may concern

Dear Sir/Madam,

RE: Judy Nyabuto: C54/81909/2015

The above named is a bonafide student at the University of Nairobi undertaking a Master of Library and Information Science (MLIS), at the Department of Library and Information Science.

She has successfully completed her course work and has been cleared by the Department to collect data for her research project "Transformative Impact of Wireless Internet Connectivity on Academic Libraries: Case of the University of Nairobi Library 'which is a requirement for the award of the degree.

Your support towards accomplishing the research study will highly be appreciated.

Yours faithfully,

DEPARTMENT OF LIBRARY AND INFORMATION SCIENCE
UNIVERSITY OF NAIROBI
14 JUN 2018
P.O. Box 30197, NAIROBI

Dr. Dorothy Njiraine
Ag. Chairperson
Department of Library & Information Science (DLIS)

Appendix II: Letter of Introduction

Judy K. Nyabuto
C54/81909/2015
P. O. Box 1104,
Nyahururu.
TEl: 0727334032
Email: nyabutojudy@gmail.com

20th Aug, 2019.12.18.

To
The Registrar Academic,
University of Nairobi,
P. O. Box 30197 - 00100,
Nairobi.

Through,
Faculty of Arts,
University of Nairobi.

Dear Sir/ Madam,

RE: REQUEST FOR INFORMATION

My name is Judy K. Nyabuto a Masters' student at the University of Nairobi, Department of Library and Information Science. As part of fulfilling the requirement I am doing a research project under the topic "Transformation aspects as wireless connectivity in academic libraries": A case of University of Nairobi.

As a result I am requesting for information on the current postgraduate studies at the college of humanities and social sciences.

Your help with request will be highly appreciated.

Thanks in advance.

Yours faithfully,

Judy K. Nyabuto
C54/81909/2015

Appendix III: Questionnaire for Postgraduate Respondents

Instructions

Please respond by ticking in the brackets **[√]** against your preferred response for questions with options. For questions that require suggestions or comments, please use the provided space.

Background Information

1. Name of information management institution.…….…….……
2. Department …….…….....
3. Postgraduate programme……...
4. Age: a) 21-30 [ ] b) 31-40 c) 41-50 [ ]d) 50 and above [ ]

Application of Wireless Innovations

5. Aware of wireless innovations at the University of Nairobi library.

   a) Yes [ ]

   b) No [ ]

6. Indicate how you learnt about the wireless innovations.

   a) Fellow student [ ]

   b) Library staff [ ]

   c) Notice board [ ]

   d) Lecturer [ ]

   e) University website [ ]

   f) Other.....

7. Duration of use of wireless innovations.
    a) 0-2 Years [ ]
    b) 3-5 Years [ ]
    c) 6 Years and above [ ]
8. Select the gadgets you use in accessing wireless innovations in the university library
    a) Desktop computer [ ]
    b) Laptop [ ]
    c) Handheld devices (smartphone, iPhone, smartwatches) [ ]
    d) Other.....

Wireless Innovations in Academic Libraries

9. To what extent do you agree or disagree with the following statement in relation to wireless innovations in the library. Use a scale of 1-5 where, **Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree = 1.**

Wireless Innovations in the Library	**4**	**3**	**2**	**1**
Transform access to digital information resources and services				
Facilitate greater access to quality information resources				
Helps meet the needs and demand of users				
Helps solve the space issue				

Wireless Innovations and Research, Learning and Development

10. Indicate the extent to which wireless innovations support research, learning and development in academic institutions. Use a scale of 1-5, where **5=Strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=Strongly Disagree**

Wireless Innovations support teaching, learning, research and development	**5**	**4**	**3**	**2**	**1**
Access to more literature and quality information					
Seamless instant communication platforms					
Ample environment for intensive concentration					
Virtual contact with library staff					
Online sharing and collaboration					

Wireless Innovations and Transformation in Academic Libraries

11. Mention the range of wireless technologies applied in the academic libraries. On a scale of 1-5, pick the appropriate option where **5=Strongly Applied, 4=Applied, 3=Somewhat Applied, 2=Not Applied, 1=Don't Know.**

Wireless Technologies	**5**	**4**	**3**	**2**	**1**
Video/audio library instructions					
E-learning					
Smart digital shelves					
Social media					
Access to OPAC					
Bring your own device					
Digital information systems					

12. Select the wireless innovations that show transformation of services in academic libraries.

Wireless Innovations	Tick all that apply
Access to library instructions via digital devices	
Self-navigation in the library with the help of video/audio simulation	
Wireless OPAC provides up to date information	
Automation of information resources	
Access to digital repositories	

Innovative Applications of Wireless Innovations in Academic Libraries

13. Select the applications influencing the wireless technologies and innovations in academic libraries.

Innovative Wireless Applications and Technologies	Tick all that apply
Virtual library access	
Online library lending of materials	
Online notifications on new and relevant materials	
E-learning	

14. Tick appropriately the practical applications of wireless innovations that facilitate usability of information resources in academic libraries. Use a scale of 1-5, where **5=Strongly Applied, 4=Applied, 3=Somewhat Applied, 2=Not Applied, 1=Don't Know.**

Wireless Technologies and Innovations Facilitate	**5**	**4**	**3**	**2**	**1**
Wireless access to online resources					
Internet of Things					
Automation of information					
Mobile smart applications					
Social media					

Strategies that Enhance Wireless Innovations in Academic Libraries

15. State the strategies used in enhancing effective management of wireless innovations in the library.

Strategies for Managing Wireless Innovations	**Tick All That Apply**
Developed information infrastructure	
High speed wireless technologies	
Management support	
Security	
Privacy	
Unlimited access	
Uninterrupted wireless connections	
Refined and updated with wide downloadable applications	

16. Mention the priority requirements that academic libraries need to put in place to sustain wireless connectivity.

Sustainable Strategies for Wireless Innovations	**Tick All That Apply**
Leadership and management	
Policy formulations	
Technology investment	
Management support	
Collaboration and partnerships	

17. Provide further comments_____

Thank you

Appendix IV: Interview Schedule for Library and ICT Staff

Background Information

1. Name of the organization…….
2. Department……
3. Profession/Occupation……...

Wireless Innovations in Academic Libraries

4. Highlight the changes that wireless innovations witnessed in relation to digital information resources.
5. Outline the potential capabilities of wireless innovations in promoting digital resources in academic libraries.

Wireless Innovations and Delivery of Services

6. Name new information products and services that your clients have due to wireless innovations.
7. State the contribution of wireless innovations in promoting research and development.
8. What is the comparison of using wireless innovations in serving both the traditional learning and virtual learning?

Innovative Applications of Wireless Innovations

9. Kindly state how wireless innovations affect the technology that is already in place from the wired internet.
10. State whether there are any beacons in place such as wireless devices which notify users on their phones once in the library on where to get the desired services.
11. State any advanced technological innovations that have resulted from wireless technologies in the library.

Strategies that Enhance Wireless Innovations

12. State other technological investments the library has made.
13. Outline challenges of wireless technologies and innovations in the library.
14. Provide policy formulations regarding wireless technologies in the library.
15. State sustainable strategies influencing wireless innovations.