EXPLORING LIBRARIANS' READINESS FOR THE APPLICATION OF THE 4TH INDUSTRIAL REVOLUTION DEVICES FOR ACADEMIC LIBRARY SERVICES IN KWARA STATE, NIGERIA

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BEING A PROJECT SUBMITTED TO THE DEPARTMENT OF LIBRARY AND INFORMATION SCIENCE, INSTITUTE OF INFORMATION AND COMMUNICATION TECHNOLOGY, KWARA STATE POLYTECHNIC, ILORIN

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CERTIFICATION

This is to certify that this project titled **"*Exploring Librarians' Readiness for the Application of the 4th Industrial Revolution Devices for Academic Library Services in Kwara State, Nigeria*"** has been read and approved as meeting the requirements of the Department of Library and Information Science, Kwara State Polytechnic, Ilorin, for the Award of National Diploma in Library and Information Science.

A. O. Isiaka (Supervisor)	Date
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S. A. Sulyman (Project Coordinator)	Date
External Examiner	Date

DEDICATION

This research is dedicated to Almighty God.

DECLARATION

I, ADEYEMI, Kasirat Adedoyin an ND student in the Department of Library and Information Science, Kwara State Polytechnic, Ilorin, hereby declare that this research project titled *"Exploring Librarians' Readiness for the Application of the 4th Industrial Revolution Devices for Academic Library Services in Kwara State, Nigeria"*, submitted by me is based on my actual and original work. Any materials obtained from other sources or work done by any other persons or institutions have been duly acknowledged.

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The study examined librarians' readiness for the application of the 4th Industrial Revolution devices for academic library services in Kwara State, Nigeria. The objectives of were to assess the level of awareness of the 4th industrial revolution devices for academic library services in Kwara State, Nigeria; identify the 4th industrial revolution devices available for academic library services in Kwara State, Nigeria; and examine the institutional facilities in readiness for the application of 4th industrial revolution devices for academic library services in Kwara State, Nigeria. It adopted descriptive survey design and population for this study consists of all the librarians in university libraries in Kwara State. A total enumeration technique was adopted. Questionnaire was used as data collection instrument and percentages are used in analyzing data. The study revealed that the level of awareness of the 4th industrial revolution devices for academic library services in Kwara State was so high and they were aware of Artificial Intelligence, Cloud Computing, Library Bookmark App, Bigdata, RFID, Expert Systems and 3D Printing among others. Further highlighted the 4th industrial revolution devices available for academic library services in Kwara State such as Expert Systems, RFID, Makerspace, 3D Printing, AI Document Delivery, Cloud Computing, Internet of Things (IoT). Lastly, the study revealed the institutional facilities in readiness for the application of 4th industrial revolution devices for academic library services in Kwara State. The study concluded that the university libraries were highly aware of 4IR for their services and the institutional facilities in readiness were very high. The study recommended that good and reliable internet facilities with fast speed and high broadband should be made available to aid the effective application of 4th Industrial Revolution for library services.

Keywords: 4th Industrial Revolution, Librarians, Readiness, Application, Academic Library, Library Services, Exploring, Devices, 4IR.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Globally, libraries have gradually transformed from conventional models to contemporary ones such as building bibliographic databases and supporting search for information. Also, the trend in which academic libraries provide services is now characterized with a fundamental shift from the traditional information environment to an e-environment where emphasis is placed on the acquisition of electronic resources such as e-books, e-journals and online databases, which are the forerunner of the present Fourth Industrial Revolution (4th IR) devices that are radically transforming the roles of libraries and librarians (Cronje,2018).With the coming of the Fourth Industrial Revolution (4th IR), roles and position of academic libraries and librarians have changed dramatically as they are compelled to incorporate digital sources and resources in order to remain at the fore of information provision and dissemination (Baro, 2016). The 4th IR devices include Artificial Intelligence (AI), Robotic System, Cloud Computing, Internet of Things (IoT), Augmented Reality, 3-D printing, among others; and are already being incorporated into library services and operations in developed countries (Cox et al., 2019).

The first industrial revolution (Industry 1.0) is concerned with the exchange of goods for profit, which is based on the exchange of goods and products obtained from agriculture, to the industrial city; this is based on increased productivity. The second industrial revolution (Industry 2.0) brought the transition from the industrial city to the planned city. In the planned city, the new type of worker was exempted from the productive processes that involved gross physical labor, which has been replaced by social and security services, mechanical equipment, and total automation. The third industrial revolution (Industry 3.0) caused a transition from the planned city to the fragmented city, where industries were increasingly moving away from the

markets, thus changing the economic systems and methods of production. In the fragmented city, a new economic-social order was born, separating even more the housing from the workplace, consumer's urban life and research and innovation institutions. The Fourth Industrial revolution (Industry 4.0) brought about the transition from the fragmented city to the smart city. At this current stage, the economic-social transformations do not have their roots in discovering a new form of energy, but they are based on the latest technological digitalization (Nkem, 2020).

The 4th Industrial Revolution is a disruptive change that is mostly focused on digital technologies enabled by artificial intelligence, mobile computing, automation and Internet of Things (IoTs) among others. Trades, businesses and various sectors have highly been affected by 4th industrial revolution devices; libraries inclusive. According to Ayinde and Kirkwood (2020) libraries/information centres are presently moving into the 4th Industrial Revolution where information professionals fear that artificial intelligence, machine language, and other smart technologies may take over the library and information profession. Academic libraries of the 21st Century are shifting their paradigms from traditional setup to modern information networking. Digitally equipped libraries, knowledgeable, skilled and competent librarians that can form the information superstructure for the application and use of 4th industrial revolution devices and technologies in academic libraries have become a need of the day (Chigwada, 2021).

Currently, it has become critical for a modern academic library to take in the changing faces of its patrons and respond accordingly. Every demographic is different, but there are countless ways that the modern academic library can respond to recent trends and offer information and resources that are both innovative and relevant to its patrons. Digital technology applications exponentially improve academic library's effectiveness and efficiency, provided such academic

library could afford the infrastructure and resources required. The emergence of digital technology applications and devices therefore are removing the physical barriers thereby turning the library space into an intelligent space which is one of the characteristics of the 4th industrial revolution (Odeyemi, 2019).

The term 4th Industrial Revolution (4IR) is seen as a new level of organisation and control over the entire value chain of products. It is aimed at the increasing requirements of individual customers. The 4th Industrial Revolution is changing how we live, work and communicate. Some best examples are self-driving cars, online shopping, drone delivery services etc. The 4th Industrial Revolution is mostly focused on Artificial Intelligence (AI) and Robotics. Artificial Intelligence and automation process are changing agents in 4th Industrial Revolution which will make certain employees redundant and will replace them with the needed skills or with machines that do the job cheaper (Vaidya et al., 2018). World Economic Forum (WEF) claim that 65 percent of kids enrolling in primary education today will end up working in jobs that haven't been created yet. In the old days' students were going to universities and colleges to study for a degree that will set them up for a job for life, but, the 4th industrial revolution has made things easier. (Min et al., 2018).

According to the European Centre for the Development of Vocational Training; United Nations (2018), 9 out of 10 jobs will require digital skills in the future by 2020 (Fau & Moreau, 2018). This new era of technology is driving significant innovation; organizations are embracing new technologies to make their businesses more efficient. Academic libraries and librarians are highly been affected by this 4IR in term of services and marketing values. Libraries are changing agents of 4IR and if not updated will face numerous problems (Abid, 2019). Technologically, developing countries in Africa are foot-dragging in deploying 4th industrial revolution devices into library services and operations. Recently, the Department of Library

Services at the University of Pretoria (UP) employed the first client service robot known to be in use in any African academic library. The introduction of the robotic librarian is in keeping with its focus on evolving in line with the 4th industrial revolution (Odeyemi, 2019). Various studies have been carried out in Nigeria on the assessment of e-resources use, social media application and skills to render Information and Communication Technology (ICT) services in academic libraries. Asogwu et al. (2015) evaluated the quality of online services in academic libraries in Nigeria as regards the functionality of electronic devices.

However, Odeyemi (2019) maintained that existing literatures did not address the status of Nigerian academic libraries in the deployment of 4th industrial revolution devices with emphasis on Robotics for improving the usage of their resources and services. Odeyemi further averred that there was nothing on policies, services and the sustainability framework with which the academic libraries are using as regards adoption of emerging technologies that can then be used to guide future services and operations. In developed countries, academic libraries serve students, academics, researchers etc where users demand access to data and value information through the technology and devices they use. These devices and applications are innovative and anticipate the latest technological trends, which are later integrated into users' experience, offering them new formats and environments to provide a disruptive learning environment as an essential part of current digital transformation (Cotera, 2018).

Academic libraries do implement technologies such as Augmented Reality, Virtual Reality, Immersive Reality, Sensory Immersion, Gesture Recognition, Humanoid Robots, Mobile App, and Gamification. These initiatives have totally changed their user experience and made information discovery more intuitive, accessible and entertaining. Librarians around the globe are frightening that 4th Industrial revolution devices will badly affect their jobs and unemployment will be increasing in alarming rates. But 4th IR is merely a friendly revolution

and will pave the way for academic libraries and librarians if adopted as a tool for effective service provision (Abid, 2019). Currently, well developed and equipped academic libraries have dabbled interest in the 4th Industrial Revolution which are guiding them on how to operate and serve their users in this revolution. As this revolution mostly depends on data and internet both which tell how to gather the data in the ever-growing amount of information (Chigbu et al., 2016).

The world today is fuelled by data and internet-connected devices that are capable of collecting and processing the huge amount of data. Social-media, smart phones, digital cameras, and sensors are creating more information than ever before. The rate of information flow is increasing by the day, the 4th industrial revolution is affecting us whether we know it or not. People and Machines are connecting to each other at enormous speed; data is being collected and harnessed like never before (Odeyemi, 2019). Artificial Intelligence, Mobile computing, Machine learning and automation of every trade has become a need of the day, for example, some academic libraries use robots in combination with RFID technology. The data of bibliographic record can be retrieved from the storage and the books can be shared with users who request for them. This type of application is newer for libraries and considered to be the cutting-edge technology in library industry. Such kind of newest technology is considered to be the part of new industrial revolutions.

It becomes imperative that such kind of technology be included in academic librarianship via industry 4.0 technologies to execute routine work of the academic library to its patrons. Such kind of applications can be made available in the library services for the patrons to use them in proper manner (Mafumana, 2019). Artificial Intelligence as a device of 4th IR can help librarians detect critical errors while presenting data on web. AI and Internet of Things (IoT) are great examples for library data in 4th Industrial Revolution. If such changes were brought

into the library services in near future library services will gain more momentum. This is one aspect of IR 4.0 and if entire services are shifted on these robust technologies, academic libraries and librarians will make more contributions for the present and prospective members (Choudhury et al., 2019). During the third industrial revolution, librarians stored huge amount of data in bibliographical and digital format to give access to patrons and general users in the library. However, the limitations of technology became a big problem as librarians argued that the data being used in metadata for cataloguing library resources was just for locating materials in a specific library.

The 4IR has to do with the current and developing environment in which disruptive technologies and trends are having a huge impact changing the way we live and work and has affected almost all sectors of which libraries are also one of them. Libraries and librarians therefore, are expected to welcome and embrace this revolution for number of reasons (Ellen, 2016). The reasons as cited by Ellen (2016) includes Uber, Book to Desk (B2D), Mobile work lists alerts and push information for academics amongst others. Cronje (2018) in the same vein supported the opinion of Ellen by saying as all stakeholders of global polity from the public and private sectors have been affected by this revolution, similarly, libraries should also implement such changes in their services to fulfil the growing demands of their patrons.

1.2 Statement of the Problem

Academic libraries' activities in term of quality service delivery appears not to meet up with the current level of users' expectation and demand for information and the rate at which the users want to get information in the present age of 4th industrial revolution. An age that is characterised with innovative digital technologies. Academic libraries and librarians are highly affected by this 4th Industrial Revolution in term of services and marketing values. As such libraries are changing agents of the 4th industrial revolution and if not updated will face

numerous problems (Abid, 2019). Librarians around the globe are frightening that the 4th industrial revolution will badly affect their jobs and unemployment will be increasing in alarming rates. However, the transformed roles, innovative services and future of academic libraries have been the focus of attention by many researchers around the world (Cox, et al., 2019; Schulte et al., 2018).

The application of the 4th industrial revolution devices has been proven to assist libraries, their users and other libraries to improve on their services, yet many academic libraries in Nigeria have not automate their resources and services geared towards providing quality service delivery to their users. Odeyemi (2019) observed that academic libraries in Nigeria are foot-dragging in embracing the emerging fields and potentials embedded in the 4th industrial revolution. However, there are no known previous studies on librarians' readiness for the application of the 4th industrial revolution devices in academic libraries in Nigeria. It is against this background that this study investigates librarians' readiness for the application of the 4th Industrial Revolution devices in providing varying information and services to users in academic libraries in Kwara State, Nigeria.

1.3 Research Objectives

The main objective of this study is to examine the librarians' readiness for the application of the 4th Industrial Revolution devices for academic library services in Kwara State, Nigeria. The specific objectives are to:

i. Assess the level of awareness of the 4th industrial revolution devices for academic library services in Kwara State, Nigeria;
ii. Identify the 4th industrial revolution devices available for academic library services in Kwara State, Nigeria; and

iii. Examine the institutional facilities in readiness for the application of 4th industrial revolution devices for academic library services in Kwara State, Nigeria.

1.4 Research Questions

The following research questions are pertinent to this study:

i. What is the level of awareness of the 4th industrial revolution devices for academic library services in Kwara State, Nigeria?
ii. What is the 4th industrial revolution devices available for academic library services in Kwara State, Nigeria? and
iii. What are the institutional facilities in readiness for the application of 4th industrial revolution devices for academic library services in Kwara State, Nigeria?

1.5 Scope of the Study

The scope of this research on examining the librarians' readiness for the application of the 4th Industrial Revolution devices for academic library services in Kwara State, Nigeria will cover all academic libraries (university libraries only) in Kwara State. The criteria for choosing university libraries over other types of academic libraries are based on the fact that university libraries are better funded when compared to other academic libraries. Moreover, university graduates are professionally trained skilfully and are provided with sound and qualitative education which enables them to function effectively in any environment they find themselves. To achieve this, university libraries are expected to be aware and adopt current trends in librarianship so as to support the university achieve its vision and mission.

1.6 Significance of the Study

The findings of the study would be of immense benefits to policy makers, practitioners, stakeholders and the society at large. To the policy makers it would expose them on the inherent benefits embedded in the 4th industrial revolution and the deployment of its associated technologies in academic libraries' service provision to their patrons. To the practicing librarians in specific terms, the result of findings would expose academic librarians on the roles expected of them in provision of effective information service to library patrons. Also, by applying the recommendations of the study, it will improve the performance of their operations and services. Furthermore, it would enable them to be up-to-date with current practices in academic librarianship as practised by their counterparts in developed climes.

To the stakeholders, it would enable the management to embrace the usefulness and benefits of the 4th industrial revolution. In addition, the effect of not keying into the 4th Industrial Revolution would lead to unemployment on the part of the librarians because most of the tasks being performed by them would be done by machines. Practitioners therefore need to be abreast and possess necessary skills expected of them to remain relevant in this era of information glut.

1.7 Operational Definition of Key Terms

The following are the operational definition of terms to the study:

Academic Library: This term refers to a library that is established in any institution of higher learning to support the teaching, learning and research objective of the parent institution.

Devices: This term refers to any tool or equipment that can be used to access information for a particular purpose. It can be mechanical or electronic.

4th Industrial Revolution: This term refers to an expression which is used to frame and assess the impact of emergent technologies in the 21st Century.

Librarian: This term refers to a person responsible for processing and organising information. Librarians as used in this study comprise of both professionals and para-professionals.

Readiness: This term refers to a state of being prepared for something.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

In this chapter, an extensive review of related but relevant literature to librarians' readiness for the application of the 4th industrial revolution devices was done. This chapter focused on extensive review of related and relevant literature on awareness and use of artificial intelligence as correlates for effective library services delivery in university libraries. Review of related literature gives an evaluation of previous literature to the researcher's area of study. Literature plays a very important role in research activities, as it forms the very first step of a research pursuit. Review of literature happens to be an important segment of the concerned topic. The literature review should be conducted in a systematic way to achieve optimum results. In this study an attempt has been made to cover few works which have been undertaken in Nigeria and abroad. The review will be guided by the following subheadings:

2.2 Concept of 4th Industrial Revolution
2.3 Awareness of 4th Industrial Revolution Devices and Technologies
2.4 Application of 4th Industrial Revolution Devices in Academic Libraries
2.5 Librarians' Competency Requirements in Readiness of the 4th Industrial Revolution
2.6 Benefits of 4th Industrial Revolution to Academic Libraries in Service Provision
2.7 Theoretical Framework
2.8 Appraisal of the Literature Review

2.2 Concept of 4th Industrial Revolution (4IR)

The 4th Industrial Revolution (4IR) is an expression used to frame and assess the impact of emergent technologies in the 21st century. The concept was coined at the World Economic Forum in Davos, Switzerland by Klaus Schwab, with the reference that it would be building on the third, the digital revolution and would be characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres" (Schwab, 2016). The First Industrial Revolution (Industry 1.0) can be traced to as far back as early 1760. This revolution was based mainly on mechanical equipment driven by water, steam and power. The period allowed the transition from agrarian and feudal society to new manufacturing process. The period also witnessed the use of coal for energy while train was used as the main means of transportation (Mafumana, 2019).

The Second Industrial Revolution (Industry 2.0) began in 1900 and was based on mass production enabled by electricity and division of labour. The revolution witnessed the invention of internal combustion engine that led to an era of rapid industrialization using oil and electricity to power mass production. The Third Industrial Revolution (Industry 3.0) ushered in new technologies and electronics to further automation process. It brought about mainframe computers, computing and the internet. The internet and renewable energies changed history and the work of things. The 4th Industrial Revolution (Industry 4.0) was based on systems which involved computer generated product design and three-dimensional (3D) printing which can create solid object by building up successive layers of materials (Xu, Jeanne and Kim, 2018).

The 4th Industrial Revolution is more than just technology-driven change, but one that is powered with disruptive innovation to impact core industries and sectors positively. Industries and sectors such as education, health, business etc. The revolution is such that has changed how we live, work and communicate which is quite evident in our present-day self-driving cars, online shopping, drone delivery services among others. Educationally, the first industrial revolution focused on standard modes of learning such as the McGuffey reader. With a shift into the Second Industrial Revolution which centred on mass production and standardized testing, education was service oriented during the era, then a move into the Third Industrial Revolution witnessed students under a customer learning model. Now in the 4th Industrial Revolution, technologies have really shaped the lines between physical, digital and biological spheres (Schwab, 2016).

In higher education, 4IR has redefined the conventional way students' content are delivered. Currently, focus has changed from modes of teaching to modes of learning. As the Industrial Revolution is based on both man and machine so, it will reduce the distance between science and technology. Under this IR 4.0 much more interdisciplinary teaching, research and innovation will be a key factor in adaptation. Higher education 4.0 has become the mission of every university to combine man and machine for positive feedback (Xing & Marwala, 2017). In the business sector, a lot is being done as new markets are created and new products are defined. Netflix is competing with traditional television. Taxis must compete against Uber and Lyft. These similar products are offered to customers in new ways. You could watch your shows from your home or get a ride somewhere. With the Airbnb alternative overnight accommodations are competing against traditional hotels and motels (Jules, 2017).

In the health sector, it was recently reported that at the University of Pretoria, Faculty of Health Sciences, in South Africa, the Professor and Head of Department, Mashudu Tshifularo, conducted ground breaking ear surgery by using 3D technology, and commenting on the successful operation, "said 3D technology is allowing us to do things we never thought we could" (Ocholla, 2019). The 4th Industrial Revolution will shape the future through its impacts on government and business. People have no control over technology or the disruption that comes with the 4th Industrial Revolution. Mafuman (2019) identified some opportunities embedded in the 4th Industrial Revolution as follows; robots (machines) to supplement humans for better service, training opportunities to embrace, adapt and adopt, multitask and job rotation, up skilling, deskilling and out skilling, speed of connectivity of 24/7 to the internet, humans vs. machines- youth to drive 4th IR, knowledge sharing and skills transfer, collaboration with peers and engage with technology infused with Artificial Intelligence, and excited about new technologies.

2.3 Awareness of 4th Industrial Revolution Devices and Technologies

The current global surge in the awareness and use 4th industrial revolution devices by librarians and researchers has brought about significant impact on the educational sector. The increasingly competitive environment in information service delivery has resulted in pressure to develop and utilize alternative delivery channels such as Internet of Things (Kowalczy, 2018). Activities in the library have transformed from the manual ways of providing services to electronic or digital way. In time past, every transaction and processes in libraries were carried out manually in the library where users will spend long hours searching through the catalogue cards (Min et al., 2018). The term Industry 4.0 is among the Germany's ten target items of high–tech strategy action plan of 2012 project, which envisaged the amalgamated

manufacturing with IT and led to the development of factories that are smart, and efficient and adaptable to new technological changes and demands.

In the sustainable industry 4.0, concept include Industry 4.0 technologies such as Internet of Things (IoT), Big data analytics, cloud computing, augmented reality & robotic systems, simulation prototypes and 3D printing (Kamble, at el., 2018). Industry 4.0 is the integration of technologies such as Big Data Analytics, Cloud Services, 3D-Printing, Cyber Security, Autonomous Robots, Internet of Things, Augmented Reality, Simulation, Horizontal and Vertical Integration which allows the transformation of how organizations operate along with high changes in business models and manufacturing processes. They also submitted that the adoption of the above-mentioned set of technologies enable the deep transformation of organizations into Cyber Physical System (CPS) i.e. systems of collaborating computational entities which are in intensive connection with the surrounding physical world and its on-going processes, providing and using, at the same time, data-accessing and data-processing services available on the internet (Trotta & Garengo, 2018).

The 4th Industrial Revolution is likely to reduce barriers between inventors and markets due to new technologies such as 3D printing for prototyping. Tissue engineers use rapid prototyping techniques to produce 3D porous scaffolds. The 3D printing technique fabricates scaffolds with a novel micro and macro architecture and these in turn help shape the new tissue as it regenerates. New technologies like this 3D printing, allow entrepreneurs with new ideas to establish small companies with lower start-up costs. The entrepreneur can bring the product 'to reality' with 3D printing, without the traditional time constraints often encountered with traditional prototyping methods. The typical barriers to entry are removed from the marketing equation (Anderson, 2012).

Butler-Adam (2018), while putting more emphasis on artificial intelligence in 4IR, recognises that the education sector should be prepared to respond to the changes in the nature of work and the job market, such as possible job loss or more jobs; better education and training, particularly striving for critical skills; changes in curricula and teaching and learning content and approaches; achievement of 17 SDGs; and recognition of the fundamental role of the human factor in the revolution. Innovative technologies will integrate different scientific and technical disciplines, key forces will come together in a fusion of technologies that is blurring the lines between physical, digital, and biological spheres. This fusion of technologies goes beyond mere combination. Fusion is more than complementary technology, because it creates new markets and new growth opportunities for each participant in the innovation (Schwab, 2015).

Robotics can and will change our lives in the near future, technically robots are automated motorized tools. They cook food, play our music, record our shows, and even run our cars. But we just do not see it because robots do not have a face with whom we can talk or a butt we can kick. They have the potential to improve the quality of lives at home, work, and many other places. Customized robots will create new jobs, improve the quality of existing jobs, and give people more time to focus on what they want to do (Tilden, 2018). The Internet of Things (IoT) is the Internetworking of physical devices. Typically, the IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine (M2M) communications and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices is expected to usher in automation in nearly all fields, while also enabling advanced applications like a smart grid, and expanding to areas such as smart cities (Holler, et al., 2014).

2.4 Application of Fourth Industrial Revolution Devices in Academic Libraries

There have been rapid developments in Information and Communication Technologies (ICTs) in the 21st Century. These developments have impacted on human endeavors, operations and services of industries and institutions including libraries. Arguably, the advent of the internet is the most important and influential development in ICT (Aharony, 2014). The internet now has a distinctive influence in various aspects of human life including relationships, interactions, manufacturing and services. Apart from providing a veritable platform for the effective and efficient promotion of workflow and services, the rapid growth of the internet globally lies in its ability to foster and shape human relationships and communication. In this regard, the advent of mobile devices and social media has made internet use a part of life for a good number of the world's population. The availability of broadband internet connection, more devices with Wi-Fi capabilities, affordability at lower cost and proliferation of smart phones have also contributed to the growth of the internet.

For libraries, the internet now makes it possible for electronic packaging and virtual acquisition of information resources, online reference services, electronic cataloguing, as well as online dissemination of required information resources among others (Goman, 2018). However, Pujar and Satyanarayana (2015) observed that in recent times the internet has taken a leap from Internet of Communication (IoC) to Internet of things (IoT), making it possible to connect objects and transfer data with or without human intervention. The Internet of communication promoted better communication and improved services, but with some form of human interventions. Herein lies the distinctiveness of the Internet of things' connecting objects using sensors and networking capabilities with very minimal or no human intervention. The idea promotes a convergence of a variety of objects including Radio-Frequency Identification (RFID) tags, sensors, actuators, networked devices and others, which through unique addressing systems are able to interact with one another to achieve common goals (Boss, 2020).

The Internet of Things (IoT) has a great potential for improved and efficient services in industries and institutions including libraries. Scientists and professionals believe that this new technology would definitely impact business and economic models, human experiences and everyday life. The 4th industrial revolution era, assistive technology is any kind of technology that can be used to enhance the functional independence of a person with a disability. Often, for people with disabilities, accomplishing daily tasks such as talking with friends, going to school and work, or participating in recreational activities is a challenge. Assistive Technology (AT) devices are tools which help to overcome challenges and enable people living with disabilities to enhance their quality of life and lead more independent lives. Assistive technology can be anything from a simple (low-tech) device such as a magnifying glass, to a complex (high-tech) device, such as a computerized communication system. It can be an automated van lift for a wheelchair or small a grip attached to a pen or fork by Velcro. Assistive technology can also be a substitute such as an augmentative communication device that provides vocal output for a child who cannot communicate with her voice (Zabala, 2019).

Libraries are essential in our life to improve our knowledge. The concept the 4th industrial revolution technologies which forms a network by sharing information of each sensing object, has recently been spotlighted over the world. As libraries explore and develop their next generation library catalogue, cloud computing has emerged as a critical component of these new system. Cloud computing improves the service efficiency and visibility of libraries' collection and management services. Magic mirror is an application-based technology that could be added throughout library that will be able to sense what title the patron is holding and recommend other like material, mention related events, give a sneak peek into the books. Using Pressure pad sensors in the aisle under the floor is yet another innovative technology which gives the library a count of people browsing aisles in the library, helping with collection development and possible area where improved signage might be required and automatic turn

ON/OFF light bulbs which indeed save energy and making a smart library. Wireless sensor network enabled with Wi-Fi provides communication node to transfer and gather information and data by the sensing nodes. Above mentioned technologies inter linked to improve service efficiency and making academic library a smart library (Schopfel, 2018).

A smart library is an improved quality of a library service in the face of technological advancement. The concept is to serve all library services faster, better and smartly to its end users through digital technology in different software applications with the help of Internet and Intranet. A smart library is one that is techno-driven with AI and IoT based service provider to smart readers (Pera, 2019). It is a manifestation of an expert usage of hardware, services and internet that brings about qualitative changes in the user-librarian interaction. Smart library promotes electronic information resources through wireless nodes thereby making it seemingly for smart phone and other computer users to take advantage of fast information service provision (Corfe, 2018). With smart library, academic library patrons can easily and quickly be provided with information they need if library is able to make information available seamlessly. In information age, academic libraries and librarians need to turn smart in their structure, infrastructure and service provision approach. Given that information sources and resources are easily available online and can be accessed at the fingertips of people through smart phones with internet access, libraries can assume a central role in the trend of web-based information provision by being smart.

An academic library can only be smart if it can put in place facilities such as speed internet service, wireless access point, thin client architecture, digital librarian and digital resources (Pera, 2019). The interconnection between different library devices, users and librarians in a wireless networking environment within a library will be called a smart library. Today, there are examples of Internet of Things (IoT) applications in different types of industries. IoT is

applied to libraries in order to monitor users' activities, feedback of users, effectiveness of services, etc. It also has a significant role in information analysis and information management (Moradi, 2015). BookBot is a robotic book delivery system that uses high-density automated shelf technology to store up to 2 million items and delivers any item within five minutes of clicking on the online catalogue. BookBot only accounts for one-ninth of the space of traditional bookshelves, transforming the library from a storage facility into a rich learning and collaborative space environment. Books and other items are bar coded, sorted by size, and stored in more than 18,000 boxes, and each book and item are scanned as it is borrowed or returned from the system, allowing the library's online catalogue to track all data at any time (Kushins, 2018).

The shift toward automation is creating a tsunami of unemployment in organizations. Studies such as Ashton (2019) confirmed that technologies like Artificial Intelligence (AI) will eliminate some jobs and create demand for new skills that many workers do not have. As the application becomes increasingly powerful, diversified, pressing, several known problems in finding information became even more important in this technological era. Artificial Intelligence (AI) has revolutionized the way we work and think. It is indeed going to be the next game changer which decides the way we think and make decisions. It is an important area of computer science that concentrates on the creation of intelligent machines that work and react like humans (Techopedia, 2019).

Though librarians have acquired many skills to organize the information and making it accessible anywhere, libraries can ensure the application of the tools for the new generation of knowledge, which surpasses Google search developed for academic purposes. It is explained in the Merriam-Webster (2019) that, artificial intelligence is a part of computer science that deals with giving ability to the machines to look like they have natural human intelligence.

Artificial Intelligence (AI) is perhaps most familiar to the public in many ways today (Norman, 2020). With the applications of AI, libraries have the opportunity to change the emphasis and attention. The way we navigate the information is kept altering. AI gives a very-useful shortcut to apply this knowledge and produce better outcomes. Libraries focus on enhancing the access to content with the application of AI. We have been watching the evidence of this transformation toward AI application with many libraries initiating and providing Makerspace competences. Libraries are positioning themselves to take advantage of the application of cognitive computing in general and artificial intelligence in particular for their potential utility as a tool for refining the quality of library services (Kristin, 2016).

Vijayakumar and Sheshadri (2019) have identified some of the applications of 4th industrial revolution devices in library services:

***Expert System in Library Services*:** library activities related to reading materials, users and staff. Application of expert systems is where dialogue between staff and users, users and databases are promising. The expert system will help the librarian to understand the need for improvement in productivity.

Reference Service: is the foremost activity of any library and the expert system will serve as a substitute for reference librarians. REFSEARCH, POINTER, Online Reference Assistance (ORA), AMSWERMAN, PLEXUS all of these systems are advisory systems for locating reference resources and factual data. According to Rahi (2019), Reference Advisory System (RAS) is an expert system developed at San Diego State University to assist in providing reference services. The RAS provides a natural language interface to reference service in the areas of materials science, computer science, public health and nursing.

Cataloguing: is one of the oldest library techniques. Recent attempts to automate cataloguing through expert systems have focused on descriptive cataloguing because it is rule-based (AACR2). There are two ways to apply artificial intelligence techniques in cataloguing: (a) Human-machine interfaces, where intellectual work is divided between the intermediary and the support system. (b) An expert system with full cataloguing capabilities associated with electronic publishing systems. Since the cataloguing text is generated online, it can be passed through a knowledge-based system, and the intermediary does the cataloguing process without any intellectual input.

Classification: is the basic activity of a knowledge organization. Therefore, it is prominent in all systems that organize knowledge in libraries and information centres. The application of expert systems in the field of library classification includes Coal SORT, EP-X, and BIOSIS. Indexing of periodicals: this is another area where expert systems are developed. Indexing a periodical article involves identification of concepts, to translate the concepts into verbal descriptions, & selecting and assigning controlled vocabulary terms that are conceptually equivalent to verbal descriptions. Sheshadri (2019) posited that the reason for automating the intellectual aspects of indexing is to improve indexing consistency and quality. Based on the information provided by the indexer, the systems can arrive at appropriate preferred terms automatically to assign relevant subdivisions.

The system can make inferences & based on the inference; it can take appropriate action. The 'Med Index' is the best example of the library indexing system. As there is a lack of exposure to these expert system-oriented services in many libraries, very few library users have interacted with knowledge-based systems. In addition, most of these expert systems-oriented services are evolving over the period and undergoing many improvements to suit the needs of the library patron (Vijayakumar & Sheshadri, 2019).

Acquisition: The users of the library have a significant role to play in building library collection and online resources in particular. Several systems have been incorporated for the acquisition of these resources. Monograph Selection Advisor (MSA), a pioneering effort in applying this emerging technology is another area of building library collection. Specifically, the task modelled is the item-by-item decision that a subject bibliographer makes in selecting monographs. The prerequisite is that the knowledge base has to be broad enough and the interfacing aspect must be easy enough for the library to get the desired information from the machine (Gekara& Snell, 2020).

The first thing that comes to mind in Natural Language Processing is the ability to speak or write a complete sentence and have a machine process the request and speak. When applied to the field of Library and Information Science, more specifically, to search databases such as the Online Public Access Catalogue (OPAC), indexing becomes the basis of document retrieval. The purpose of the index is to improve the precision of retrieving part of the relevant documents; and to reduce the proportion of recalls and related files retrieved (Howard, 2019).

Robotics in Library Services: The robot is a reprogrammable, multipurpose manipulator, automatically controlled, programmable in three or more axes, which can be fixed on the location or portable for use in automation applications. Libraries can integrate robotics with other AI technologies like a drone being controlled by robots can make sure that the library is always under surveillance. Talking robots can be placed in various sections of the library as a user aid and guide. Unnikrishnan and Aswani (2018) proposed robotics system in the library for the effective delivery of books to the patrons. They can also be deployed for taking the inventory of library with huge collection, which uses RFID and barcode technology (Bomble & Dipika, 2019).

The Robbie robot developed by the Temasek Polytechnic Library can scan more than 32,000 books per day (Temasek Polytechnic Library, 2018). Tay (2017) traced the robotic applications for easy and effective delivery of newspapers, journals, books and brochures at Temasek Polytechnic Library. Robot at PESIST Central Library helps in the filing, sorting and replacing of books in the shelves. Shanghai has put up a humanoid robot at the entry which will interact with the users and clarify their doubts. The application of robotics in libraries is widespread and in present days, no doubt robots will dominate the libraries signalling the staff-less libraries ahead (Chingath & Babu, 2020).

Big Data: This is a term used to describe the large volume of data structure and unstructured that overwhelm a business daily. Big data refers to the large, diverse sets of information that grow at ever-increasing rates. It encompasses the volume of information, the velocity and the variety of scope of the data points being covered. Big data is also a field that teaches ways to analyse, systematically extract information from or otherwise deal with data sets that are too large or complex to be dealing with by traditional data processing. In relation to LIS professionals, the availability of big data fosters the need for new skills among librarians and even the one in training (Belzile, 2018). Noh (2015) and Massis (2017) identified librarians' competence in capturing and analysing data to improve information services.

Similarly, the importance of librarians' knowledge of data management owing to the complexity of information has also been emphasised. This made Deng (2019) to suggest that the world had entered the big data era and argued that librarians should provide innovative services accordingly such as using data mining to direct book acquisition. Library bookmark devices are the digital devices that are placed in the books for efficient finding and retrieval. For example, "Toout" is one of the library book mark devices. It aids a user while navigating

library shelves and it can be placed or turned in the book as user wants it. Second, it can track borrowed books, as well as remind users about the return of books and dates (Kowalczy,2018).

Drones: In the current digital dispensation, libraries are changing in their functions and activities. Modern libraries and information centres are becoming innovative and creating new areas that could enhance information activities. According to Ayinde and Kirkwood (2020), one of the things which modern librarians are doing is to introduce the drones and usage to kids and adult and also teach them how to fly a drone; an example of such media and technology literacy that take place at Santa Clara Library in California. The library provided tech clubs, a drone-flying club, and 3-D printing for youths. The library develops programming such as drone moviemaking; youths are taught how to fly drones with cameras and edit the footage to make a movie. In the Santa Clara Library, users can order books online and the drone will be used to deliver it within a few hours thereby saving the time of the users and the information professional. Also, in Claremont Colleges Library, drones were also used as technology lending program, teaching and learning of GIS (Greene & Roberts, 2018).

In the University of South Florida (USF), drones were used for research in heritage, creating visualization through their digital initiative projects. Drones consist of an Unmanned Aerial Vehicle (UAV) with a communication data link and ground control station. The UAV is the physical part of the drone which is used for book delivery to the library users or other libraries. The Communication data link is used to link the ground control station and the UAV in order to communicate; it is used to know flight path by altering altitude and direction (Collins, 2017). The Ground Control Station is for sending and receiving uplinks and downlinks which allows humans to control the UAV in the air. Drone helps to bridge the gap between rural literacy and urban literacy by providing information resources to far remote areas where they do not have access to education and electricity (Webster & Ivanov, 2020).

Drones can be used to send books to a user in smaller libraries or rural areas and drones were used to deliver books to children. Despite these benefits, drones are limited in some aspects such as climate issues, during raining seasons or strong wind; there might be a delay in deliveries. There are two ways drones deliver books; either it delivers to the user's address or based on real-time location via GPS (Nath, 2018). Drones help to save the time of users that cannot be physically present in the library. Human effects on drones such as stealing or harming the drone during delivering, legal issues, and limited numbers of drones, especially when more requests are needed to be filled. Librarians can be trained on how to remote control a drone. Staff cannot be eliminated in the drone delivery process.

When a user sent a request from home; the circulation service will receive the request, the books are retrieved, and loan processes are completed. These books are given to the drone expert; then placed into the drone; the drone is flown and delivered to users. In case a library does not have a book and the other library has, drones can make interlibrary loan easy and faster for physical books. A university library could use a drone for book delivery to faculty and departmental libraries. It can help to reduce or prevent accidents for librarians reducing the number of times librarians pick books up by climbing stairs (Evans, 2020).

BlockChain Technology: is a distributed database multiple devices connected to a common processor organizing data into records (blocks) that have cryptographic validation which are time stamped and are linked to previous records so that they can only be changed by those who own the encryption keys to write the files. It provides a decentralized system whereby the central authority is inconsequential for transactions or activities to be carried out. This will facilitate transparency in operations whereby everyone could see transactions. Block chain can be applied to different organizations from medical, energy, educational institutions, financial institutions, and libraries. Blockchain could help cut transaction and record keeping costs,

improve accuracy, and reduce the risk of losing information to disaster or sabotage (Tella, 2020). What is needed is for the potential borrower to alert the borrowers of the books to pass it to the potential borrower after usage (Cabello, 2017).

In LibChain's architecture, the library and user exchange information via blockchain. The users use the block chain to find books and store the activities or transactions and libraries can know who is holding the book at present. The Librarian is still needed in this to create one-use accounts to manage the registration system. Libchain was developed to contain information on how books are often passed on between users, loaning period, and home library of the book. It propels the connection to the pool of libraries, museums, and universities to share MARC records, authority control etc (Kowalczy, 2018). In the same view, Shrivastava (2018) posited that a library enabled expert system will help to solve problems in a number of areas. Most of which will focus on narrow domain with an emphasis on the local concern.

Lancaster and Smith (2018) admit that 4th Industrial Revolution technologies will enhance and support library operations like cataloguing, classification, indexing etc. Tay (2014) point out that programmed robots can assist librarians in answering Frequently Asked Questions (FAQ) that students may have. Other benefits in the application of 4th Industrial Revolution technologies include: enhanced decision making with data-based tools, improved competitiveness, improved organizational skills and productivity, academic librarians can work anywhere by developing customized products, provides a better work-life balance (Michelle, 2020).

2.5 Librarians' Competency in Readiness for the 4th Industrial Revolution

This disruptive technological change in the field of librarianship is radically transforming the roles and responsibilities of academic librarians. This therefore calls for a fundamental rethink in order to consider the competencies and skills of librarians to ensure that they deliver efficient services to patrons having diverse and dynamic information needs. The digital era provides librarians with an opportunity to re-profile their competencies and reinvent themselves in order to remain relevant (Chigwada & Chisita, 2021). Ahmat and Hanipah (2018) study on preparation for 4th industrial revolution by libraries in Malaysia discussed four strategic actions of focus: the aspects of reshaping the organizational behaviour; redesigning business model; restructuring business process workflow; and remaking job descriptions and roles.

Tella (2020) study on "repackaging LIS Professionals and libraries for the 4th Industrial Revolution", found the need for African library schools to repackage their curriculum to be able to produce graduates that will match up with job demands in the 4th industrial revolution era. He further identified technologies that drive the 4th industrial revolution which LIS graduates will be working with, if employed, and the necessary skills needed for functionality. The skills identified by Tella (2020) include; information curation, in-depth research, digital scanning, preservation, cloud data expansion, collaboration, teaching and facilitation, analytical thinking and innovation, active learning and learning strategies, creativity, originality and initiative, technology design and programming, critical thinking and analysis, complex problem solving, leadership and social influence, emotional intelligence, reasoning, problem solving and ideation; and system analysis and evaluation.

It is envisaged that LIS professionals who do not possess these identified skills may encounter challenges such as the following: skills barriers and the need for reskilling; question marks over the extent to which employees will get a fair share of the benefits from 4IR; and worst outcomes for some workers and job seekers (Kaijun & Uddin, 2019). In readiness to the new revolution, individuals should focus on competency requirements, and identify certain critical skills expected of all professionals. Skills such as complex problem-solving skills, critical thinking and creativity/innovation. Moreover, the life-long learning and self-learning and Continuing Professional Development (CDP) is fundamental (Ocholla, 2019). The International Federation of Library Associations and Institutions (IFLA) in 2017 conducted a special global vision discussion focused on how a united library field can tackle the challenges of the 4th industrial revolution era.

IFLA arrived at an agreement stating that: "Libraries enable literate, informed and participative societies. When we look at the future, according to the debates in a teleconference, libraries will be trustworthy information brokers; will do more with new technology; will provide universal access to information and scholarly works, whether it be media or information we already know or new media; preserving and providing access to information in all formats and providing trusted and effective support for political and social engagement. Libraries will be advocates for and facilitators of the 4th industrial revolution, where people create their own devices and objects" (Jules, 2017).

In addition, Fibrich (2017), a Library Training Services Australia General Manager expected that the scope of change (for libraries and librarians) is unprecedented. She added that "Personalisation will be in increasingly important. Due to the nature of the new technologies solving new and meaningful problems for customers, we will start to see them expecting services on their terms according to their ideals and needs. Thus, we will need to develop new

business models that cater to our customers' needs on their terms". World Economic Forum (2016) published ten skills which will be needed to thrive in the 4th industrial revolution. All these skills are needed by information professionals to survive in the 4th industrial revolution; these skills will assist information professionals to survive in the 4th industrial revolution.

The skills include sense making, social intelligence, novel and adaptive thinking, cross-cultural competency, computational thinking, trans-literacy, transdisciplinary, design mindset, cognitive load management, virtual collaboration objects. Jain (2019) highlighted new roles and skills expected of academic librarians in order to survive in the digital environment: Technology savvy and experts by training in both using and training technologies. By implementing a variety of digital web-based projects, initiatives and infrastructures, librarians preserve, extend and facilitate access to information and knowledge comprising humankind's cultural, scientific and intellectual heritage (Belzile, 2018). Goman (2018) aligned with the 21st century library services, formulated the new five laws of library science which also represent modern academic libraries. These new five laws of library science include: Library serve humanity, respect all forms by which knowledge is communicated, use technology intelligently to enhance service, Protect free access to knowledge, and Honour the past and create the future.

The fourth industrial revolution is changing the day-to-day activities at workplaces with the use of disruptive technologies and trends such as robotics, virtual reality, artificial intelligence and Internet of a Thing (Holland, 2020). These disruptive changes have also affected the libraries and information centres and the 4^{th} Industrial Revolution can be viewed from technology innovation (Ahmat & Hanipah, 2018). Institutional response towards readiness of fourth industrial revolution would be noticed by research, innovation discourse, policy, capacity building, such as Continuous Professional Development (CPD) (Ocholla, 2020).

Gleason (2018) noted that creativity, data analytics, artificial intelligence (AI), Continuous Professional Development (CPD) and lifelong learning are poised to play a fundamental role in the revolution in Higher Education (HE). Still on institutional support, Wenborn (2018) noted that "the demand for collaborative learning will also challenge institutional leaders to reflect on how the design of library spaces can better facilitate the face-to-face interactions that take place there".

Butler-Adam (2018) while putting more emphasis on AI in 4IR, recognized that the education sector should be prepared to respond to the changes in the nature of work and the job market, such as possible job loss or more jobs; better education and training, particularly striving for critical skills; changes in curricula and teaching and learning contents and approaches; achievement of 17 Sustainable Development Goals and recognition of the fundamental role of the human factor in the revolution. Thus, the institutional/university response should be strongly ingrained in the agenda of Higher Education Institutions. But institutional responses can also be reflected in research and innovation.

2.6 Benefits of 4th Industrial Revolution to Academic Libraries in Service Provision

The applicability of 4th industrial revolution devices to libraries has become a subject of discussion among professionals. Libraries cannot afford to be left behind in the provision of improved services to patrons. Potter (2019) posited that though 4th industrial revolution devices are still in a stage of infancy, it holds a great potential for libraries. Pujar and Satyanarayana (2015) enumerated potential areas for implementation of 4th industrial revolution devices in libraries to include improved access to the library and its resources, collection management, information literacy, recommendation service, location-based service, appliances management and usage statistics. Library activity involves lot of manual work which can be partially or fully done effectively with the help of 4th industrial revolution technologies.

There are many benefits inherent in the adoption and use of these technologies/devices towards information and services provision by academic libraries and librarians to library users. Wojcik (2016) opined that 4th industrial revolution devices have the potential to improve library services by providing users with tools that allow easy use of libraries, constant contextual help, and personalization processes. Wojcik further noted that 4th industrial revolution devices can also be useful for sharing information, consultation and training, provision of access to spaces and equipment, gathering, description, storage, analysis and selection of collections, marketing and promotion.

Shahid (2017) explained that the BluuBeam application is based on the iBeacon technology. The application sends location-triggered information to mobile devices which helps users search for resources as well as expands their interests with contextual hints. Sarmah further describes the application as 'a virtual tapon the shoulder'. Swedberg (2017) noted that the BluuBeam technology is also used by about 30 other libraries in the USA. One of the libraries is using the technology to send user reminders about overdue books and items available for pick up. Apart from the benefits and opportunities they offer, Wojcik (2016) observed that new technologies like 4th industrial revolution devices bring along with them some potential challenges. Questions often arise about privacy, data security, ethical and legal issues. Other challenges revolve around long term financial and technical sustainability of such projects.

2.7 Theoretical Framework

Theories are prime tools that enable a researcher to explain why phenomena occur. In the area of scholarly and academic writing, theories are key features that are commonly used to underlie contentions or explications of a broad spectrum of research focus (Chen & Hwang, 2019). This study combines the constructs in the TAM with the technology readiness constructs and expand the original TAM model developed by Davis (1986). The model poses that the success of information systems is not only evaluated by technical and managerial qualifications, but it may also change by the personal characteristics, expectations, and perceptions of the users that may affect the success of adoption primarily. The theoretical foundations of the model underlie the Theory of Reasoned Actions (TRA), created by Fishbein and Ajzen (1975). TAM is largely believed to be simplistic, predictive, robust, and comparable (Venkatesh & Davis, 2000).

TAM consists of several causal relationships. Perceived Usefulness (PU) is defined as the possibility that an individual takes forward productivity in an organizational context by using a particular system. Scoring high in Perceived Usefulness (PU) means users believe in the positive use-performance relationship. Thus, it enables users to have a more efficient system experience (Davis, 1989: 320). Perceived Ease of Use (PEoU) is identified as the level of individual belief, which he or she can get rid of physical and mental efforts using particular system. In the model, Perceived Ease of Use (PEoU) is assumed to show a significant immediate influence on Perceived Usefulness (PU). Because when integral components are equivalent, a system that appears more comfortable to use will improve work performance (Davis, 1986).

Consequently, attitude is a function of two underlying beliefs, as Perceived Benefit (PB) and Perceived Ease of Use (PEoU). Attitude towards Using (AtU) refers to the level at which a user is interpreted to harness the use of the target system in his work (Fishbein & Ajzen, 1975). Therefore, the definition of attitude and measurement is consistent with the description of behavioral criteria proposed by Ajzen and Fishbein (1977). Behavioral Intent (BI) is a gauge of the power of a person's intention to perform a particular behavior (Fishbein & Ajzen, 1975: 288). Just like in TRA, TAM indicates that computer use is intentionally determined. However, it differs from the idea that the user's intention is defined in common with his AtU of the system and PU (Davis et al., 1989).

On the other hand, Actual System Usage (ASU) means the direct use of a particular system individually. Therefore, it is a highly dynamic behavioral criterion, which is goal-specific, repetitive, non-specific to action, context, and timeframe (Fishbein and Ajzen, 1975). Parasuraman (2000) created the Technology Readiness Index (TRI) to comprehend the attitudes and behaviors of individuals in technology-related issues. Technology Readiness (TR) is simply identified by Parasaruman as individuals' leverage to unfold and use bleeding-edge technologies to reach objectives in their daily lives and workplaces (Parasaruman, 2000). TRI is a multiple-item scale to figure individuals' preparedness to interact with technology. The author divided the structure into two sides: positive and negative beliefs on technology and four distinct apparent technology readiness characteristics: Optimism, Innovativeness, Discomfort, and Insecurity.

Parasaruman divided people into five sections in terms of their technology readiness: Explorers (E), Pioneers (P), Skeptics (S), Paranoids (P), and Laggards (L). Individuals with high scores in Optimism can adopt new technologies earlier, faster, and are called "explorers and "pioneers" (Parasuraman and Colby, 2001). Explorers are strongly motivated and emphasize confidence in

the use of technology. They mostly belong to younger age groups, and such individuals have a higher income and are more educated. Pioneers (P) have above-average scores in contributors and inhibitors. Besides, they perform insufficient reluctance for new systems. Individuals who belong to this dimension have average revenue and education, and they are younger parts of the population (Parasuraman and Colby, 2001; Massey et al., 2007).

Paranoids and laggards occupy discomfort (D) and Insecurity (I) dimensions of the index. Paranoids adopt technology, and they feel optimistic, but they do not tend to innovate about it. They accept technologies when the intensity of technological diffusion begins to diminish. Individuals belonging to this group are middle-aged or older, mostly women, and their welfare and educational levels are low (Parasuraman and Colby, 2001; Massey et al., 2007: 282). Individuals in the segment of "laggards" were identified as the least likely group to adopt the technology. They have low scores for the dimensions of innovation and optimism. In a way, they are the opposite of explorers. Laggards are usually the oldest individuals, mostly women, and have the least income and education level (Parasuraman and Colby, 2001; Massey et al., 2007).

There is another group in the middle of these four groups: Skeptics. Skeptics are not against technology and new systems; they just have a weak level of desire and enthusiasm. They generally do not tend to adopt what technology offers them to control more in their lives. Individuals who belong to this dimension have an intention to wait and see until the benefits of technology are proven. Contributors' and inhibitors' scores were usually very low. In this segment, individuals have average ages, incomes, and education (Parasuraman and Colby, 2001; Massey et al., 2007).

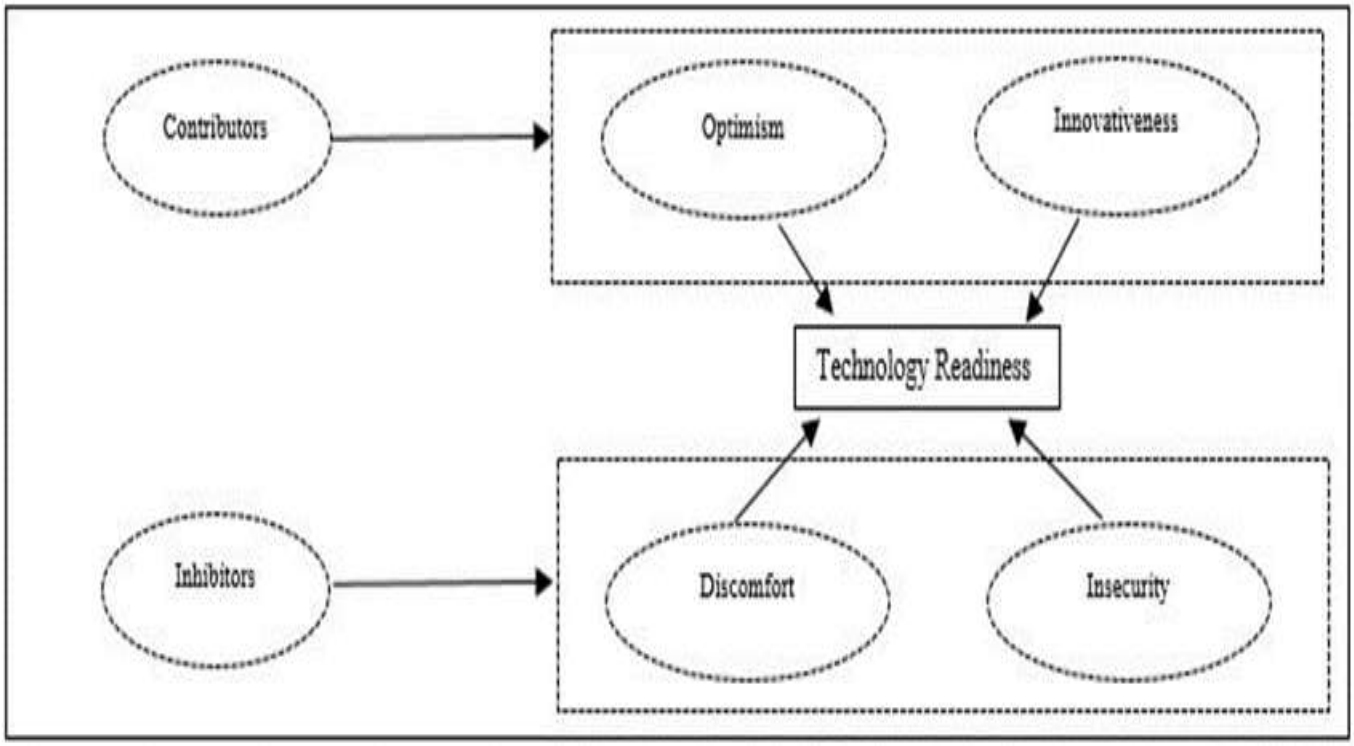

Figure 2.1: Adopted from Parasuraman (2000)

Explanation of the Variables in the Theory of Technology Readiness Model is as follows:

Optimism: Optimism (O) can be identified in the context of favourable aspects of technology and beliefs such as productivity, control, flexibility, and efficiency.

Innovativeness: The Innovativeness (In) indicates inclination be a pioneer and opinion leader in technology. Both Optimism and Innovativeness are the indicators that might enhance users' technology readiness.

Discomfort: Discomfort (D) shows a deficiency of control in new technology and overwhelming. The model measures the threat and apprehensions, which individuals experience while encountering technology.

Insecurity: Insecurity (I), as an inhibitor, refers to skepticism about deprivation of confidence in technology and the capability to work adequately. Insecurity (I) concentrates on the apprehensions of individuals when they face a new system or process. Discomfort (D) and Insecurity (I) can be counted as inhibitors that may compress TR. TRI provides a clear and

scientific idea of whether the individual is ready for technology utilizing the scores obtained from these four dimensions.

Pioneers (P) have above-average scores in contributors and inhibitors. Besides, they perform insufficient reluctance for new systems. Individuals who belong to this dimension have average revenue and education, and they are younger parts of the population (Parasuraman and Colby, 2001; Massey et al., 2007). Paranoids and laggards occupy discomfort (D) and Insecurity (I) dimensions of the index. Paranoids adopt technology, and they feel optimistic, but they do not tend to innovate about it. They accept technologies when the intensity of technological diffusion begins to diminish. Individuals belonging to this group are middle-aged or older, mostly women, and their welfare and educational levels are low (Parasuraman and Colby, 2001; Massey et al., 2007).

2.8 Appraisal of Related Literature Review

The review of related literature revealed certain facts that directed the course of the present research. First, it showed that the concept of 4th industrial revolution is based on a new level of organization and control which is changing how we live, work and communicate. This study reviewed awareness of the 4th industrial revolution devices by librarians; the 4th industrial revolution devices; institutional facilities and readiness towards the application of 4th industrial revolution; librarians' competencies towards the application of 4th industrial revolution devices and the constraints militating against the effective implementation. From the review of literature, a number of scholars have carried out various studies to examine the application and use of 4^{th} Industrial Revolution devices.

From the review of literature, a number of scholars, for example Asogwa, Ugwu and Ugwuanyi (2015), reported that poor funding, intermittent power supply and weak telecommunication infrastructures were among the major impediments to online services in Nigerian universities. Through adequate funding and prudent management of library funds, online services in Nigerian university libraries could meet global standards; Quadri and Adebayo (2016) in their study established that there was a high level of awareness of social media tools in providing varying information services to library clienteles; (2016), Njoku (2017)in open source technology for effective academic libraries services in academic libraries in Nigeria discovered that certain factors such as lack of technological knowledge for its adoption, passive attitude towards the use of technology by management, lack of Internet facilities to download and use software amidst others were found to be militating against the provision and utilization of information resources and services.

Azubuike and Madu (2017) study on mobile information services delivery by librarians in university libraries in Nigeria observed that electricity failure; too many mobile devices to learn; lack of knowledge; slowspeed of the internet; inadequate funds, staff and training opportunities in using mobile devices for marketing library and information products and services have been identified as some of the constraints to mobile information services delivery, and Abid (2019) have carried out various studies to examine 4th industrial revolution technology. However, Abid (2019) opined that the 4th industrial revolution is merely a friendly revolution and will pave way for libraries and librarians if adopted as a tool for services. Fourth industrial revolution devices if effectively applied and utilized in academic library operations will help to solve library problems in number of areas, enhance and support library operations like acquisitions, cataloguing, classification, indexing to mention but a few. It will also assist librarians in answering users' frequently asked questions; provide a better work-life balance etc.

It is therefore evident that previous studies which investigated 4th industrial revolution devices in academic libraries, use different variables to evaluate the application and use of 4th industrial revolution devices, the types of 4th industrial revolution devices, the extent of usage, the impact of 4th industrial revolution devices, the factors influencing application and use 4th industrial revolution devices and the challenges encountered in using 4th industrial revolution devices. With respect to the literature reviewed, this study therefore examined librarian's readiness for the application of the 4th industrial revolution devices, awareness of the 4th Industrial Revolution devices by librarians; the 4th industrial revolution devices, institutional facilities in readiness towards the application of 4th industrial revolution devices; librarians' competencies towards the application of 4th industrial revolution devices and the benefits of the 4th industrial revolution devices.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter covers the method that will be employed in conducting the research on librarians' readiness for the application of the 4th industrial revolution devices in academic libraries in Kwara State, Nigeria. The chapter covers the following area; research design, population of the study, sample and sampling techniques, research instrument, validity of the instrument, reliability of the instrument, procedure for data collection, method of data analysis and ethical consideration.

3.2 Research Design

The design of this study was descriptive survey. Descriptive survey, according to Cresswell (2015), it involves a systematic and comprehensive collection of information about the opinions, attitude, feelings, and beliefs and behaviour of people through observation, interviewing, and administering of questionnaires to a relatively large and representative sample of the population of interest. This study aims at collecting information about librarians' opinions, feelings, attitude and beliefs towards readiness for the application of the 4th industrial revolution devices using questionnaire. Therefore, the survey design is appropriate for this study because it will enable the researcher to provide a rich detailed for application of the 4th industrial revolution devices among academic libraries in Kwara state.

3.3 Population of the Study

The term population, according to Asika (2018) is made up of all individuals, conceivable elements, or observations that relate to a phenomenon which is of interest to the researcher. It is a collection of a set of individuals, objects of measurements whose property are being observed. This research is limited to all university libraries in Kwara State. There Nine (9) universities in Kwara State at the time of conducting this study. The population of the librarians in the nine university libraries is presented in Table 3.1

Table 3.1: Study Population of Librarians in University Libraries in Kwara State.

S/N	University Libraries	Librarians Population
1	University of Ilorin, Ilorin	62
2	Kwara State University, Malete	13
3	Al-Hikmah University, Ilorin	13
4	Landmark University, Omu-Aran	9
5	Summit University, Offa	3
6	Ojaja University, Eiyenkorin	4
7	Ahman Pategi, University, Pategi	2
8	Thomas Adewunmi University, Oko	2
9	Muhammed Kamaldeen University, Ilorin	2
	Total	**110**

3.4 Sampling Size and Sampling Technique

Sampling is the selection of some units from a study population of interest. It a technique which allows a researcher to make inference about a population based on the nature of the sample (Aina, 2015). Total enumeration technique was adopted in for this study. According to Kumar (2018), if a study population is small and less in number; it may be preferable to do a study of everyone in the population, rather than drawing out a sample. The researcher involved all the librarians in all the university libraries in Kwara State. Therefore, the sample size obtained for this study was amount to One-Hundred-and-Ten-Thousand (110) librarians.

3.5 Research Instrument(s)

An open-ended questionnaire was used as instrument of data collection for this study. The questionnaire is a useful tool for gathering data from a large population of respondents to give definite answers based on the structure of the questions in a relative short period. The instrument was selected because of its popularity in social research for investigating human attitudes, opinions and behaviour, as well as its suitability for collecting data to meet the research objective of this study (Aina, 2015). The research instrument titled "Librarians' readiness for the application of the 4th industrial revolution" (LRA4IR). The questionnaire was divided into sub sections that help elicit information on the following variables:

Section A (Demographic data): This section of the questionnaire was designed to collect the demographic data of the respondents. Data that will be collected include respondents' age, gender, name of institution and academic qualification.

Section B (Awareness of 4th industrial revolution devices): This section is made of six (6) item-statements on level of awareness of open access resources. It was measured on highly aware, aware, moderately aware and not aware.

Section C (The available 4th industrial revolution devices): This section is made up of six (6) item-statements on the impact of using open access resources. It was measured on a four-point Linkert scale of strongly disagree (SA=1) to strongly disagree (SD=4).

Section D (Institutional facilities in readiness for 4th industrial revolution): This section is made up of six (6) item-statements on the impact of using open access resources. It was measured on a four-point Linkert scale of strongly disagree (SA=1) to strongly disagree (SD=4).

3.6 Validity and Reliability of the Instrument(s)

Validity and reliability are concepts used to evaluate the quality of research, they indicate how well a method, technique or test measure something. Reliability is about the consistency of a measure, and validity is about the accuracy of a measure, the validity of an instrument is the degree to which an instrument measures what it intended to measure. The instrument for this study was validated to know and be sure of the extent to which it will collect the correct data for which it was designed (Winter, 2015). The research instrument went through several stages of face validation. The researcher and the supervisor designed the instrument based on the research questions. The questions were vetted and corrections were made to ensure that the research questions are met what they are intended. The internal consistency and reliability were established as all modified items will go through reliability test through the use of Cronbach's alpha to pick constructs with high values of alpha which was more desirable to measure the variables in the research. All the items used in this research have a scale ranging from 0.6 to 0.8 which was accepted by alpha level.

3.7 Method of Data Collection

The researcher personally visited the proposed academic libraries along with the help of a research assistant to administer the questionnaire. A letter of introduction was obtained from the Head of Department to facilitate access to the respondents. Copies of the questionnaire were administered to the respondents during the working hour for the period of two weeks by the researcher and research assistance in all the university libraries in Kwara State. The questionnaires were retrieved immediately after filling to avoid loss of questionnaire. Assurance was given that the data collected from the respondents will be used only for research purpose.

3.8 Method of Data Analysis

The responses of the respondent were collected, compared, aggregated and presented in a tabular form. A frequency of occurrence was established using SPSS (Statistical Product and Service Solution) version 24.0. The descriptive statistics includes the frequency counts and percentages. Tables will be used for results presentation and interpretation.

3.9 Ethical Considerations

This study was conducted within the confines of ethical issues adhered to in the conduct of quality research. It was devoid of plagiarism, sourced materials and intellectual properties would be appropriately cited and credited duly accorded. In line with the principle of inform consent, the respondents were adequately made to know what the research entailed and that participant in the research was voluntary. While on the field, it ensured that the respondents gained utmost confidence in the research that their responses given would be made confidence and used for the purpose of the research. It also ensured that fabrication of data was equally guided against (Lawrence, 2018).

The study employed the anonymity ethical consideration and follow all the ethics guiding scholarly writing by ensuring the work is original. According to Mugenda and Mugenda (2003), anonymity refers to keeping secret by not identifying the ethnic or cultural background of respondents, refrain from referring to them by their names or divulging any other sensitive information about a participant. This is why, during study, the researcher must promise to protect the information given in confidence by the respondent. But, if any information has to be revealed, then consent must be sought from the respondent(s).

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter presents and analyses the data presented through primary source. Data collected through questionnaires are presented in tables and analyzed using frequency counts and percentages. The results are presented based on the variables focused in the research objectives. Also in this chapter, the major findings of the study are further highlighted.

4.2 Response Rate

Table 4.1: Response Rate

Administered Questionnaire	Retrieved Questionnaire	Valid	Percentage (%)
110	108	108	98.1

The total of 110 copies of questionnaires was administered to the librarians and library officers in the eight universities in Kwara State. 108 were retrieved and valid which resulting as response rate of 98.1%. As shown in table 4.1.

4.3 Demographic Data of the Respondents

Table 4.2: Demographic distribution of the respondents.

University Libraries:	Frequency	Percentage (%)
University of Ilorin, Ilorin	60	55.5
Kwara State University, Malete	13	12.0
Al-Hikmah University, Ilorin	13	12.0
Landmark University, Omu-Aran	9	8.3
Summit University, Offa	3	2.8
Ojaja University, Eiyenkorin	4	3.7
Ahman Pategi, University, Pategi	2	1.9
Thomas Adewunmi University, Oko	2	1.9
Muhammed Kamaldeen University, Ilorin	2	1.9
Total	**108**	**100.0**

Highest Qualification:	**Frequency**	**Percentage (%)**
ND	6	5.6
HND	13	12.0
BSc	56	51.9
MSc	24	22.2
PhD	9	8.3
Others	0	0.0
Total	**108**	**100.0**
Age:	**Frequency**	**Percentage (%)**
30 and below	25	23.1
31 – 40	56	51.9
41 – 50	20	18.5
51 – 60	7	6.5
61 and above	0	0.0
Total	**108**	**100.0**
Gender:	**Frequency**	**Percentage (%)**
Male	70	64.8
Female	38	35.2
Total	**108**	**100.0**
Years of work experience:	**Frequency**	**Percentage (%)**
1 – 5	29	26.9
6 – 10	44	40.7
11 – 15	25	23.1
16 – 20	10	9.3
Total	**108**	**100.0**

Table 4.2 showed that out of the 108 respondents, 62 of them representing 55.5% are working in Unilorin library, 13(12.0%) are working in KWASU and Al-Hikmah library respectively, 9(8.3%) are working in Landmark library, 3(2.8%) are working in Summit, 4(3.7%) are working in Ojaja library and 2(1.9%) are working in Thomas Adewunmi and Ahman Pategi library respectively. This shows that majority of the respondents were from Unilorin library while Thomas Adewunmi, Ahman Pategi and Mahammed Kamaldeen were the lowest.

The table also showed that out of the 108 respondents, 6 out of them representing 5.6% were ND holders, 13(12%) were HND holders, 56(51.9%) were BSc holders, 24(22.2%) were MSc holders, while 9(8.3%) were PhD holders. This shows that most of the respondents were BSc

holders while MSc holders followed and ND holders were the lowest. In the age range, 25 of them representing 23.5% were 30 years and below, 56(51.9%) were within the age range of 31-40, 20(18.5%) were within the age range of 41-50, 7(6.5%) were within the age range of 51-60. This shows that majority of the respondents were within the age range of 31 to 40 while the lowest were within the age range of 51 to 60.

The table showed that from the 108 respondents, 70(64.8%) were males, while the remaining 38(35.2%) were females. This indicates that more male respondents participated in the study than their female counterpart. Lastly, table also showed the years of work experience of the respondents, 29(26.9%) has worked for 1-5 years, 44(40.7%) has worked for 6-10 years, 25(23.1%) has worked for 11-15 years while the remaining 10(9.3%) has worked for16-20 years. This indicates that majority of the respondents has worked for 6-10 years while the lowest years of work experience were 16-20 years.

4.4 Analyses of Research Questions

Research Question One: What is the level of awareness of the 4th industrial revolution devices for academic library services in Kwara State, Nigeria?

Table 4.3: The level of awareness of the 4th industrial revolution devices for academic library services.

Items	Highly Aware	Aware	Not Aware	Rarely Aware
Artificial Intelligence	78(72.2%)	29(26.9%)	1(0.9%)	0(0.0%)
Robotics	57(52.8%)	50(46.3%)	1(0.9%)	0(0.0%)
Smart libraries	59(54.6%)	48(44.4%)	1(0.9%)	0(0.0%)
Internet of Things (IoT)	53(49.1%)	53(49.1%)	2(1.9%)	0(0.0%)
Big Data	67(62.0%)	40(37.0%)	1(0.9%)	0(0.0%)
Blockchain	60(55.6%)	46(42.6%)	2(1.9%)	0(0.0%)
Cloud Computing	78(72.2%)	29(26.9%)	1(0.9%)	0(0.0%)
RFID	67(62.0%)	40(37.0%)	1(0.9%)	0(0.0%)
Expert Systems	67(62.0%)	40(37.0%)	1(0.9%)	0(0.0%)
Drones	78(72.2%)	29(26.9%)	1(0.9%)	0(0.0%)
Makerspace	53(49.1%)	53(49.1%)	2(1.9%)	0(0.0%)
Library Bookmark App	78(72.2%)	29(26.9%)	1(0.9%)	0(0.0%)

3D Printing	67(62.0%)	40(37.0%)	1(0.9%)	0(0.0%)

Table 4.3 revealed the level of awareness of the 4th industrial revolution devices for academic library services in Kwara State, 78 of the respondents representing (72.2%) were very aware of artificial intelligence, cloud computing and library bookmark app respectively; 67(62.0%) bigdata, RFID, Expert Systems and 3D printing respectively; 60(55.6%) blockchain; 59(54.6%) smart libraries; 57(52.8%) robotics; 53(49.1%) internet of things (IoT) and makerspace respectively among others. This indicates that majority of the respondents were highly aware of 4th industrial revolution devices for academic library services.

Research Question Two: What is the 4th industrial revolution devices available for academic library services in Kwara State, Nigeria?

Table 4.4: The 4th industrial revolution devices available for academic library services.

Items	Really Available	Available	Not Available	Rarely Available
Artificial Intelligence	3(2.8%)	0(0.0%)	65(60.2%)	40(37.0%)
AI Document Delivery	56(51.9%)	49(45.4%)	3(2.8%)	0(0.0%)
Robotics	10(9.3%)	16(14.8%)	70(64.8%)	12(11.1%)
Smart Libraries	12(11.1%)	38(35%)	57(52.8%)	1(0.9%)
Internet of Things (IoT)	43(39.8%)	60(55.6%)	3(2.8%)	2(1.9%)
Big Data	10(9.3%)	10(9.3%)	60(55.6%)	28(25.9%)
Blockchain	9(8.3%)	10(9.3%)	62(57.4%)	27(25.0%)
Cloud Computing	56(51.9%)	49(45.4%)	3(2.8%)	0(0.0%)
RFID	65(60.2%)	40(37.0%)	3(2.8%)	0(0.0%)
Expert Systems	65(60.2%)	40(37.0%)	3(2.8%)	0(0.0%)
Drones	9(8.3%)	10(9.3%)	62(57.4%)	27(25.0%)
Makerspace	65(60.2%)	40(37.0%)	3(2.8%)	0(0.0%)
Library Bookmark App	43(39.8%)	60(55.6%)	3(2.8%)	2(1.9%)
3D Printing	60(55.6%)	43(39.8%)	3(2.8%)	2(1.9%)

Table 4.4 revealed the 4th industrial revolution devices available for academic library services in Kwara State, 65 of the respondents representing (60.2%) expert systems, RFID and Makerspace were really available respectively; 60(55.6%) for 3D printing; 56(51.9%) for AI document delivery and cloud computing respectively; 43(39.8%) for internet of things (IoT)

and library bookmark app respectively. This indicates that high number of 4th industrial revolution devices are available for academic library services.

Research Question Three: What are the institutional facilities in readiness for the application of 4th industrial revolution devices for academic library services in Kwara State, Nigeria?

Table 4.5: The institutional facilities in readiness for the application of 4th industrial revolution devices for academic library services.

Items	Strongly Agree	Agree	Strongly Disagree	Disagree
There is provision for Capacity Building.	78(72.2%)	29(26.9%)	1(0.9%)	0(0.0%)
There is Continuous Development Programs (CDP).	57(52.8%)	50(46.3%)	1(0.9%)	0(0.0%)
Policies regarding automation of library operations are formulated.	59(54.6%)	48(44.4%)	1(0.9%)	0(0.0%)
There is provision for research and innovation.	53(49.1%)	53(49.1%)	2(1.9%)	0(0.0%)
There is availability of digital technologies/devices.	67(62.0%)	40(37.0%)	1(0.9%)	0(0.0%)
There are changes in curricula content.	60(55.6%)	46(42.6%)	2(1.9%)	0(0.0%)
There is Uninterrupted/Alternative power supply.	67(62.0%)	40(37.0%)	1(0.9%)	0(0.0%)
The learning environment is conducive.	53(49.1%)	53(49.1%)	2(1.9%)	0(0.0%)
There is provision of Wi-Fi.	57(52.8%)	50(46.3%)	1(0.9%)	0(0.0%)

Table 4.5 above revealed the institutional facilities in readiness for the application of 4th industrial revolution devices for academic library services in Kwara State, 78 of the respondents representing (72.2%) were strongly agreed that there is provision for capacity building; 67(62.0%) there is availability of digital technologies/devices and there is Uninterrupted/Alternative power supply; 60(55.6%) there are changes in curricula content; 59(54.6%) policies regarding automation of library operations are formulated; 57(52.8%) there is continuous development programs (CDP) and there is provision of Wi-Fi among others. This indicates that the academic libraries are readily set for the application of 4th industrial revolution devices for library services.

4.5 Discussion of Findings

This study has revealed that respondents with BSc and MSc have the lager ratio from the frequency distribution; it also shows that male respondents as the larger ratio more than female. This is in accordance with the findings of Abosede and Ibikunle (2011) who reported that there are more male librarians in a study they carried out on Lagos Polytechnic library. Followed is the age between 31-40 years of respondents as the highest response rate. Also, by years of work experience 6-10 years have the lager ratio from the frequency distribution in this study.

The findings of the study have revealed the level of awareness of the 4th industrial revolution devices for academic library services in Kwara State such as Artificial Intelligence, Cloud Computing, Library Bookmark App, Bigdata, RFID, Expert Systems and 3D Printing, Blockchain, Smart Libraries, Robotics, Internet of Things (IoT) and Makerspace as the major 4th Industrial Revolution devices the academic library were are of for their services. The finding agrees with a study by Tilden (2018) that users are aware of 4IR and the potential to improve the quality of lives at home, work, and many other places. Customized robots will create new jobs, improve the quality of existing jobs, and give people more time to focus on what they want to do.

The findings of this study further revealed the 4th industrial revolution devices available for academic library services in Kwara State such as Expert Systems, RFID, Makerspace, 3D Printing, AI Document Delivery, Cloud Computing, Internet of Things (IoT) and Library Bookmark App as the available 4IR devices for academic library services in Kwara State. The finding agrees with a study by Kamble at el. (2018), industry 4.0 is the integration of technologies such as Big Data Analytics, Cloud Services, 3D-Printing, Cyber Security, Autonomous Robots, Internet of Things, Augmented Reality, Simulation, Horizontal and

Vertical Integration which allows the transformation of how organizations operate along with high changes in business models and manufacturing processes.

Lastly, this study revealed the institutional facilities in readiness for the application of 4th industrial revolution devices for academic library services in Kwara State such as: There is provision for capacity building; There is availability of digital technologies/devices and there is Uninterrupted/Alternative power supply; There are changes in curricula content; Policies regarding automation of library operations are formulated; There is Continuous Development Programs (CDP) and There is provision of Wi-Fi. The finding agrees with a study by Schopfel (2018) that institution/organization should provide wireless sensor network to enabled with Wi-Fi provides communication node to transfer and gather information and data by the sensing nodes. Above mentioned technologies inter linked to improve service efficiency and making academic library a smart library.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter provides an overview of the key findings in summary and discussions in line with the objectives of the study. Covered in this chapter are also conclusion and recommendations. Lastly, the chapter provides possible areas for further studies that were outside the scope of this study.

5.2 Summary

The major findings of the study indicated that the librarians were highly aware of 4IR, also there are available 4IR devices for university library services in Kwara State. The findings also highlighted the institutional readiness for the application of 4IR for university library services. The major findings of the study are summaries as follows:

i. University libraries in Kwara State were aware of Artificial Intelligence, Cloud Computing, Library Bookmark App, Bigdata, RFID, Expert Systems and 3D Printing, Blockchain, Smart Libraries, Robotics, Internet of Things (IoT) and Makerspace.
ii. University libraries in Kwara State indicates that Expert Systems, RFID, Makerspace, 3D Printing, AI Document Delivery, Cloud Computing, Internet of Things (IoT) and Library Bookmark App are available 4IR devices.
iii. Lastly, the study highlighted the institutional readiness for the application of 4IR such as there is provision for capacity building; there is availability of digital technologies/devices and there is uninterrupted/alternative power supply; there are changes in curricula content; policies regarding automation of library operations are formulated among others.

5.3 Conclusion

The application of 4th Industrial Revolution devices for university library services has been shown to be very crucial in this study. It is clearly observed from the study that the university libraries were highly aware of 4IR for their services. Furthermore, it is very convincing to ascertain that 4IR will plays significance roles in university library services. Also, the findings showed that Expert Systems, RFID, Makerspace, 3D Printing, AI Document Delivery, Cloud Computing, Internet of Things (IoT) and Library Bookmark App are available 4IR devices. The study highlighted the institutional readiness for the application of 4IR such as there is provision for capacity building among others.

5.4 Recommendations

Based on the findings from this study, the following recommendations were generated:

i. University should provide a reliable uninterrupted power by making available alternative power generating source for the library every time in order to make use of 4IR devices for purpose it was bought for.
ii. Adequate budgeting should be allocated to the university library in order to curb some of potential challenges that might affect the application of 4th Industrial Revolution for library services.
iii. Good and reliable internet facilities with fast speed and high broadband should be made available to aid the effective application of 4th Industrial Revolution for library services.

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APPENDIX

QUESTIONNAIRE ON:

EXPLORING LIBRARIANS' READINESS FOR THE APPLICATION OF THE 4TH INDUSTRIAL REVOLUTION DEVICES FOR ACADEMIC LIBRARY SERVICES IN KWARA STATE, NIGERIA

Dear respondent,

I am a student of the Department of Library and Information Science, Institute of Information and Communication Technology, Kwara State Polytechnic, Ilorin. I am currently undertaking research project titled: *"exploring librarians' readiness for the application of the 4th industrial revolution devices for academic library services in Kwara State, Nigeria"*. I therefore, request you to kindly provide your opinions to the questions as contained in the attached questionnaire. Information provided in this questionnaire will be held confidential and used for research purpose only.

Your quick response will be highly appreciated.

Thanks for your anticipated cooperation.

ADEYEMI, Kasirat Adedoyin

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SECTION A: Demographic Data

Specify by ticking the right option

Please indicate your university library:

University of Ilorin Library [ ]

Kwara State University Library [ ]

Al-Hikmah University Library [ ]

Summit University Library [ ]

Landmark University Library [ ]

Ojaja University Library [ ]

Ahman Pategi University Library [ ]

Thomas Adewunmi University Library [ ]

Muhammed Kamaldeen University Library [ ]

Highest Qualification: ND [ ]; HND [ ]; BSc [ ]; MSc [ ]; PhD [ ]

Age: 30 below [ ]; 31-40 [ ]; 41-50 [ ]; 51-60 [ ]; 61 above [ ]

Gender: Male [ ]; Female [ ]

Year of Work Experience: 1-5 [ ]; 6-10 [ ]; 11-15 [ ]; 16-20 [ ]

SECTION B: What is the level of awareness of the 4th industrial revolution devices for academic library services in Kwara State, Nigeria?

S/N	Items	Very Aware	Aware	Not Aware	Rarely Aware
1.	Artificial Intelligence				
2.	Robotics				
3.	Smart libraries				
4.	Internet of Things (IoT)				
5.	Big Data				
6.	Blockchain				
7.	Cloud Computing				
8.	RFID				
9.	Expert Systems				
10.	Drones				
11.	Makerspace				
12.	Library Bookmark App				
13.	3D Printing				

SECTION C: What is the 4th industrial revolution devices available for academic library services in Kwara State, Nigeria?

S/N	Items	Very Available	Available	Not Available	Rarely Available
1.	Artificial Intelligence				
2.	AI Document Delivery				
3.	Robotics				
4.	Smart libraries				
5.	Internet of Things (IoT)				
6.	Big Data				
7.	Blockchain				
8.	Cloud Computing				
9.	RFID				
10.	Expert Systems				
11.	Drones modern				
12.	Makerspace				
13.	Library Bookmark App				
14.	3D Printing				

SECTION D: What are the institutional facilities in readiness for the application of 4th industrial revolution devices for academic library services in Kwara State, Nigeria?

S/N	Items	Strongly Agree	Agree	Strongly Disagree	Disagree
1.	There is provision for Capacity building.				
2.	There is Continuous Development Programs (CDP).				
3.	Policies regarding automation of library operations are formulated.				
4.	There is provision for research and innovation.				
5.	There is availability of digital technologies/devices.				
6.	There are changes in curricula content.				
7.	There is Uninterrupted/Alternative power supply.				
8.	The learning environment is conducive.				
9.	There is provision of Wi-Fi.				