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# Digital Solutions and the Case for Africa's Sustainable Development

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and Proficiency in Sustainability  
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## **Chapter 1**

E-Commerce: Is It a Safe Avenue for Global Trade? ..... 1

*Andrew Omambia, University of Eastern African, Baraton, Kenya*

Use of ecommerce technologies have been on the rise in the recent past mostly because they provide access point to the world market competitively and offer a means to which efficiency in the way of conducting business is maintained. Whereas all those benefits sound good and entice so many users to venture into this technology, ecommerce technological trust and security services are on the weighing scale and these two factors are perceived to be the most important factors that affect users' intentions to use ecommerce technologies. Considering the rise of cyber-crime activities in the world and hearing of sad stories of cybercrime offenses particularly in developing countries, this chapter then investigates the challenges of ecommerce and how such challenges have posed serious setbacks in regard to the use and adoption of ecommerce and suggest solutions to curb this challenges for the betterment of global trade and efficiency in way business is conducted through such platform. The recommendations from this study will go a long way to inspires ecommerce technology developers to incorporate secure features that can ensure confidence of use from the users' side.

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Impact of ICT Adoption on Small and Medium Enterprises in Ilala District,  
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*Masese Benard, Kampala International University, Uganda*

ICT plays a critical role in the growth and development of SMEs. Tanzania is a developing country where small and medium enterprises (SMEs) are perceived as the engine of growth, yet they have not attained the expected level. The adoption of ICT enables the SMEs to be more competitive. ICT plays a very important role in the current knowledge economy. The ICT sector presents a tremendous



opportunity for economic growth. If ICT is adopted, it will significantly improve the performance and productivity of SMEs. The problem facing most of the SMEs is partial or non-adoption of technology. They have to adopt ICT in order to remain competitive and be competitive. The study investigates how the adoption of ICT could contribute to the success of small and medium enterprises (SMEs), examines impact of information and communication technologies in small and medium enterprises growth and development. Technology acceptance model was adopted by the researcher. The case study and cross-sectional survey research design was used to generate data. This is because with such a design it is easy to collect data in a short period of time from many respondents. The researcher used questionnaires to gather data from SMEs institutions covering Ilala district in Dar es Salaam, Tanzania. The researcher used the sample size of 82 respondents. Simple random sampling was used in sampling SMEs in Ilala district. The data collected from the survey was analyzed using simple percentage, mean, standard deviation, and regression analysis. The results show that T1 and T3 Pearson's correlation coefficient( $r$ ) equals .231\*, indicating a strong relationship in terms of correlation.  $p < .037$  and indicates that the coefficient is significantly different from 0. We can conclude that there is correlation between T1 and T3. In particular, it seems that the more the use of computer network it stimulates the growth and development of the SMEs ( $r = .231, p < .037$ ). Also T1 and T2 Pearson's correlation coefficient( $r$ ) equals .196\*, indicating a strong relationship in terms of correlation.  $p < .077$  and indicates that the coefficient is significantly different from 0 ( $r = .196, p < .077$ ). ICT has great potential in the growth and development of SMEs which is still untapped in Ilala district. The adaption of ICT in SMEs business has helped to transform business to another level, sharpen market intelligence, improve efficiency, reduce supply chain from B2C, B2B, and increase customer satisfaction.

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*Joel Stephan Tagne, The University of Ngaoundere, Cameroon*

The objective of this study is to show the effects of digitalization on the innovative capability of companies in Sub-Saharan Africa. To meet this objective, the authors used the World Bank data (Enterprise Survey) on survey of service companies and manufacturing industries in 2016. Making use of a binary probit model and a recursive bivariate probit model, they found that digitization has a significant effect on business innovation in Sub-Saharan Africa. Specifically, they found that when a company has a website, its probability of introducing an innovation in to the market increases by 27% as compared to companies without a website. However, when a company has its own website, the probability to introduce an incremental innovation is 0.34 higher than radical innovation. Thus, they can recommend to entrepreneurs in Sub-Saharan Africa to invest not only in the digitalization of their companies

but also and above all in research and development, which is a translational and inevitable determinant for radical innovation.

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From its onset, education has had an integral role in transforming society to become what it is. In fact, developments in society, especially in terms of human capital, have resulted from the nature of education its members have received. In the past two decades, owing to several factors, society has seen a stark transformation in economics and commerce. A major part of this development has offset the sync between education and practice, such that the earlier has fallen behind the latter. The question of institutions producing employable graduates is on the rise as educational institutions fall back in their ability to do so. Harnessing developments and latest advances in technology to carve out efficient human capital could give education a surviving chance.

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This chapter explores the digital innovations in the financial services sector relevant to sustainable agricultural production, the extent of their availability to the farmers and impact on productivity. It also assesses application of digital solutions on knowledge management and delivery of agricultural extension services to the farmers. Digital transformation in agricultural projects has also been covered in this chapter covering the entire project life cycle; production tasks are currently delivered as projects. Lastly, this chapter also looks at the digital innovations in marketing agricultural products.

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The concept of smart city is a burgeoning strategy that is fast becoming popular as a

strategy that will be able to mitigate the problems emanating from the uncontrolled population growth and urbanization. Academicians have turned their attention to the smart city concept, but an in-depth understanding of the concept is still required. There is a dearth of information on the concept and hence the phenomenon is not well understood. This study, therefore, aims to fill the gap in literature regarding smart cities and propose a framework for grasping the concept further. Based on exploratory studies on the concept of smart cities, this chapter focusses on nine key factors that will form the framework for smart cities and the smart cities initiatives. These nine critical factors include the management, organization governance, technology, people, policy, economy, natural environment, built environment, and the implications of big data on smart cities. These factors provide the basis for the development of an integrative framework that can be employed to examine the manner in which governments around the world, including Kenya, are envisioning smart city initiatives. The framework provides the agendas and directions for smart approaches that can be implemented in cities and a road map for the attainment of smart cities.

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*Jonai Wabwire, Kisii University, Kenya*

This chapter examines the transformation of oral and written storytelling practices in African folklore industry to online digital platforms. The chapter engages the complexities, limits, and constraints of the stakeholders participatory model as it informs digital storytelling, and applies theoretical tactics to community media and the digital storytelling movement to develop an analytic framework for understanding how these stories can be used to give a voice to the voiceless, raise awareness, increase education, and promote democracy. Folklores serve a descriptive as well as prescriptive role by consistently depicting societal and cultural norms. The increasing usage of new media technologies amongst the producers and audiences of these folklores cannot be ruled out in Africa.

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This chapter studies the relevance of the feedback mechanism on the library database in academic libraries. The study is a systematic literature review which uses Kitchenham and Charters methodology. The chapter has three objectives, which are to enumerate the concept of information retrieval and its problems and the relevance of feedback mechanism to the database in academic libraries. The findings

indicated that feedback is very important in the information retrieval systems most especially in relation to the database in an academic library. The contributions of this chapter show that the feedback mechanism is relevant to information retrieval. It also creates awareness among librarians of the importance of these mechanisms and encouraged them to seek for a database with these components whenever they want to buy a new database for their various institutions. The chapter, however, recommends further empirical studies on the subject matter.

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Framework for Technology-Enriched Active Class Learning of Physics in Secondary Schools in Kenya.....131

*Elizabeth Sarange Bosire Abenga, Masinde Muliro University of Science and Technology, Kenya*

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*Sarah Otanga, National Taiwan University of Science and Technology, Taiwan*

Active learning transforms the learning process and activities from tutor focused to learner-cantered and is driven by the learner’s learning ability. In other words, active learning provides an opportunity for self-directed learning that enables the learners to engage with the learning materials at personal level and pace. Thus, this chapter argues that active learning can provide equal learning opportunity for every single learner irrespective of the differences in their personality traits that would otherwise affect how they learn. Hence, this chapter proposes a framework for technology-enriched active learning for young learners that provides a personalized learning that deviates from the traditional “fit-for-all” classroom setups that tends to favour only the extrovert students. The proposed framework leverages advancement in technology such as personal learning network, virtual physics labs, massive open online courses, and crowd-sourced expert opinions to provide the learners with just-in-time active learning opportunity.

## **Chapter 10**

Higher Education Governance of Big Data: A Systematic Literature Review ..152

*Muhammed Jamiu Soliudeen, Polytechnic Digital Library, Federal Polytechnic, Johor, Nigeria*

*Kayode Ibrahim Adenuga, Farnborough College of Technology, UK*

*Fatai Idowu Sadiq, Ambrose Alli University, Edo State, Nigeria*

In this chapter, the authors conducted a study on higher education governance of big data. Big data can be described as the amount of data created which is beyond the technical capacity to be efficiently processed, stored, and managed. There are

six objectives for the study, which are to investigate the characteristics of big data in higher education, in how big data contributes to higher education, how to govern big data in higher education, the higher educational governance models, the roles of government in managing higher education and the big data initiative in the developing nations. Kitchenham methodology is adopted in this study to carry out a systematic literature review. The finding, therefore, reveals that the characteristics of big data include value, velocity, volume, veracity, and variety. The findings show that big data contributes to higher education by given real-time feedback, monitor students'school performance. It shows that big data can be used for the detection of attrition risk, data visualization, students's skill estimation, and grouping and collaborations among the students. It also shows that big data can be governed through provisions of information security, compliances, and ensuring privacy. This chapter, therefore, contributed data quality and accountability as other methods of governing big data. Therefore, the authors recommend the future study to cover data stakeholders in higher education.

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# Preface

## **INSPIRATION FOR WRITING THE BOOK**

With Africa's mobile phone penetration on high gear and 70% of Africa's population under 30 years old, a digital approach empowered by Information Technologies can and will play a fundamental role in providing solutions that address the African problems towards achieving the ambitions African Union Agenda 2063 in the area such as Africa Virtual and E- University, Pan African E- Network, Single Air-Transport Network, and African Outer Space Strategy.

It is the use of Information Science and Technologies through computers and other applicable devices to develop digital solutions to the existing problems by especially focusing on the African context.

This publication highlights the content and knowledge on a digital approach in pertinent areas of Agriculture, Entrepreneurship, Education, and Healthcare in the African context to provide practical measures and solutions that could and will contribute significantly to addressing the African sustainable Development problems and challenges.

## **IMPORTANCE OF THE BOOK**

This book will point out the gap in theory and practice while considering the role of Information Science and Technologies through computers and other applicable devices to develop digital solutions to the existing problems especially focusing on the African context.

This publication will focus on areas such as eCommerce, entrepreneurial innovation, education entrepreneurship, Agriculture, digital landscape and the African heritage, innovation, collaborations, social business models, applications such as data sharing, and urban living and working spaces and data governance among other areas to provide practical measures and solutions that could and will

contribute significantly to addressing the African sustainable Development problems and challenges.

## **TARGET AUDIENCE**

In the general ICT market, the book *Digital Solutions and the Case for Africa's Sustainable Development* will appeal to readers wanting to improve their knowledge and capacities in digital solutions to African problems. This book is relevant to academia targeting institutions of higher learning who are custodians to relevant digital knowledge, and are in position of identifying skills gaps and seek to build the right digital skills that would help drive the economic prosperity of the African countries; Tech Hubs that are instrumental in building business and communities that are Digitally driven; Inventor and Innovator Communities that are spaces for intellectual property and technological progress in African horizon; Investors especially in the African Digital niche which is rapidly growing and is in need of avid investors who are ready to take on business risks in providing digital solutions to African problems and lastly, policymakers in both public and private institutions that are responsible in providing effective research-based policymaking focusing on the supply side in order to provide the enabling environment for digital solutions that promote sustainable develop in specific countries and Africa in general.

## **THE EXPECTATION FROM THE BOOK**

In our book, we discuss perspectives and perceptions on Digital Applications in Agriculture and Entrepreneurship activities, we also consider viewpoints on the role of digital application in the classroom environment and Education in general. With healthcare being a serious challenge in Africa, sometime is also allocated in considering how effective and relevant Digital applications are in the healthcare industry all in the African context.

## **ACKNOWLEDGMENT**

We would like to thank IGI Global Publishers for the guidance and consistent robust support all through processes in bringing this book to a realization. We also express our gratitude to the editorial review board for their time and expertise and the valuable input in the peer review process to ensure quality and rigor for this publication. Special appreciation goes to the chapter contributors for working

***Preface***

tirelessly in the write-ups and revisions and bringing this project to a realization.  
We hope you enjoy your reading.



# Chapter 1

## E-Commerce: Is It a Safe Avenue for Global Trade?

**Andrew Omambia**  
*University of Eastern African, Baraton, Kenya*

### **ABSTRACT**

*Use of ecommerce technologies have been on the rise in the recent past mostly because they provide access point to the world market competitively and offer a means to which efficiency in the way of conducting business is maintained. Whereas all those benefits sound good and entice so many users to venture into this technology, ecommerce technological trust and security services are on the weighing scale and these two factors are perceived to be the most important factors that affect users' intentions to use ecommerce technologies. Considering the rise of cyber-crime activities in the world and hearing of sad stories of cybercrime offenses particularly in developing countries, this chapter then investigates the challenges of ecommerce and how such challenges have posed serious setbacks in regard to the use and adoption of ecommerce and suggest solutions to curb this challenges for the betterment of global trade and efficiency in way business is conducted through such platform. The recommendations from this study will go a long way to inspires ecommerce technology developers to incorporate secure features that can ensure confidence of use from the users' side.*

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## **INTRODUCTION**

The use of e-commerce platforms in the Kenyan market has increased at a tremendous rate in the recent past. With a population of 43.18 million (World Population Review, 2020) and central location in the East African Community, Kenya presents itself as a hub for finance and trade and e-commerce plays a big role (African Development Bank, 2019). The unprecedented growth of e-commerce in Kenya has made it possible for the country to widen its scope in the market (Ekekwe, 2015). Kenyans are also keen and excited to adopting the use of ecommerce majorly because it remains to be the fastest method to transact (Kenneth & Rebecca, 2012). Although this technology is seen by many as good avenue to conduct business it also has its dark side like incase of starting capital, ecommerce investment may not be much but maintaining ecommerce technology is an uphill task in Kenya, for a simple reason that marketing the ecommerce business to a breakeven level is a mountain and this makes many businesses to shy away from venturing into it. It needs quite a good strategy survive (Olah & Kitukutha, 2018).

In the past, the trend has been preference to visit physical shop locations to buy things because they can see physically because of fear of being scammed. With the myriad changes in the online landscape, Kenyans have not been properly sensitized concerning the use of ecommerce simply because many of them are not tech savvy and their negative attitude mainly because of issues insecurity that comes along with the use of such technologies (Hsiao, 2009). Since the landing of submarine sea cables in the Kenyan coast the quality of internet has drastically improved especially looking at the aspect of internet speed which has improved in terms of speed and cost which has come down drastically. These two constructs have in return impacted positively on the ecommerce use and adoption from the end users' side and also implementation of ecommerce platforms from the investor's side. Some of the sectors that has in the recent past adopted the use of ecommerce include but not limited to clothing industry, shoes, accessories, books, electronic equipment, cosmetics nutrition suppliers among others (Gido et al., 2016).

Given the fact that ecommerce or the exchange of products and services and payments through telecommunications systems is rapidly expanding around the world, the capacity of the country to support ecommerce and the opportunities in this field can be said to be very important in determining the country's position as a regional hub (Erden, 2016). Being a leader of issues to deal with information technology and communication in the region, it's no surprise that Kenya was able to adopt and take advantage new means of practicing business transactions of electronic commerce (Yabs & Yabs, 2018). A new era of online shopping system was opened up to the people of Kenya which can now make a variety of purchases straight from mobile devices. They offered convenience, speedier checkout processes, and a wider

## **E-Commerce**

range of purchasing options than ever before in the history finance and trade of this nation (Lynchpin, 2020). On the contrary, however, as e-commerce platforms in Kenya become popular, cybercrime and compromise on information security are becoming key concerns.

## **The Benefits of Ecommerce in Kenyan Market**

Today ecommerce has revolutionized the way companies conduct businesses. Consumers can purchase virtually everything online 24/7. In Kenya many people opt for ecommerce because of its easy of doing business and convenience. At the comfort of the consumer one can buy anything at any time of the day with the ability to transfer funds online. Because of this convenience consumers can save time that was initially used in traditional shopping in doing other productive activities that can otherwise improve their lives. Consumers can also get information concerning the product at any time of the day and use such information to make decision to purchase the product they need.

Ecommerce is an efficient and competent method of trading especially in Kenya where the cost of doing scares many investors because business is very high. Ecommerce comes as solution to that such that setting up ecommerce is extremely low as compared to traditional brick and mortar shops where licenses and permits are required and employees to manage such business all those coupled together business in Kenya become very costly. Ecommerce is seen as an alternative method that can save a lot money that can be diverted into other activities like online marketing to improve the business.

This study is more useful to the Kenyan economy because its analysis on the challenges of electronic commerce can help both government and private firm on achieving their goals through many ways. This study is of potential usefulness to the ICT Board of Kenya and Ministry of Information and Communication in their endeavor for a regulatory framework for ecommerce in Kenya. To change the perception of people of Kenyan's towards ecommerce that for ones to do a transaction he/she should do a paper-based transaction.

## **METHODOLOGY**

This paper focuses on tracing the challenges of ecommerce considering the rise of dark stories emanating from the use and application of ecommerce activities in the world today and reading concerning the challenges facing ecommerce particularly in developing countries. In view of addressing such issues the researcher investigated the

challenges of ecommerce and how such challenges can affect the way of conducting trade and suggested ways to mitigate such challenges.

To achieve the objectives of this study the researcher reviewed articles related to the topic under study by querying the key words such as ecommerce, global trade and cybercrime.

The said articles were searched from academic databases including IEEE, Ebscohost, Joost Sage, ScienceDirect and ACM Library. The search was only limited to papers published between the year 2010 and 2019 majorly because this ensures that data gathered were current and up to date and also only those papers published in academic journal were selected to ascertain that information gathered was of high quality since those papers were peer reviewed.

Following this filtering process, the papers obtained formed the sample of references used in this study

## **LITERATURE REVIEW**

In this section, the term ecommerce and its challenges have been explained. This is followed by a discussion on the studies that have been conducted on ecommerce in Kenya. The section concludes by presenting the ideas on the measures to be taken for the successful development of an electronic commerce platform in the country.

Most of the private companies in many developing countries including Kenya are trying to cope with the changes in the world of business in technology today by migrating to the new system of doing business which is electronic based system known as ecommerce, although it has not operated optimally well compared to the developed countries majorly because of lack of supportive policies which can create a conducive environment for ecommerce to be thrive and be successful (Onyango Omenya, 2016; Datta, 2011). For example, in the Kenyan setup, some places lack access to internet access and electricity (Ejiaku, 2014), such kind of place ultimately ecommerce cannot be introduced unless such facilities are availed. But there is no debate about the intent of the private sector and the government in the implementation of the ecommerce in the country, in the light of the government introducing the laws which legalize the online business transaction to ensure ecommerce work successfully, this study then intends to assess the challenges facing ecommerce to date and the solution ought to be achieved to achieve the successful implementation of this technology that has recorded success story in the developed countries (Mata & Quesada, 2014).

## **Definition of Ecommerce**

There are many definitions for the concept of Ecommerce depending on the perspective of the reader. For the purpose of this study however, below are a few definitions of Ecommerce as described by different authors.

Electronic Commerce deals with facilitation of transactions and selling of products and services online either via the internet or any other telecommunications network (Khan, 2016). Ecommerce, in the popular sense, can be defined as: the use of the Internet and the Web to conduct business transactions. A more technical definition would be: ecommerce involves digitally enabled commercial transactions between and among organizations and individuals (Patil & D.Bhakkad, 2014).

Ecommerce is a method of trading that replaces paper-based documentation by a mutually binding electronic protocol between buyers and sellers(Ganne, 2018).

Ecommerce is a way of conducting business via electronic media, and most commonly, the Internet. The internet or World Wide Web (WWW) is a network of millions of computers linked around the world through telecommunications systems, allowing for almost instantaneous transfer of data (Mata & Quesada, 2014).

Ecommerce, thus, refers to a type of business model, or segment of a larger business model, that allows an organization or individual to conduct business over an electronic network. It is any form of economic activity conducted via electronic connections, does not necessarily has to involve the internet and World Wide Web (WWW), so long as it is a business transaction that involves the electronic devices it is qualified to be an ecommerce. It has three main components:

- Economic activity.
- Interaction occurs electronically.
- The interaction crosses organization boundaries.

## **Categories of Ecommerce**

Electronic commerce operates in four of the major market segments: business to business, business to consumer, consumer to consumer and consumer to business. It can be thought of as a more advanced form of mail-order purchasing through a catalog. Almost any product or service can be offered through ecommerce, from books and music to financial services and even plane tickets (Webber, 2013)..

Few years ago, ecommerce has increasingly become necessary component of business strategy for efficient transaction in Kenya. Ecommerce technology in business could revolutionize relationships within organizations and individual transaction settings.

The expansion of ecommerce goes directly proportional to the development of the information technology and communication (ICT) in any country. Statistics shows that number of the internet has been increased exponentially every year in the country. According to the report from the communications commission of Kenya (CCK) the number of internet/data subscriptions grew by 13.0 percent to stand at 13.1 million subscribers up from 11.9million in the 2012 (ICT Authority, 2014). Nowadays, many business operations, especially online shopping had widened the access to their products through new methods of marketing via electronically mediated ecommerce. Good understanding of the requirements, expectations and the operational concept of internet shopping could results an advantage to effective online retailing and as well help the manufacturers in developing more effective and targeted online retailer operations.

Apart from all the improvement of ecommerce which has been described from the other studies, there are challenges which can affects the economy in one way or another have to be addressed.

## **Privacy**

There is a major concern about the security when it comes to the online shopping. Consumer wants to be assured of protection and trust for their personal details to which they provide to the system.

Before doing anything on any ecommerce website a customer must have an account or any other means of which will make an interaction platform between the customer and the owner of the business. To do so, the customer must provide some personal information which can be accessed by the owner of the business. There is some concern on how the private information are used by the other side, are they really using those details for business purposes? Can they be trusted? Are their systems secured (by hackers).

Privacy can be defined as a state of being free from public attention, doing your own things with no obstruction or without any interference. In ecommerce point of view, privacy can be defined as the self control over one's personal data and security (van den Hoven & Warnier, 2019). According to the Kenya constitution privacy of individuals must be observed by the authorities, no body or organization allowed to disclose someone's personal details for any reason.

Knowing that, the government has taken some serious measures to ensure the people's privacy are observed and their details are not used to harm others by introducing an online identity-verification system in order to curb cybercrime and create a secure online business transaction environment. The government introduced Public Key Infrastructure. The online system, Public Key Infrastructure (PKI),

## **E-Commerce**

involved creating certification agencies to register and assign virtual identities to every internet user (Nguyen, 2017).

Individual users are able to register their personal e-mail addresses and identifying information in the database while businesses will provide their contact information and credentials. The online identity system is used to authenticate online users, it particularly help people who engage in ecommerce or any other online activity to identify who they are dealing with at the other end of the communication (Mwaura k., 2013).

## **Security**

Security is one of the major assurance factors of a successful online payment system. Many organizations which operate in online system, like banks, product and service providers running websites are hoping that with an increase of awareness and availability of network security, electronic commerce will eventually succeed to be secured. These days, airline companies operating in the country are using the online based systems for ticket bookings, confirmation of reservations and general information, but other organizations appreciate the importance of ecommerce but they are not ready to take the risk of fraud at all, they are hesitant to use it until security is guaranteed (Mwaura K., 2013).

## **Cyber Security**

Cyber security is an information technology security, focuses on protecting computers, networks, programs and data from unintended or unauthorized access, change or destruction on other words it is a means of protecting information and information systems from unauthorized access, use, disclosure, disruption, modification or destruction (Australia, 2013).

Cyber security refers to the technologies and processes designed to protect computer networks and data from unauthorized access, vulnerabilities and attacks delivered via the internet by cyber criminals (Gichovi, 2013).

Globally, cybercrime landscape has changed dramatically; with criminals apply more sophisticated technology and greater knowledge of cyber security (Herhat, 2011). Cyber insecurity has become a biggest threat of the growth of information technology activities in Kenya and ecommerce is not an optional therefore, lobby group wanted the government to work with the private sector more to tackle the problem.

Cybercrime is a crime dealing with computers and networks whereby a computer is the subject of the crime such as hacking or used as a tool to commit offense like child pornography. Kenya is experiencing a growing number of cybercrimes that

threaten national security, Information, communications and technology infrastructure as well as citizens privacy, this happen through different ICT devices e.g. smart phones laptops etc (Gichovi, 2013).

It is estimated that Kenya is losing 2 billion shillings every year through cyber crime. According to over 75 percent of critical financial applications and portals were vulnerable to cyber attacks. Threats came through, Social Media, Denial of Service attacks, online transactions and mobile banking, Mobile money fraud and cyber espionage, are the top eight threats of Cyber security in Kenya. Banking and government found that their online portals cannot be sure about the security of their customer's login credentials.

Out of 33 portals sampled, only two portals had client side encryption implemented on 2012 a total of 7 organizations incurred over Ksh 2 million in fraudulent on VoIP phone calls in one year only.

The amounts of cyber security crime increase because there is no regulatory framework at which all the stakeholders of the information technology and communication can rely. On this matter, the government can play the major role to ensure it implement rules governing all the experts of online business and create the road map of their activities.

According to (Kigen, 2014), thousands of computers in Kenya are infected with malicious program sending spam mails infected with viruses; the report shows that some of the insecurity reasons are:

- Poorly designed and insecure web applications expose local financial institutions to possible compromise and defacement by cyber criminals.
- Automated attacks targeting organizations in Kenya are going undetected due to poor detection and prevention methods.
- Cyber criminals are selling stolen credit cards issued by Kenyan banks online for \$10 US dollars Businesses in Kenya are experiencing cases of insider threat including information leakage and insider fraud.

Few years ago, there were increase a number of online mobile banking something which is encouraging (Munyoki, 2018). However, the report shows that the continued popularity of Mobile money adoption in the region has attracted criminals who are now targeting this new money transfer channel. Globally the report indicates that Kenya has a higher percentage of malware infected systems compared to global averages, Kenyan Internet Service Providers (ISPs) have poor reputation scores leading to email and web, traffic getting blocked (Kigen, 2014).



## **Fraud**

According to the Oxford Dictionary fraud can be defined as an act where by a person or thing intended to deceive others, typically by unjustifiably claiming or being credited with accomplishments or qualities (deception whereby someone knowingly makes false representation).

Here I am going to discuss much more about banking systems as a part of ecommerce systems and the different scenarios of fraud as reported during the year between 2011 and 2014. Fraud is one of the major fear in the ecommerce sector in Kenya due to the rising number of incidents concerning fraud, people are not sure of the security of the information they disclose to the existing online ecommerce systems (Mugwng'a, 2013). They fear to expose the details from their credit card, ATM cards and other tangible chip used in online payments systems.

Statistics show that the amount of fraud incidents increased in Kenya, It is reported that Fraudsters have stolen at least Ksh1.5 billion (\$17.64 million) from Kenyan banks in the year 2013, in schemes hatched by technology-savvy bank employees (Mwaura K., 2013).

The security experts claimed that, the reported amount is estimated to be only half of the actual amount which was stolen because some other banks did not get to reveal their losses in the fear of spoiling their brand names. Increasing issues about of fraud and cybercrime indicate that financial institutions need to raise their investment and introduce some serious measures in detection and preventive mechanisms to fight against the fraudsters who are increasingly sophisticated.

Also according to (Mwaura K., 2013), the investigation agency, in its monthly crime reports identified that these incidents frequently happen on identity theft, electronic funds transfer, credit card fraud, loan fraud, forgery of documents and online fraud as some of the ways used to defraud financial institutions.

Research also shows that, it is down to all the ecommerce stakeholders, to increase investment in their systems security that can detect fraud as it happens, so that it then gives them an assurance of recovering the funds once the crime happen (Massa & Valverde, 2014). Many Kenyan banks lack the Information Technology systems that can detect fraud as it occurs, meaning that there is always a lag between the time the fraud occurs and when the crime is detected.

Many banks rely on traditional internal audit of which it takes longer to detect the incident and by the time detections are noticed the money could have already been moved or withdrawn that's makes almost impossible to recover the loss, this can only be erased by introducing strong Information Technology system.

## CONCLUSION

The researcher conclude by commenting that all sides' government and private sector have an important role on the implantation and making ecommerce as an important a better way of operating business transactions compared to the normal paper based system in both ways, in terms of security and time consuming both sides should play their part well.

To achieve planned goal fort exercise an ecommerce, there some leadership measures should be made by the government ICT experts in general.

## RECOMMENDATIONS

Based on the literature reviews from different articles and the conclusion of the study, the researcher felt that the following recommendations are necessary to make ecommerce successful for Kenyan economy:

1. The government should create good infrastructure for information technology widespread throughout the country so that customers get access to the internet at affordable cost, this will motivate and attract more people on ecommerce system since it will be economic viable.
2. The government should implement rules and regulations against any form of cyber crime.
3. An independent body should be established to protect consumer's right and governing the activities concerning online business transactions.
4. People must be educated enough to understand how to use the Internet to its fullest capacity.
5. Also, a researcher would like to emphasize to all the ecommerce new comers to put into consideration the challenges a facing an electronic commerce before implementing it to avoid getting stack at the middle of the business.

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## Chapter 2

# Impact of ICT Adoption on Small and Medium Enterprises in Ilala District, Dar Es Salaam, Tanzania

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### **ABSTRACT**

*ICT plays a critical role in the growth and development of SMEs. Tanzania is a developing country where small and medium enterprises (SMEs) are perceived as the engine of growth, yet they have not attained the expected level. The adoption of ICT enables the SMEs to be more competitive. ICT plays a very important role in the current knowledge economy. The ICT sector presents a tremendous opportunity for economic growth. If ICT is adopted, it will significantly improve the performance and productivity of SMEs. The problem facing most of the SMEs is partial or non-adoption of technology. They have to adopt ICT in order to remain competitive and be competitive. The study investigates how the adoption of ICT could contribute to the success of small and medium enterprises (SMEs), examines impact of information and communication technologies in small and medium enterprises growth and development. Technology acceptance model was adopted by the researcher. The case study and cross-sectional survey research design was used to generate data. This is because with such a design it is easy to collect data in a short period of time from many respondents. The researcher used questionnaires to gather data from SMEs institutions covering Ilala district in Dar es Salaam, Tanzania. The researcher used*

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## **Impact of ICT Adoption on Small and Medium Enterprises in Ilala District, Dar Es Salaam, Tanzania**

*the sample size of 82 respondents. Simple random sampling was used in sampling SMEs in Ilala district. The data collected from the survey was analyzed using simple percentage, mean, standard deviation, and regression analysis. The results show that T1 and T3 Pearson's correlation coefficient( $r$ ) equals .231\*, indicating a strong relationship in terms of correlation.  $p < .037$  and indicates that the coefficient is significantly different from 0. We can conclude that there is correlation between T1 and T3. In particular, it seems that the more the use of computer network it stimulates the growth and development of the SMEs ( $r = .231, p < .037$ ). Also T1 and T2 Pearson's correlation coefficient( $r$ ) equals .196\*, indicating a strong relationship in terms of correlation.  $p < .077$  and indicates that the coefficient is significantly different from 0 ( $r = .196, p < .077$ ). ICT has great potential in the growth and development of SMEs which is still untapped in Ilala district. The adaptation of ICT in SMEs business has helped to transform business to another level, sharpen market intelligence, improve efficiency, reduce supply chain from B2C, B2B, and increase customer satisfaction.*

## **BACKGROUND**

SMEs are central actors in every economy and form a substantial contribution to poverty alleviation, employment and gross domestic product. Research reports indicates that many SMEs are focused on local markets, but have been driven to react to competition on a worldwide stage as well. In recent years, the business environment in which SMEs operate has undertaken a major change. The market now demands customer satisfaction and service flexibility from SMEs. To meet these challenges, companies are employing various measures and techniques to improve their functioning, such as improved business processes, business model innovation, job automation, improved client service (by using CRM) and the deployment of data engineering systems like ERP (Salum and Rozan, 2015).

Small and medium sized enterprises known as the SMEs refers business entity whose employee numbers or annual sales turn-over falls under certain limitation (Alam, Jani, Omar, & Hossain, 2012). Sme's can be categorized as adopters and non-adopters of ICT and also confirmed the importance of organizational support of key decision-makers such as owner managers in ICT adoption process. The early adopters also identified as change agents or innovation champions and access to financial resources are among the key organizational characteristics that influence ICT adoption in small businesses (Chinyanyu, Milne, & Watkins-Mathys, 2017)

The rapid development within society of the use of information and communication technologies has meant a revolution in the way businesses work, as indeed it has changed the way in which very many people in Europe work. Information and communication technology includes networks, computers, other data processing and transmitting equipment, and software (e-Business W@tch, 2006).

Recent advances in Information and Communication Technologies (ICTs) have brought many innovations to the field of Information Systems (IS). The main goal of such innovations, for both developed and developing countries, is the improvement of organizations' performance and the achievement of competitive advantages. Developing countries, in particular, are looking forward to achieve several social, economical and strategic gains by implementing various "western-originated" ICT initiatives. (Mutaz and Enas, 2012).

According to (Jaganathan, Mahmood, and, & Ahmad, 2014) in Malaysia the rapid advancement and development in the information and communication technology (ICT) have changed dramatically many aspects of economic and social lives. It has also transformed radically the way businesses are conducted. This transformation has not only created more opportunities, it also posed a threat to the small and medium enterprises (SMEs). SMEs are more likely to experience several ICT adoption and implementation challenges given their relatively small sizes; simple structures; shortage of resources and lack of capacity to view ICT strategically (Chinyanyu, Milne, & Watkins-Mathys, 2017).

SMEs are an important element in all economy because the SMEs are providing a substantial employment opportunities (Alam, Jani, Omar, & Hossain, 2012). SMEs comprise a large part of the global economy and employ a great number of workers. More than 95 percent of the total establishments in Malaysia are SMEs and they control a large chunk of the economy. However, SMEs lagged behind other industries in fully embracing the ICT capabilities, and this makes them more vulnerable to changing economic conditions as they have relatively lower level of competitiveness. It has been reported that lack of education and technical skills were the main factors leading to the lower rate of technology adoption among SMEs in Malaysia (Jaganathan, Mahmood, and, & Ahmad, 2014).

The economic importance of SMEs within the sector of services is highly recognized at the European Union level. According to Eurostat (2008), in total, there were almost 19 million enterprises in the EU-27's non-financial business economy in 2004. Of these, 99.8% were SMEs, the majority of which were micro enterprises (employing fewer than 10 persons). However, in order to have a significant impact on Europe's economy, SMEs need to grow bigger, meaning that they should increase employment, expand their variety of services, and enlarge their markets and earnings. Innovation is the most important driver of SMEs growth, because it could lead to new products and services or more efficient ways of delivering existing ones, through

the introduction of new technology, know-how, additional staff with new skills, and access to new markets (European Commission, 2008).

In Kenya SMEs comprise about 75% of all businesses, employ 4.6 million people (30%), accounts for 87% of new jobs created and contributes 18.4% of the GDP. (GOK, 2009). Information and Communication Technology (ICT) is identified as an enabler of other sectors, (GOK, 2007) presenting enormous opportunities for SMEs to improve market access.

Mutula and Van Brakel (2006) Information is an important asset that gives small and medium enterprises (SMEs) a competitive advantage in the new economy. However, they point out that access to information is a problem in developing countries like Botswana and South Africa, due to a lack of ICT infrastructure. Therefore, it is important for small and medium enterprises to strategically position ICT within their organisation in such a way that they will maximise its benefits

In South African SMEs should especially explore mobile technologies; however, one of the biggest problems in South Africa is the high cost of connectivity and lack of infrastructure. According to Herselman (2003), South Africa has been developed in an uneven manner: the urban areas have the latest modern technologies while the rural areas are underdeveloped with little of the infrastructure, such as electricity and telephone lines, that is needed to thrive in the knowledge economy. This highlights the problem of the growing gap of the digital divide between the developed and the developing countries accordingly (Mutula, 2004). SMEs face many challenges in the adoption and sustainability of new technologies. This is because SMEs operate with limited resources, making IT adoption in the SME domain different to IT adoption by big businesses with more resources (Salum and Rozan, 2015).

## **OBJECTIVES**

1. To examines role of ICT Adoption in the Sme's in Ilala district Dar es Salaam.
2. To evaluates factors hindering ICT adoption and growth and development in the SME;
3. To assesses the impact of ICT adoption on SMEs growth and development.

## **PROBLEM STATEMENT**

Technological development is not easy, especially for small- and medium sized enterprises (SMEs). It is not easy for the SMEs to utilize new emerging technologies, despite the high potential of SMEs in contributing to Social-economic development; the sector continues to face binding constraints that limit their potential and growth.



Market access constraints continue to persist despite numerous policy interventions (KIPRA, 2006). ICT as an enabler of other sectors offers many opportunities for enhance market access. Tanzania vision 2030 has acknowledged the critical role it plays in the development, growth and competitiveness of all sectors. Studies indicate a low adoption of ICT by SMEs (Ritchie & Bridley, 2005; Kiveu, 2008) the problem is that SMEs are mainly using traditional tools to stay competitive. They need to take advantage of the power of ICT in order to take on the competition, whether small, big or global. Both the traditional and the ICT tools are very important for the competitiveness of the business. SMEs are facing both opportunities and challenges due to the information and communication technologies development hence this paper examines the role of ICT adoption, factors hindering its adoption and the impact of ICT adoption by sme's in Tanzania.

## **LITERATURE REVIEW**

### **Social media**

Social media such as Facebook, Twitter, Google Plus, YouTube and blogs have been widely adopted by various sme's. Many large companies were early adopters of social media and integrated social media marketing as a key part of their comprehensive marketing strategies. Social media networks such as Facebook or Twitter in this regard become ideal platforms for social exchanges. The cost-benefit assessment of a user determines what and how the user will participate in social media activities. (He, Wang, Chen, & Zha, 2015). There is a 'growing importance of social media as a strategic tool among organizations', as it can revolutionize how organizations engage with the market and society, creating new enterprise-wide possibilities and challenges from marketing and operations, to finance and human resource management (Duane & O'Reilly, 2016)

Social networks of business owners also play a crucial role in driving or inhibiting ICT adoption in SMEs. For example, in communities where culture is viewed as a key factor, particular cultural traits, beliefs and values attached to resources and investment may influence ICT adoption in several different ways. In addition, the size and type of social structures as well as the nature of social links and preference for personal friendships and contacts may have positive or negative influence on ICT adoption in SMEs.

In terms of positive influence, social networks are crucial to small business owners for sharing information, business experience and technical knowledge especially if the SMEs are experiencing resource constraints which inhibit ICT

adoption, formal training and effective innovation as well as growth (Chinyanyu, Milne, & Watkins-Mathys, 2017).

According to (He, Wang, Chen, & Zha, 2015) found out that Facebook was the dominant social media network used by the small businesses in this case study. Only three small businesses also used Twitter or YouTube, as well. Many of these adopters actively posted daily specials, promotions, recipes, event announcements, achievements, and interesting stories and/or pictures for their fans on their Facebook sites. Social media adoption experiences rapid growth and sme's have difficulty adapting to the pace. sme's may have been induced to use social media by pressures from competitors, trading partners and customers. Use may expand from marketing to enhancing customer relationships, reputation management, value and brand equity, digital advertising, ideation and establishing networks with business partners, while product/service innovation may also emerge (Duane & O'Reilly, 2016).

## **e-Commerce and e-Business**

In the study set out to determine the extent of e-commerce adoption in small and medium enterprises in Nairobi, Kenya. While ecommerce was found to provide strategic value to adopters, it was noted that a good number of SMEs in Nairobi had not embraced the technology. It was established that e-commerce is not widespread. 43% of all the firms surveyed had no functioning websites. 31% of the firms had static websites, while 22% of the firms had active websites that allowed interactive communication with customers. The study findings also indicate that over 80% of all firms surveyed did not have a specific e-commerce strategy (Joshua, N., & Njeru, 2013).

According to (Vivian Khoo, 2018) found that key barriers that deter e-commerce adoption is slow Internet speed, poor telecommunications, lack of industry support, and lack of e-commerce policy in the country. Financial problems and high level of uncertainty in the e-commerce market for SMEs would also decrease the tendency of SMEs to adopt e-commerce. Besides, security is one of the crucial issues affecting the development of e-commerce. The negative perception of the customer towards the security and confidentiality of e-commerce would decrease customers' confidence in e-commerce and in turn affect the development of e-commerce negatively. On the other hand, that the key external barriers are lack of external sources of information from vendors, IT consultants and public information media, and lack of competition threats.

(Syed, 2011) Noted that Internet security has been regarded as the key to e-commerce diffusion. A number of studies have found that one of major barrier in developing E-commerce is the security of using E-commerce. To adopt E-commerce information safety it is essential for the company to have integrity of the entire system.

Also revealed that the reluctance among many consumers to embrace e-commerce is basically centered on the concerns over security issues and lack of confidence in the current set-up e-commerce.

In the context of Tanzania, it is found that the barrier of e-commerce adoption at the organizational level derives the lack of management support. Management resistance is in fact caused by an ongoing resistance from government in the adoption of e-commerce in order to strengthen and reaffirm their authority at the expense of SMEs (Kabanda, 2012).

According (Rumanyika & Mashenene, 2014) a study done in Tanzania the findings show that poor telecommunication infrastructure, poor e-commerce security systems, lack of IT education and training, poor e-readiness and socio-cultural beliefs and lack of IT experts are significant impediments of e-commerce adoption among SMEs in Tanzania. The study recommends that policy makers should view these impediments as interrelated obstacles of e-commerce adoption among SMEs in Tanzania which need integrated effort and strategies when addressing them.

E-Business initiatives help in the growth of the sme's. Some of the initiatives and tools are E-Procurement, Customer Relationship management (CRM), Supply Chain Management (SCM), Internet infrastructure, Extranet and Intranet (Kumaran, 2016). The challenges for the adoption of E-Business in sms's are low awareness of customers and suppliers, huge implementation cost, lack of expert professionals, reluctance from management and hesitant to change the way of working, management's fear about security, insufficient interest of suppliers and business partners to partake in E-Business initiatives (Kumaran, 2016).

Due to the global reach of e-commerce, Small and Medium-sized Enterprises (SMEs) in the developed countries have started adopting e-commerce in their businesses ; but SMEs in Malaysian and many other developing countries are still reluctant to use information technology or e-commerce in their day-to-day business operation (Syed, 2011).

Digital marketing is new concept that attracts many businesses nowadays. Businesses shifted their focus to use the internet and electronic media to support their marketing activities and as a result digital marketing is growing rapidly. Therefore, digital marketing has shaped the way customers and business communicate, share information, buy, and sell from each other. Nowadays, with the increase number of internet users and availability of computer devices such as smartphones and usage of social platforms have been a useful means that influences customer behavior and experience (Yaseen, AL-Adwan, & AL-Madadha, 2019)The characteristics of Digital Marketing including the ability to target right customers, cost efficiency and accessibility and affordability have attracted many small medium enterprises companies (SMEs) to use Several digital marketing channels to engage with their customers. Moreover, digital marketing has become an important marketing tool to

be considered in the organizations strategic marketing plan (Yaseen, AL-Adwan, & AL-Madadha, 2019).

(Tan, Chong, Lin, & Eze, 2010) Noted that among the most prevalent benefits of ICT adoption include:

1. Reduced operating cost in communicating with customers and suppliers and Continuous advertising all over the globe, geographical related barriers are broken down.
2. Increased speed in the delivery of goods by suppliers through better communication, Improved company image, increased sale due the market scope
3. Enhanced efficiency through better co-ordination of firms in the value chain and closer working relationship among trading partners;
4. Effective communication tool with customers;
5. Bigger market exposure which opens the enterprise to new business opportunities;
6. Enhanced access to market information and knowledge by means of improved
7. Information exchange with customers and suppliers; and Effectiveness in collecting information, good customer service and better customer satisfaction
8. As a future tool in terms of facilitating new ways of managing and organizing businesses and effective information of customers hence improved productivity
9. Better supplier services and support and flexible delivery of supplies, reduced cost in acquiring suppliers

According to (Ibrahim, Turyakira, & Katumba, 2019) it is clear that lack of effective e-commerce adoption by SMEs in developing countries is attributed to:

1. Inadequate financial resources and imbalance between investment costs and return on investment;
2. Limited management support, Managers/owner's expertise and commitment;
3. Perceived lack of security in Internet transaction;
4. Negative attitude towards technology and perception of relative advantage;
5. Limited technological competencies and technical support;
6. Persistent change of e-commerce technology;
7. Limited access to internet and unavailability of a proper network infrastructure in the company;
8. Inadequate infrastructure, high cost of IT equipment, installation and software prices;
9. Poor maintenance of technological infrastructures;
10. Government policies and regulations; and Limited support by government and other agencies.

11. lack of qualified IT personnel to develop and maintain the e-commerce system of the enterprise;
12. unsuitability for business as SMEs are not convinced of the financial benefits to be attained;

Also (Rumanyika & Mashenene, 2014) noted the following challenges in the adoption of ICT in Tanzania

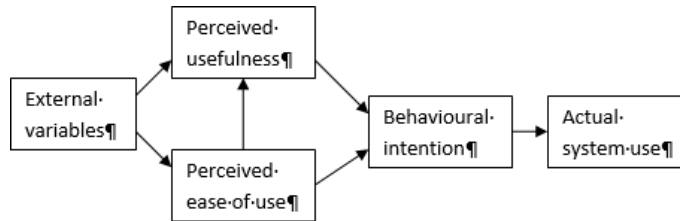
1. e-commerce security systems,
2. lack of information technology education and training,
3. weak government policy,
4. high taxes imposed on e-commerce services,
5. poor e-readiness and socio-cultural beliefs,
6. lack of capital,
7. lack of IT experts,
8. abrupt technological changes,
9. Lack of clear communication standards.

According to Sajuyigbe and Alabi, (2012) shows that infrastructural, cost of acquisition, lack of finance, skills, management and government support are the main challenges of ICT adoption by SMEs in Nigeria. Adebayo, Balogun and Kareem, (2013) in their empirical study shows that cost, funds, infrastructure, skills and training, management support and government support attitude are the main factors that affecting ICT adoption in Nigeria by SMEs.

Kapurubandara and Lawson (2006) there are numerous factors hinder SMEs' adoption of ICT in a developing country; such as owner/manager characteristics, the role of top management, firm characteristics, costs and return on investment, lack of adequate telecommunication infrastructures such as poor internet connectivity, lack of fixed telephone lines for end-users, dial-up access and the underdeveloped state of the Internet Service Providers also lack of knowledge on how to use the technology and the low computer literacy are other contributing factors for not adopting ICT (Knol and Stroeken 2001).

Chacko and Harris (2005) also state that the use of ICT by SMEs depends on the benefits the ICT tools can bring to the business, which means its usage depends on the cost effectiveness. The ICTs adopted by SMEs serve as basic tools for their business communication such as using either mobile phones or fixed lines. For example, after SMEs adopt ICT tools, they also use personal computers (PC) with basic software installed. They can enjoy improved communication (with suppliers, customers or employees and so on) and meet information processing needs. Having Internet presence also enable SMEs to enjoy improved communication tools such

*Figure 1. The Technology Acceptance Model*  
Adopted from (Davis, 1989)



as email, file sharing, creating websites, e-commerce, among others (Chacko and Harris, 2005).

Alam and Noor (2009) in their study examined the relationship between ICT adoption and its five factors which are perceived benefits, perceived cost, ICT knowledge, external pressure and government support. The results of this study show that three factors examined are significantly important to the adoption of ICT whereas perceived cost and external pressures are found to be insignificant in determining its adoption. This study provides a greater understanding of SME's perception about ICT adoption in their service business.

## **Theoretical Perspective**

The study adopted technology acceptance model which indicates that perceived ease of use and perceived usefulness. The acceptance and the adoption of ICT in SME's in Tanzania. Perceived usefulness and perceived ease of use, determine the attitude of the user, and that attitude determines the intent to use of SME's. The technology acceptance model (TAM) proposed by Davis (1989) is widely applied. The technology readiness of each individual SME is not the same, although there is a growing awareness about the potential of e-commerce. In TAM, perceived usefulness refers to the degree to which the user believes that using the technology will improve his or her work performance, while perceived ease of use refers to how effortless he or she perceives using the technology will be.

## **METHODOLOGY**

**Research approach:** A quantitative research approach was used in this study. According to Dawson (2009), quantitative research generates statistics through the use of large-scale survey research, using methods such as questionnaires or structured

interviews. The research instrument used was self-administered questionnaires. The research also employed a cross-sectional design. According to Bryman and Bell (2007), research designs are classified as experimental, cross-sectional, longitudinal and case study. Cross-sectional research design involves a collection of quantitative data. It is suited for research that involves looking into a phenomenon, for example, a technology, at a particular time from different perspectives. Business Intelligence concerns a technological phenomenon, a cross-sectional research design was therefore considered appropriate for the study

## **Sample Size**

The research used the sample size of 82 respondents which was generated from the business owners and the operators in ilala district

## **Sampling procedure**

Simple random sampling was used in sampling the sme's in Ilala district, Dar es Salaam city in Tanzania. The aim of using simple random sample was to reduce the potential for *human bias* in the selection of cases to be included in the sample.

*Table 1. Sample of SME'S in Ilala district*

<b>Area</b>	<b>no</b>	<b>%</b>
Ilala	82	100
Total	82	100.00

Source: field data (2012)

As a result, the simple random sample provided us with a sample that was highly representative of the population being studied, assuming that there is limited missing data. Since the units selected for inclusion in the sample are chosen using probabilistic methods, simple random sampling allows us to make generalisations (*i.e.* statistical inferences) from the sample to the population. This is a major advantage because such generalisations are more likely to be considered to have external validity.

*Table 2. Reliability statistics*

Cronbach's Alpha	N of Items
.749	50

## DATA ANALYSIS AND RELIABILITY OF THE INSTRUMENT

The questionnaire were close-ended questions, using the likent scale of 1.0 strongly agree, 2.0 agree, 3.0 neutral, 4.0 disagree, 5.0 strongly disagree. Face validity of the questionnaire was performed to ensure the relevance of content and interpretation by discussing with experienced faculty members of Kampala International University.

A Pearson's correlation analysis was made, comprising the generation of correlation between role of ICT adoption, growth and development, factors hindering the adoption of ICT and growth and development of Sme's in Ilala district. SPSSv16.0 software was used to generate the Pearson's correlation. Cronbach's Alpha was used to test the internal reliability of the questionnaire and it produced a result of 0.749, which show that the instrument used was reliable.

*Table 3. Marital status of the SME'S operators*

Marital Status					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Married	34	41.5	41.5	41.5
	unmarried/divorced	48	58.5	58.5	100.0
	Total	82	100.0	100.0	

*Table 4. Education level/qualification*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	postgraduate	16	19.5	19.5	19.5
	undergraduate	51	62.2	62.2	81.7
	others	15	18.3	18.3	100.0
	Total	82	100.0	100.0	



## **ANALYSIS**

The simple percentage, mean, standard deviation, Pearson’s correlation analysis were used to conduct the various analysis of the study. Descriptive statistics like frequencies, percentages, mean and standard deviation were used to elicit information on the demographic profile of the respondents. The Pearson’s correlation was used to evaluate role of ICT adoption in the SME growth and development and assess the factors hindering ICT adoption on SMEs and growth and development.

*Table 5. How long have you been in business*

		<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
Valid	less than 5 years	23	28.0	28.0	28.0
	5-8 years	50	61.0	61.0	89.0
	8 years and above	9	11.0	11.0	100.0
	Total	82	100.0	100.0	

*Table 6. How many times in a day do you use an ICT device in your business*

		<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
Valid	less than 1 hour a day	8	9.8	9.8	9.8
	2-7 hours a day	42	51.2	51.2	61.0
	8-24 hours a day	32	39.0	39.0	100.0
	Total	82	100.0	100.0	

*Table 7. Likent scale and its interpretation*

<b>Scale</b>	<b>interpretation</b>
4.45 - 5.0	strongly disagree
3.45 - 4.44	disagree
2.45 - 3.44	neutral
1.45 - 2.44	agree
0.5 - 1.44	strongly agree

*Table 8. Role of ICT adoption, growth and development of SMS'S*

<b>Role of ICT adoption, growth and development of SMS'S</b>	<b>N</b>	<b>Mean</b>	<b>Inferences</b>	<b>Std. Deviation</b>
adoption of ICT products facilities accurate records	82	1.7195	Agree	.45200
adoption of ICT facilities is convenient during business hour	82	1.8049	Agree	.57604
Adoption of ICT Enhances Prompt and fair attention for customers	82	2.0000	Agree	.52116
Adoption of ICT Enhances Faster Services to the customers	82	1.7561	Agree	.61986
Ability to Access Accounts at any Location is convenient	82	1.9390	Agree	.63533
Ability to Access Account at any Point in Time is prompt	82	1.8171	Agree	.44799
Adoption of ICT hastens Funds Transfer	82	1.7683	Agree	.90675
Adoption of ICT Makes International Market accessible	82	1.7195	Agree	.93326
Adoption of ICT improves Interpersonal Relationships	82	1.4878	Agree	.63331
Adoption of ICT makes Communication Easy	82	1.4878	Agree	.94600
Internet services availability hence there is sufficient bandwidth resulting in fast internet access up to 24 hours of the day, and use of free internet bundles from telecommunication companies like tigo	82	2.2439	Agree	.83977
Computer network services has played an important role in the rapid advancements networking services and consistent computer network services	82	2.3780	Agree	.93809
Improve customer service because the use of computerized systems and use of social medias for advertisement e.g whatsapp, Facebook etc.	82	1.6220	Agree	.73098
Computer hardware equipment and software services used to support business services are upgraded, and also supported by the equipment's like smart phone, tablets etc	82	1.4512	Agree	.50068
Increased ability to compete – competitive advantage	82	1.5732	Agree	.58858
Online sme's services are widely accessed by mobile banking services, and availability of Atm and banking services in most place	82	1.9146	Agree	.39130
Change in technology / current trend has changed the way business are done	82	1.9634	Agree	.71051
There are many Perceived benefits in the adoption of ICT.	82	1.5244	Agree	.57145
Reduce Cost and Time of service delivery to customers	82	1.6707	Agree	.86145
Nature of Business and how ICT can be integrated	82	2.0488	Agree	.76823
Demand by customers and other businesses to adopt the ICT services	82	1.6341	Agree	.97515

## **DISCUSSION OF THE RESULTS**

From the Table 3 above it shows that 41.5% operates of the sme's in ilala district are married and 58.5% are either unmarried / divorced. Hence that indicates that more unmarried / divorced operate the sme's in ilala district.

From table 4 show that most operators are the undergraduate lie certificate, diploma and bachelors' holders which comprises of 62.2% of the respondents. 19.5% postgraduate lie PhD, MPhil, postgraduate diploma and masters, others for example form four, form six and un educated also consists of 18.3% of the respondents.

**Impact of ICT Adoption on Small and Medium Enterprises in Ilala District, Dar Es Salaam, Tanzania**

From table 5 it indicate that 61.0% have been operating the sme’s business for a period between 5-8 years,28.0% they have been in business less than 5 years and 11.0% more than 8 year and above.

From table 6 shows that 51.2% use the ICT device between 2-7 hours a day, 39.0% use these devices 8-24 hours a day and 9.8% less than 1 hour a day, which is very low since ilala is a 24 hour economy.

According to the descriptive statistics table 7 Computer network services has played an important role in the rapid advancements networking services and consistent computer network services has the high mean of 2.3780 with the standard deviation of .93809 which indicates that most respondents 64.4% agree that computer networks have played an important in the adoption of ICT in the sme’s. Arendt (2008) confirms that cost of ICT equipment and networks, software, and re-organisation are barriers to ICT adoption in most SMEs.

Internet services availability hence there is sufficient bandwidth resulting in fast internet access up to 24 hours of the day, and use of free internet bundles from telecommunication companies like tigo which stimulates the growth and development of the SME’S has the mean of 2.2439 the second highest mean and the standard deviation of 0.83977 that is 64.6% of the respondents agree that the availability of internet plays a role in the adoption of ICT.

Hanna (2010) Internet based technologies provide small firms the Opportunity to effectively overcome the limitations of size and compete and/or in larger markets

*Table 9. Factors hindering the adoption and growth and development of SMEs*

Factors hindering the adoption and growth and development of sme’s	N	Mean	Inference	Std. Deviation
Many client need for face-to-face interaction	82	1.9268	Agree	.69886
The SMEs operators they concern about security issues and the privacy of data	82	1.9146	Agree	.54888
Most of our customers do not use the technology	82	2.1951	Agree	.80797
Most of our customers cannot do using e-commerce facilities	82	2.0122	Agree	.83878
Costs of implementing an e-commerce site	82	1.9634	Agree	.67486
Making needed organizational changes	82	2.0610	Agree	.55216
Level of ability to use the Internet as part of business strategy	82	1.9268	Agree	.78222
Business laws do not support e-commerce	82	2.4268	Agree	1.01872
Inadequate legal protection for Internet purchase	82	2.2439	Agree	.82494
Influence of ICT on Time Saving	82	2.8171	Neutral	.84806
Influence of ICT Devices on Error Rate Reduction	82	2.5976	Neutral	.84415
Lack/poor infrastructure of ICT support	82	2.6098	Neutral	.91295
Lack of confidence in security framework and cybercrimes	82	2.7439	Neutral	.81363

with bigger sized establishments. There is some evidence to suggest that the Internet has increased international opportunities for SMEs.

Mutula & Van Brakel (2006) noted that ICTs, especially the internet, have a significant impact on the operations of SMEs by facilitating their access to global markets, enabling them to sell to international customers, and to compete favourably with large corporations. Strategic use of ICTs is viewed as near solutions to firm's problems e.g. ICT has the potential to reduce the impacts of distance, reduce transaction costs, be used in information gathering and dissemination, inventory control, and quality control. ICT can enable SMEs to participate in the regional and international markets which are strategic for competitiveness, growth and further development (Ramsey et. al., 2003).

According to descriptive statistics of table 9 lack of IT skills and technological knowhow among the employees in the sme's has highest mean of 2.81171 and the standard deviation of 0.84806 that is 71.9% of the respondents agree that it is factor that hinders the ict adoption. MacGregor et al. (2002) argued that some of the barriers to ICT adoption are unique to SMEs, low level of existing hardware technology, hence preference for traditional technologies such as normal telephone system or face to face interaction, lack of IT skills and technical knowledge amongst employees, lack of awareness about ICTs' business benefits, are the factors hindering the adoption and growth of ICT in the sme's.

Lack of confidence in the security framework and cybercrimes has the mean of 2.439 and the standard deviation 0.81363 that mean 57.7% respondents agree that it's a mojor factor that hinders the adoption and the use of ict, Walchzuch et al (2000) and Chitura et al (2008) also noted that confidence in the security framework, ICT use among business partners and adaptation of business processes (MacGregor et al., 2002) agrees that security concerns are among the barrier that hinder ICT adoption in the SME'S.

*Table 10. Assess the impact of ICT on Growth and development of SMEs*

Growth and development of SME'S	N	Mean	Inference	Std. Deviation
Increase profit from online sales and web marketing and globalization	82	1.9634	Agree	.57618
The ICT has played a role of Providing managers better access to information	82	1.7561	Agree	.43208
Improved communication within and outside the organization	82	1.4878	Agree	.54984
Improve service delivery to the customers	82	1.9024	Agree	.65940
The use of ICT has to better production planning systems	82	1.8049	Agree	.53146
Adoption of ICT has Improved Quality Control	82	1.9878	Agree	.61852
ICT adoption has improved productivity of the sme's	82	2.0488	Agree	.75199
ICT adoption has improved on customer needs	82	1.7805	Agree	.56709

Poor infrastructure of ict has the mean of 2.6098 and the standard deviation of 0.91295, which is 70.7% of the respondents agree. Mutula and Van Brakel (2006) in his research agree that point out that access to information is a problem in developing countries like Botswana and South Africa, due to a lack of ICT infrastructure. Ladokun I.O et al (2013) in their study the result indicates that infrastructure is one of the most factors that inhibit ICT adoption by SMEs in Nigeria

Table 10 shows that ICT adoption has improved productivity of the sme's with the mean of 2.0488 and the standard deviation of 0.75199 which indicates that the use of ICT has improved the Sme's. Ashrafi and Murtaza (2008) also agree with the assertion that information and communication technologies (ICT) have positive effect on firm performance in terms of productivity, profitability, Brynjolfsson and Hitt (2003) agrees that there is a substantial long-term productivity gain with the use of ICT in organizations. According to a study by Lymer (1997) it stresses that ICT implementation in the SMEs has the potential to reduce costs and increase productivity level.

*Table 11. Pearson's correlations*

		<b>T1</b>	<b>T2</b>	<b>T3</b>
T1	Pearson Correlation	1	.196	.231*
	Sig. (2-tailed)		.077	.037
	Sum of Squares and Cross-products	3269.492	403.047	298.163
	Covariance	40.364	4.976	3.681
	N	82	82	82
T2	Pearson Correlation	.196	1	.160
	Sig. (2-tailed)	.077		.151
	Sum of Squares and Cross-products	403.047	1291.941	129.644
	Covariance	4.976	15.950	1.601
	N	82	82	82
T3	Pearson Correlation	.231*	.160	1
	Sig. (2-tailed)	.037	.151	
	Sum of Squares and Cross-products	298.163	129.644	508.992
	Covariance	3.681	1.601	6.284
	N	82	82	82
*. Correlation is significant at the 0.05 level (2-tailed).				

T1=Role of ICT adoption, growth and development of SMS'S

T2=Factors hindering the adoption and growth and development of sme's

T3=Growth and development of SME'S

Improved service delivery to the customers has the mean of 1.9024 and the standard deviation of 0.65940 reveals that the respondents agree that ICT has promoted and facilitated the growth and development of the SME's. Sajuyigbe and Alabi (2012) also affirm that ICTs are being used to provide an effective means of organizational productivity and service delivery. According to Chau (1995), ICT enhances the production process in organizations as monitoring technologies could be used to reduce the number of supervisors required in the process.

It can be deduced from the Pearson's Correlations table 10, that the T1 and T3 Pearson's correlation coefficient( $r$ ) equals .231\*, indicating a strong relationship in terms of correlation.  $p < .037$  and indicates that the coefficient is significantly different from 0. We can conclude that there is correlation between T1 and T3. In particular, it seems that the more the use of computer network it stimulates the growth and development of the SME's ( $r = .231, p < .037$ ).

Also that the T1 and T2 Pearson's correlation coefficient( $r$ ) equals .196\*, indicating a strong relationship in terms of correlation.  $p < .077$  and indicates that the coefficient is significantly different from 0. We can conclude that there is correlation between T1 and T3. In particular, it seems that lack of IT skills and technological knowhow amongst the employees it strongly hinders the growth and development of the SME's ( $r = .196, p < .077$ ).

## **CONCLUSION**

The analysis results indicate that the usage of ICT in SME's business has helped to totally re-shape value chains, sharpen market intelligence, improve efficiency, reduce time-to-market and increase customer satisfaction. In addition, with the aid of technology, SMEs can now go global from day one, reaching overseas markets and talent pools instantly. The huge potential of ICT in the new economy still remains untapped in Ilala district. Despite the high potential of SMEs in contributing to Social-economic development, the sector continues to face binding constraints that limit their potential and growth. However still the SME's have some challenges like lack of infrastructure, lack of skilled human resource, security and government policies hence the use of ICT in SMEs should be more encouraged and this could involve improving technical and managerial skills, making appropriate e-commerce solutions for SMEs available, addressing the high cost of ownership of ICT equipment (European Commission, (b), 2008). Public policy makers are important for stimulating programs for SMEs and they should initiate relevant actions in order to motivate SMEs associations to run programs to increase e-business competency in member organizations (Eikebrokk T. R. and Olsen D. H., 2007).

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## Chapter 3

# The Effects of Digitalization on Entrepreneurial Innovation in Sub-Saharan Africa

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### **ABSTRACT**

*The objective of this study is to show the effects of digitalization on the innovative capability of companies in Sub-Saharan Africa. To meet this objective, the authors used the World Bank data (Enterprise Survey) on survey of service companies and manufacturing industries in 2016. Making use of a binary probit model and a recursive bivariate probit model, they found that digitization has a significant effect on business innovation in Sub-Saharan Africa. Specifically, they found that when a company has a website, its probability of introducing an innovation in to the market increases by 27% as compared to companies without a website. However, when a company has its own website, the probability to introduce an incremental innovation is 0.34 higher than radical innovation. Thus, they can recommend to entrepreneurs in Sub-Saharan Africa to invest not only in the digitalization of their companies but also and above all in research and development, which is a translational and inevitable determinant for radical innovation.*

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## **INTRODUCTION**

Innovation is recognized as a major force for economic development (Fagerberg, 1987). It mainly refers to the thorough and complete introduction new ideas into operations, also a change in an existing product or process can be considered an innovation (Ozgen et al., 2013). However, existing literature, the question of its measurement remains a major concern. Some authors prefer a measure based on inputs (expenditure and staff in research and development) and, others on the other hand a measure based on outputs (patent filings, publications...). Still, others prefer a measure based on activities (ability and efficiency of the company to use her resources to achieve set objectives).

By revisiting the data of the World Intellectual Property Organization (OAPI), we can see that for the year 2018, some Sub-Saharan African countries such as South Africa (58th/126), Mauritius (75th/126) and Kenya (78th/126) have made efforts in terms of innovation, but majority of countries in this zone occupy the lowest rankings in the world. These include Togo (125th/126), Burkina Faso (124th/126), Cote d'Ivoire (123th/126), Niger (122th/126) and Cameroon (111th/126).

According to Biatour and Kegels (2008), three factors are considered as the main determinants of innovation: research and development efforts, workforce skills and the spreading of new information and communication technologies. Regarding information and communication technologies, several researchers have mentioned that digitization has an effect on business innovation. The digitalization of the company is considered as an organizational transformation related to the development and integration of digital collaboration technologies into the individual and collective practices of companies (Dudezert, 2018). Digital transformation started at the beginning of the internet, when mail was replaced by emails, salons by web forums, stores by e-commerce sites.

According to Berger (2017), though some Sub-Saharan African countries are moving closer to developed countries in terms of the internet's contribution to gross domestic product (e.g. Senegal: 3.3; Kenya: 2.9), Africa significantly lags behind (this index is 1.1 for Africa, 1.9 for emerging countries and 3.7 for developed countries).

The theoretical analysis of the link between digitisation and business innovation was carried out by Schon (1967) in his "technology push" approach. This approach has made the main assumption that the internal development of technologies is the only source of innovation (Schon, 1967). In this regard, some authors consider that digitisation requires huge investments that can reduce efficiency gains and innovation in companies, but Bharadwaj (2000) shows that firms that make significant investments in information and communication technologies achieve higher levels of innovation as compared to other firms. This result can be explained by the fact that ideas that become innovations are generally implemented by information and

communication technology initiatives. Thus, reduced transaction costs, improved business processes, better coordination with suppliers and increased diversification resulting from the use of ICTs lead to efficiency gains that in turn will facilitate innovation (Koellinger, 2005). While it is therefore certain, firstly, that digitisation is a proven source of innovation, secondly, that the level of innovation is very low in Sub-Saharan Africa and, thirdly, that there is a very large digital divide between Sub-Saharan African countries and developed countries, it is worthy to ask if it is not this low level of digitisation that is responsible for the low level of innovation in Sub-Saharan Africa. Thus, the following research question deserves to be asked: what are the effects of digitalization on the innovative ability of companies in sub-Saharan Africa?

The objective of this study is to show the effects of digital transformation on the innovative capability of companies in Sub-Saharan Africa. Specifically, the aim is to highlight in the first place the effect of digitisation on the introduction of innovation and secondly the digitisation effect on the type of innovation introduced by Sub-Saharan African companies.

The remaining part of this work is organized as follows: Section 1 presents the literature review, Section 2 presents the methodology and finally Section 3 discusses the different results.

## **Literature Review**

On a theoretical level, the analysis of the link between digitisation and business innovation can be attributed to Schon's (1967) pioneering works. This author introduced the concepts of "demand-pull" and "technology push" to explain the determinants of innovation that are unique to the enterprise's environment. Depending on these approaches, innovation can be either demand led or technology led. According to the first approach, which presents innovation as demand-led, consumers' needs are at the origin of innovation. These needs can either be qualitative or quantitative. The qualitative aspect of demand refers to the evolution of consumers preferences while the quantitative aspect gives information on the intensity of demand. However, according to Schmookler (1966), demand plays a decisive role in the intensity and the path taken by the innovation activity in firms. The "Technology-Push" approach, on the other hand, is based on the assumption that the internal development of technologies is the unique source of innovation (Schon, 1967). Based on the neo-Schumpeterian literature, according to which the weight of these two approaches varies according to the life cycle of a company and the type of innovation being considered, Errabi (2009) affirms that these two approaches are complementary. Thus, in the first phase of the life cycle, the technology push can be very important

for significant advances in innovation, while the market push is more important for incremental innovations.

On the empirical level, several studies have linked digitalization and business performance. They mainly focused on the contribution of information and communication technologies to the company's productivity. However, through the use of digital technologies, companies can achieve optimal results through the optimal use of resources by reducing transaction costs, increasing employee productivity and optimizing supply chains (Coupette, 2015; Kagermann, 2015; Loebbecke and Picot, 2015). With globalization, the environment is becoming highly competitive, requiring companies to use ICTs to improve their efficiency and profitability and to offer products and services of high-quality to their customers (García-Olaverri et al., 2006).

Some researchers have focused on company performance but rather on innovation (for example: Cuevas-Vargas et al., 2016; Foerster-Metz et al., 2018). However, digitization facilitates the exchange of information between individuals and companies, and it also facilitates access to knowledge (Foerster-Metz et al., 2018). According to these authors, in companies that use digital technologies, communication and knowledge sharing are easier. In this regard, digitization increases the company's ability to establish external links (Idota et al., 2015), which can lead to new forms of cooperation between companies or to a change in relations with the customers and employees (Kiel et al., 2016), which will subsequently strengthen innovation activity (Idota et al., 2015). Digitization also facilitates the creation of new products and services as well as the diversity of products and services that were before operationally and economically unfeasible without this technology (Arvanitis and Loukis, 2015). Wagner and Boutellier (2002) note that companies are increasingly dependent on knowledge and technologies developed outside their frontiers and most of them have given particular attention to the use of digital technologies to advance the life cycle management systems of products or services (Berglund and Sandstrom, 2013; Urbinati et al., 2018). In this regard, the use of digital technologies has a positive influence on the creation of products and services (Kathan et al., 2016) and on marketing activities (Gbadegeshin, 2019). Information technology also facilitates business planning and encourages the development and implementation of production programmes (Huerta, 2002).

Morikawa (2004) found that Japanese SMEs using computers were more likely to engage in innovative activities than other firms. Also, Koellinger (2008), using a sample of European companies, found that e-commerce technologies enable companies to offer new products and services, improve production and marketing processes, briefly, they are facilitators of innovation. In another study by Arvanitis et al (2011) on a sample of 271 American companies, these authors found that ICTs had a significant positive impact on product and process innovation. To them, e-sales

have an impact on process innovation, while e-recruitment is not a driving force of innovation. Similarly, Spiezia (2011), in her research on service and manufacturing companies in OECD countries, found that ICTs facilitate innovation, particularly product and marketing innovations, in both service and industrial companies. On the other hand, Hempell and Zwick (2008) distinguishing between functional flexibility (workers' ability to cooperate and make decentralized decisions) and numerical flexibility (reduction of fixed costs) have shown that the use of ICT is associated with an increase in both types of flexibility but their implications for innovation activities differ. While functional flexibility is highly associated with product innovations, numerical flexibility reduces the capacity for innovation in the long run.

Finally, Cuevas-Vargas et al (2016) in their study show that information and communication technologies influence the growth of economies and facilitate innovation. They also found that innovation, like ICT, has a significant impact on business performance. Therefore, decision-makers should pay particular attention to how they manage ICT-related activities as they are a key element for the success of a company.

## **METHODOLOGY**

We will first present the data, then a statistical analysis of the different variables and finally present the econometric model.

### **Presentation of the Data**

This study is based on secondary data from the World Bank survey. Since the 1990s, a survey called a company survey has been conducted by units of the World Bank on a representative sample of the private sector in an economy. The surveys cover a wide range of issues related to the business environment, including access to finance, corruption, infrastructure, crime, competition and performance. The questionnaire is sent to company managers and senior executives, but sometimes the company's accountants and human resources managers are consulted during the interview. Generally, formal (registered) enterprises with 5 or more employees are targeted for an interview, but in some countries, informal (unregistered) enterprises and microenterprises are included in the sample. Since the survey units are manufacturing and service companies, 1,200 to 1,800 interviews are conducted in larger economies, 360 in medium-sized economies and 150 in smaller economies. The sampling methodology is stratified random sampling<sup>1</sup>. The strata for this survey are the size of the company, the sector of activity and the geographical region of the country.

Regarding this study, we selected the results of the survey conducted in 2016. The choice of 2016 is justified by the fact that it is the most recent year in which the survey was carried out on a large number of African countries. Of the countries involved in the 2016 survey, we have chosen to focus our analysis on 4 countries, namely Cameroon, Togo, Ivory Coast and Lesotho as these countries have almost similar economic characteristics.

## **Statistical Analysis of Variables**

Innovation has been measured at two levels: first, we look to see if the company has introduced something new or likewise improved on her main market and second, we look to see what kind of innovation the company has introduced if it has innovated. In our sample, only 33% of companies report having introduced an innovation in their main market and among these 35% report having introduced an incremental innovation compared to others who report 65% of a radical innovation. The digitization of the company in turn was captured by the use or not of a website. When we read Table 1 below, we see that the majority of companies (76.49%) in our sample do not have a website but most (65.97%) have an e-mail address. The proportion of companies using a website that have introduced an innovation is higher than that of companies using a website and have not introduced any innovation ( $0.3176 > 0.1955$ ). Similarly, the proportion of companies with a website that introduced radical innovation is higher than that of companies with a website and have introduced incremental innovation ( $0.3594 > 0.2457$ ).

## **Econometric Model**

The model draws inspiration from previous theoretical developments. Making reference to our problem, we can see that company  $i$  decision is at two levels. First, the company could make a decision between introducing an innovation (I) or not (N). Second, if it has chosen to innovate, it could innovate incrementally (In) or radically (Ir). Let  $U_{ij}$  be the maximum possible utility of the company  $i$  when it chooses one of the two alternatives  $j$  for each level. This function is decomposed into a deterministic and a stochastic component such that:

$$U_{ij} = X_i \beta_j + \varepsilon_{ij} \quad (1)$$

With  $X_i$  the vector of observable characteristics,  $\beta_j$  the vector of company's parameters when choosing the option  $j$  and  $\varepsilon_{ij}$  the error term. On the one hand, utility  $U_{i,I}$  is



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Table 1.

Variable	Description	Proportion (standard deviation)				
		All together	Introduction of innovation		Type of innovation	
			No innovation	innovation	Incremental innovation	Radical innovation
Website	0 the company has no website 1 the company uses a website	0,7649(0,0133) 0,2350(0,0133)	0,8044(0,0153) 0,1955(0,0153)	0,6823(0,0252) 0,3176(0,0252)	0,7542(0,0398) 0,2457(0,0398)	0,6405(0,0326) 0,3594(0,0326)
Age of company	0 up to 5 years 1 between 6 and 10 years 2 more than 10 years	0,0614(0,0076) 0,1875(0,0123) 0,7510(0,0137)	0,0652(0,0096) 0,1836(0,0150) 0,7511(0,7511)	0,0547(0,0125) 0,1914(0,0217) 0,7537(0,0237)	0,0535(0,0213) 0,1607(0,0348) 0,7857(0,0389)	0,0518(0,0152) 0,2122(0,2815) 0,7358(0,0303)
Number of sites	0 a single site 1 several said	0,7397(0,0137) 0,2602(0,0137)	0,7674(0,0162) 0,2325(0,0162)	0,6852(0,0252) 0,3147(0,0252)	0,6864(0,0428) 0,3135(0,0428)	0,6912(0,0314) 0,3087(0,0314)
Legal form	0 soleproprietorship 1 general partnership/ simple sponsorship 2 limited liability companies	0,5698(0,0155) 0,0723(0,0081) 0,3577(0,0150)	0,5907(0,0190) 0,0899(0,0110) 0,3193(0,0180)	0,5283(0,0273) 0,0328(0,0097) 0,4388(0,0271)	0,5299(0,0466) 0,0341(0,0168) 0,4358(0,0460)	0,5258(0,0342) 0,0328(0,0122) 0,4413(0,0341)
Manager's experience	0 up to 5 years Between 6 and 10 years More than 10 years	0,0913(0,0092) 0,1991(0,0128) 0,7094(0,0145)	0,0978(0,0117) 0,2096(0,0160) 0,6925(0,0181)	0,0771(0,0148) 0,1759(0,0211) 0,7469(0,0241)	0,0917(0,0277) 0,1559(0,0349) 0,7522(0,0415)	0,0714(0,0178) 0,1857(0,0268) 0,7428(0,0302)
Main market	0 local 1 national 2 international	0,4357(0,0278) 0,3699(0,0270) 0,1943(0,0221)	0,4537(0,0339) 0,3796(0,0330) 0,1666(0,0254)	0,4100(0,0494) 0,3500(0,0479) 0,2400(0,0429)	0,3428(0,0814) 0,3142(0,0796) 0,3428(0,0814)	0,4444(0,0631) 0,3650(0,0611) 0,1904(0,0498)
R&D	0 no investment in R&D 1 investment in R&D	0,8954(0,0096) 0,1045(0,0096)	0,9310(0,0098) 0,0689(0,0098)	0,8222(0,0210) 0,1777(0,0210)	0,8230(0,0306) 0,1769(0,0360)	0,8224(0,0261) 0,1775(0,0261)
Source of funding	0 Shareholders' equity 1 external financing	0,7394(0,0141) 0,2605(0,0141)	0,7762(0,0163) 0,2237(0,0163)	0,6624(0,0267) 0,3375(0,0267)	0,6605(0,0455) 0,3394(0,0455)	0,6567(0,0335) 0,3432(0,0335)
Size of the company	0 less than 10 employees 1 Between 10 and 100 employees 2 more than 100 employees	0,3994(0,0154) 0,4820(0,0157) 0,1185(0,0102)	0,4147(0,0191) 0,4856(0,0194) 0,0995(0,0116)	0,3712(0,0264) 0,4760(0,0273) 0,1526(0,0197)	0,3135(0,0428) 0,5254(0,0461) 0,1610(0,0339)	0,3981(0,0337) 0,4502(0,0343) 0,1516(0,0247)
Annual turnover	0 less than 15 million 1 between 15 million and 100 million 2 More than a 100 million	0,3423(0,0156) 0,2948(0,0149) 0,3628(0,0158)	0,3898(0,0197) 0,3017(0,0185) 0,3083(0,0186)	0,2402(0,0238) 0,2824(0,0256) 0,4772(0,0285)	0,2718(0,4405) 0,2621(0,0435) 0,4660(0,0493)	0,2139(0,0289) 0,2985(0,0323) 0,4875(0,0353)
Gender of the leader	0 female 1 male sex	0,1625(0,0115) 0,8374(0,0115)	0,1691(0,0144) 0,8308(0,0144)	0,1500(0,0193) 0,8500(0,0193)	0,1355(0,0316) 0,8644(0,0316)	0,1566(0,0247) 0,8433(0,2473)

Source: Authors computation on World Bank data

the utility of the decision to innovate and  $U_{i,N}$  utility of the decision not to innovate. On the other hand, utility  $U_{i,In}$  is the utility of the decision to innovate incrementally and  $U_{i,Ir}$  utility of the decision to innovate radically.

The utility of this choice is not observable, what is observable is rather the choice  $Y_i$  as it is.

$$y_{1i} = \begin{cases} 1 & \text{if the enterprise has innovated} \\ 0 & \text{otherwise} \end{cases} \quad (2)$$

$$y_{2i} = \begin{cases} 1 & \text{if the enterprise has radically innovated} \\ 0 & \text{otherwise} \end{cases} \quad (3)$$

This decision is made by comparing these two utilities. Consider the latent variables  $y_{1,i}^*$  and  $y_{2,i}^*$  as equal to the difference between the utility provided by the decisions I and N on the one hand and the decisions In and Ir on the other hand:

$$y_{1,i}^* = U_{i,I} - U_{i,N} \quad \text{and} \quad y_{2,i}^* = U_{i,Ir} - U_{i,In} \quad (4)$$

$$\begin{cases} \text{the enterprise has innovated if } y_{1,i}^* > 0 \\ \text{otherwise } y_{1,i}^* \leq 0 \end{cases} \quad \text{et} \quad \begin{cases} \text{the enterprise has radically innovated if } y_{2,i}^* > 0 \\ \text{otherwise } y_{2,i}^* \leq 0 \end{cases} \quad (5)$$

In this case, the binary Probit model is used. It should be noted that the probit regression uses the maximum likelihood method to estimate the parameters of the model. To achieve the results, the following equations are estimated.

$$Innov_i = \beta X_i + \varepsilon_i \quad \text{and} \quad Typin_i = \beta' X_i + \varepsilon'_i \quad (6)$$

With  $Innov_i$ , innovation,  $Typin_i$ , the type of innovation,  $\beta$  and  $\beta'$  the vectors of the parameters,  $\varepsilon$  and  $\varepsilon'$  the error terms,  $X$  and  $X'$  the vectors of observable characteristics. Among these observable characteristics, and in addition to having the variable related to digitization, we also have a set of control variables. These variables can be grouped into three categories: characteristics that are unique to the company (its age, size, turnover, legal form, number of sites on which it operates and investment in research and development), characteristics that are specific to the

entrepreneur or manager (experience and gender) and characteristics that are peculiar to the company's environment (the company's main market and source of financing).

As Biatour and Kegels (2008) affirm, investment in research and development is the traditional determinant of innovation. Hence, it must be included in our model. The size of the company, its turnover and the number of sites on which it operates are included in the model in order to strengthen Schumpeter's (1942) idea that large companies are better placed to develop and exploit new technologies through greater availability of resources and greater ability to take advantage of economies of scale. According to Higon (2012), the age of the company must be included in the model because years of accumulated experience can reflect the effects of learning by doing. Legal status can also be included in the model because family and non-family enterprises (Gudmundson et al., 2003), and private and public enterprises (Ayygari et al., 2007) differ in terms of innovation.

According to Higon (2012), years of experience can be used to justify the introduction of the manager's or manager's experience into the model. The gender of the entrepreneur or manager can also be included in the model even if Sonfield et al (2001) introduced it into their own model and found no gender disparity in the adoption of innovation.

The source of financing is included in the model to verify the idea of Sadowski and Sadowski-Rasters (2006) that foreign-owned companies are more likely to introduce new products and production processes. Referring to Lachenmaie and Wobmann's (2006) idea that exportation will expand the company's geographical network and connect it to a richer source of knowledge, skills and technologies not available on the domestic market, the company's main market can be included in the model.

However, simple probit models remain limited in that they do not take into account the interdependence between digitization and the introduction of innovation on the one hand and between digitization and the type of innovation introduced on the other. To consider this interdependence, the recursive bivariate probit model has been used. This model makes it possible not only to take into account the interdependence between the dependent variable and the variable of interest, but also to take into account that digitization is not random, and that it depends on certain unobserved characteristics. Let us consider  $y_{1i}^*$ , and  $y_{2i}^*$ ,  $y_{3i}^*$  as the latent variable for digitization, the introduction of innovation and the type of innovation introduced respectively. That is:

$$\begin{cases} y_{1i}^* = x_{1i}\alpha + \gamma\pi + \varepsilon_{1i} \\ y_{2i}^* = x_{2i}\beta + y_{1i}^*\lambda + \varepsilon_{2i} \end{cases} \quad \text{and} \quad y_{3i}^* = x_{3i}\delta + y_{1i}^*\lambda + \varepsilon_{3i} \quad (7)$$

The error terms  $\varepsilon_{1i}$ ,  $\varepsilon_{2i}$  and  $\varepsilon_{3i}$ , are such that with  $\text{cov}(\varepsilon_{1i}, \varepsilon_{2i}) = \rho$  and  $\text{cov}(\varepsilon_{1i}, \varepsilon_{3i}) = v$   $\rho \neq 0$  and  $v \neq 0$ .  $\pi$  refers to all the instrumental variables that are correlated to digitization but may not be correlated to the introduction of innovation or the type of innovation. We can cite investment in research and development and the company's main market. On the one hand, we believe that a company with international presence is obliged to use digital technology to better communicate with its external partners. Similarly, with the advent of the digital economy, a company cannot carry out good research and development without integrating digital technology.

## **Results**

From Table 2 below, we can see from the binary probit that the model explains nearly 23% of the variability of digitization in relation to the introduction of innovation. Similarly, at the level of Table 3 for binary probit, the model explains 26% of the variability of the digital transformation on the type of innovation introduced.

We can also see that the coefficient of the variable symbolizing the digitalization (website) of the company is significant not only at the introduction of innovation but also at the type of innovation introduced by the company. The probability that a company that uses its website will innovate increases by 0.12 compared to a company that does not have a website. Similarly, if one compares a company without a website to one with a website, then the probability of the latter introducing a radical innovation into its main market increases by 25%. Thus, the use of a website facilitates the innovation of a company in Sub-Saharan Africa. This result could be justified by the fact that the website is a social network of the company that facilitates the transfer of useful information and knowledge for innovation. Although digitization is considered to require huge investments that can reduce efficiency gains and innovation for companies, our result is in line with the results of the majority of authors in the existing literature.

Apart from digitization, investment in research and development plays a significant role in the introduction of innovation by the company. However, the probability that a company that has made investments in research and development will introduce an innovation to the market increases by 19% compared to a company that has not invested in research and development. However, investment in research and development facilitates a company's innovation. This result is consistent with that of Crepon et al (1998), which reveal that regardless of the size of the company, the intensity of research and development has a positive effect on the probability of introducing an innovation, with a higher probability for product innovation than for process innovation. However, problems of information asymmetry between companies

and financial intermediaries in the financing of research and development can hinder innovation in the latter as a result of credit constraints (Evans and Jovanovic, 1989).

The size of the company also significantly influences its innovation. However, the probability that a company employing between ten and one hundred individuals will introduce an innovation into the market falls by 14% compared to a company employing less than ten individuals. Similarly, if one compares a company that employs fewer than ten individuals to a company that employs between ten and one hundred individuals to a company that employs more than one hundred individuals, then the probability of the latter introducing a radical innovation into the market drops by 38% and 28% respectively. The size of the company is not only a hindrance to the introduction of innovation on the market but also and above all a hindrance to the introduction of radical innovation. This result, though contrary to Schumpeter's (1939) idea that large firms are more likely to innovate than small firms, is consistent with Cooper's (1965) idea that in large firms, the level of bureaucracy is high, creating a less comfortable environment for creative contributions from its employees.

The experience of the company's promoter (or manager) also plays a significant role in the company's innovation. However, the probability that a business owner with six to ten years of experience will introduce an innovation in the market decreases by 24% compared to the business owner with at most five years of experience. However, the more the entrepreneur's experience increases, the more difficult it is for the company to innovate. This is contrary to the popular understanding that from professional experience, an individual can develop motivations that reflect his or her personal qualities that give him or her the willingness to introduce an innovation. One of the reasons for this ambiguous result is the existence of specific characteristics of the company that can determine its ability to innovate. But it was also mentioned that younger and therefore less experienced entrepreneurs (or managers) behave in a more proactive, flexible and aggressive way. In this regard, it is normal that lack of experience should be an obstacle to innovation.

The last two significant variables here are the number of sites on which the company operates and the legal status of the company. That is, when a company that initially operated on a single site multiplies its activities to operate on several sites, then the probability that it will introduce an innovation into its main market increases by 24%. However, the more the company's number of sites increases, the more she innovates. Regarding the legal status of the company, we note that when a company changes from a sole proprietorship to general partnership or limited partnership, the probability to introduce an innovation into the market decreases by 15%. However, though not significant, the sign attributed to the limited liability company (LLCs) or public limited company category is positive, which suggests that limited liability companies and public limited companies innovate more than individual companies. This can be justified by the fact that, LLCs and incorporated

companies (ICs) have an accumulated stock of technological knowledge and their advanced skills in large-scale research and development projects and their high access to resources facilitate their innovation compared to individual companies.

As mentioned above, the digitalization of the company depends on several unobservable factors. This is the company's main market and investment in research and development. If these variables are omitted in the explanation of digitization, this could lead to endogeneity bias. The use of the bivariate probit model should be used to solve this endogeneity problem.

We see that the main market and investment in research and development are strong instruments. They explain at least 5% of the company's tendency towards digitalization. In Table 2, we find that the probability of introducing an innovation into the market increases by 27% for a company with a website compared to a company without a website. Its effect in the recursive bivariate probit model is higher than in the binary probit model. However, ignoring unobserved variables underestimated the company's potential to introduce an innovation into the market. In Table 3, we find that when a company has its own website, the probability to introduce an incremental innovation is 0.34 higher than radical innovation. Its effect in the recursive bivariate probit model is however lower than in the binary probit model. However, ignoring unobserved variables instead overestimated the effect of digitization on the introduction of radical innovation. We can say that digitisation is more important for incremental innovation than for radical innovation. The latter (radical innovation) is determined more by factors such as investment in research and development than by digitalization.

## **CONCLUSION**

The purpose of this work was to analyse the influence of digitization on the innovation capacity of companies in Sub-Saharan Africa. Even if in the majority of cases the authors seem to share the same opinion on the positive effect of digital transformation on the innovation potential of companies, there are still some contradictory ideas that digitalization requires huge investments that can reduce efficiency gains and innovation in companies. To verify this relationship in Sub-Saharan Africa, we used data from the World Bank (Enterprise Survey) from a survey of service companies and manufacturing industries in 2016. We used the binary probit model and a recursive bivariate probit model. In this light, we found that the digitalization of the company through the creation of a website has a significant effect on innovation in Sub-Saharan Africa. Particularly, we found that when a company has a website, its probability of introducing an innovation to the market increases by 27% compared to companies without a website. However, when a company has its own website,

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*Table 2. Effect of variables on the introduction of innovation*

Variable	Binary probit	Recursive bivariate probit	
	Introduction of innov	Introduction of innov	Website
<b>Website</b> Has no a website has a website	Ref 0,1219(0,0629)*	Ref 0,2707***	
<b>Age of the company</b> up to 5 years between 6 and 10 years more than 10 years	Ref 0,0907(0,1223) -0,0449(0,1039)	Ref 0,0946 -0,0516	
<b>Number of sites</b> a single location several locations	Ref 0,2408(0,0673)***	Ref 0,2707	
<b>Legal form</b> sole proprietorship limited/general partnership Ltd/Plc	Ref -0,1589(0,0708)** 0,1156(0,0750)	Ref -0,1839* 0,1196	
<b>Manager experience</b> within 5 years between 6 and 10 years more than 10 years	Ref -0,2428(0,0967)** -0,0732(0,0941)	Ref -0,2460*** 0,0840	
<b>Main market</b> local national international	Ref -0,0290(0,0582) -0,0061(0,0754)	Ref -0,0593 -0,1028	Ref 0,3078(0,0896) 0,3094(0,0849)***
<b>Investment in R&amp;D</b> no investment investment	Ref 0,1926(0,0643)***	Ref 0,1200***	Ref 0,3094(0,0849)***
<b>Source of funding</b> equity capital external financing	Ref 0,0636(0,0574)	Ref 0,0778	
<b>Size of the company</b> less than 10 employees Between 10 and one 100 employees more than 100 employees	Ref -0,1485(0,0648)** -0,1275(0,0828)	Ref -0,1657* -0,1252	
<b>Annual turnover</b> less than 15 million between 15 million and 100 million More than a 100 million	Ref 0,0278(0,0702) 0,1672(0,0951)	Ref 0,0411 0,1872*	
<b>Gender of the leader</b> female male	Ref -0,0184(0,0773)	Ref -0,0178	
	Prob>chi2=0.0000 Pseudo R2=0.2341	Prob > chi2 = 0.0000 Atrrho = -0.7430(1.0344)	

*The Effects of Digitalization on Entrepreneurial Innovation in Sub-Saharan Africa*

*Table 3. Effect of variables on the type of innovation introduced*

Variable	Binary probit	Recursive bivariate probit	
	Type of innovation	Type of innovation	Website
<b>Website</b> Has no website Has a website	Ref 0,2532(0,021)***	Ref -0,3421***	
<b>Age of the company</b> up to 5 years between 6 and 10 years more than 10 years	Ref 0,1533(0,1742) 0,0023(0,1744)	Ref 0,1736 0,0175	
<b>Number of sites</b> a single location several locations	Ref 0,1021(0,0893)	Ref 0,0445	
<b>Legal form</b> sole proprietorship limited/general partnership Ltd/Plc	Ref -0,5857(0,1388)*** -0,0271(0,1156)	Ref -0,5696** -0,0719	
<b>Manager experience</b> within 5 years between 6 and 10 years more than 10 years	Ref -0,3055(0,2312) -0,1364(0,1089)	Ref -0,2712 -0,1149	
<b>Main market</b> local national international	Ref 0,0685(0,0868) -0,1304(0,1276)	Ref 0,0922 0,09467	Ref 0,1121(0,1337) 0,4024(0,1191)***
<b>Investment in R&amp;D</b> no investment investment	Ref -0,0381(0,0955)	Ref 0,1313**	Ref 0,2729(0,1172)**
<b>Source of funding</b> equity capital external financing	Ref -0,1110(0,0862)	Ref -0,1011	
<b>Size of the company</b> less than 10 employees Between 10 and 100 employees more than 100 employees	Ref -0,3806(0,0836)*** -0,2883(0,1069)**	Ref -0,5130** -0,5354**	
<b>Annual turnover</b> less than 15 million between 15 million and 100 million More than a 100 million	Ref 0,4351(0,1727) 0,2055(0,1927)	Ref 0,3761** 0,2641	
<b>Gender of the leader</b> female male	Ref -0,1073(0,2155)	Ref -0,1062	
	Prob>chi2=0.1126 Pseudo R2=0.2550	Prob > chi2 = 0.0000 Atrrho = 14.2801(2.5029)	



the probability to introduce an incremental innovation is 0.34 higher than radical innovation. Thus, we can recommend to entrepreneurs in Sub-Saharan Africa to invest not only in the digitalization of their companies but also and above all in research and development, which is a translational and essential determinant for radical innovation.

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## **ENDNOTE**

- <sup>1</sup> In a simple random sampling, all members of the population have the same probability of being selected and no weighting of observations is required. In a stratified random sampling, all units of the population are grouped into homogeneous groups and simple random samples are selected from each group. This method allows estimates to be calculated for each stratum with a specified level of precision, while population estimates can also be estimated by correctly weighting individual observations.

# Chapter 4

## Educational Entrepreneurship: The Urgent Need for Sustainability in Education

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### **ABSTRACT**

*From its onset, education has had an integral role in transforming society to become what it is. In fact, developments in society, especially in terms of human capital, have resulted from the nature of education its members have received. In the past two decades, owing to several factors, society has seen a stark transformation in economics and commerce. A major part of this development has offset the sync between education and practice, such that the earlier has fallen behind the latter. The question of institutions producing employable graduates is on the rise as educational institutions fall back in their ability to do so. Harnessing developments and latest advances in technology to carve out efficient human capital could give education a surviving chance.*

### **INTRODUCTION**

Traditionally, education has always been a knowledge imparting process where learners absorb what teachers have acquired through experience. In such a system, almost always, the teacher is assumed to be the one who knows it all, and knowledge imparted was limited to the teacher's experience. This premise was consistent until the introduction of the internet. With the rise of the internet, knowledge became decentralized, such that it was now at the disposal of learners. Resulting from these

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transformations, the role of teachers and learners also required rethinking. Today, the premise of the teacher being the ‘sage on the stage’ needs to be debunked. Sadly, a vast population of educators still holds on to the traditional framework which does not allow empowering learners to be self-motivated and driven. The way education is delivered needs rethinking, especially, given the recent trends in the teaching and learning processes and the accountability of the education sector towards global needs.

United Nations Educational, Scientific and Cultural Organization (UNESCO) advocating sustainable education, contended the integration of critical issues such as climate change, biodiversity, disaster risk reduction and sustainable consumption and production into the curriculum. Given the rise in global catastrophe, there immediately arises the question of what can we do to save the planet. Truth is, if the education system at large cannot bring this change, who will? It seems like the adaptation of the education systems to become centers that generate solutions to problems in practice, is the way forward. The need for entrepreneurial strategies to innovate and create newer ways to make this adaptation possible has never been more urgent today than it has ever been. Innovative strategies to craft out education making it not only accessible but versatile without compromising its original goal—creating employable citizens—and maintaining quality at the same time is the need of the hour. Education needs to be tailored to promote competencies that are suitable across professions—critical and system thinking, collaboration, efficient decision-making, a sense of responsibility for the current and future generations.

## **Sustainability in Education**

The world we live in is an interconnected system of ecological, social, psychological and economic elements. As opposed to the way we treat it, it is very much complex and finite, and a lack of this recognition has led to global crises we face today. A way to turn this around would very much lie in the ability to transform from a dominant mechanical worldview to an emerging ecological worldview (Kuzich, 2011). This would allow a more holistic view of the world as integrated ecosystems which would require collaboration and interaction of various stakeholders for its sustenance—an urgent response to current global problems. Off course, education is an efficient vehicle to usher in this change which can be done by tapping into the resources that the education sector presents by default—learning. The learning that takes place in academic environments is the resource when renewed allows for sustainability.

In essence, the learning modules that teachers design sets off the energy of learning that students have. When this is created for life, then the energy becomes renewable. On the contrary, when learning is presented as an end in itself, then a degree/diploma is treated as an end, rather than a beginning of a new energy to be

passed on. Consequently, the energy is depleted rather than renewed. In order to renew this energy learning must be imparted in a way that permits its recreation and extension. Consequently, academic experiences must be filled with opportunities for creativity and innovation which is unlikely if education is not participatory in nature. Sustainability of education would therefore, depend much on the ability of the learning communities to adopt the mind-set of knowledge generation rather than knowledge consumption.

## **Educational Entrepreneurship**

The term *educational entrepreneurship* in this chapter has been used to indicate entrepreneurial initiatives within the education sector. It may be worthwhile to point out that there is limited literature pointing to this concept using the same terminology. What has been mostly addressed in literature is the education of entrepreneurs, largely referred to as entrepreneurship education. A great deal of national effort has gone into preparing students with entrepreneurial skills in countries such as Norway, Denmark, and Sweden ...etc. (Vestergaard, 2015). However, a focused effort of entrepreneurial training in teacher education may yield benefits for the education sector at large.

Attempting to define entrepreneurship Kim and Petersen (2006) refer to it as using available resources to solve problems, consequently, adding value to society. Simply put, it is the effort made to constantly be seeking solutions to problems, thereby, creating better processes and making a profit. Another perspective suggests that a desire of creating wealth and adding value to society is what drives an individual to think different, making them entrepreneurs (Kao, 1993). It is apparent that there is consensus in novelty being an integral aspect of entrepreneurship.

Given that the education sector prepares the workforce as per the need of industries, it is appropriate that it undergoes changes to stay abreast the changing work environments. Change, although essential, is packed with a host of challenges that often render it uninviting (Dagget, 2014). The need for such change has created a vacuum that can possibly be filled only by rethinking the educational process. An approach to rethinking education is to adopt the disruptive thinking perspective. Adding to the literature on innovation, Chirstensen and Raynor (2003) proposed the idea of disruptive innovation. They suggested that disruptive innovation challenges traditional thinking to give new ideas an opportunity to take over new markets (Feder, 2017). By extension, this view will give the education sector means to carve out new processes, allowing entrepreneurship to take form. Technological advances have come a long way in providing a significant shift in the way industries function today thereby, paving the way for disruptive thinking.



## **Technology Integrated Education**

Several technological advances can be employed to make education more efficient. It must be borne in mind though that technology integration has more to do with enhancing the delivery of content more than the technology itself (Harris & Hofer, 2011). For instance, technology has allowed the incorporation of multimodality in course offerings. The use of content management systems, online platforms for interaction, knowledge management systems, blockchain technology are few examples that have significant potential in creating sustainable education that can help empower learners and encourage them to be independent thinkers making valuable contributions to society. Change, as hard as it is, is equally essential to remain relevant in today's work environments. Leadership has a tremendous responsibility to re-think evaluation and assessment such that learners are of top priority. Once this model is accepted and propagated, then, guided by institutional mission and vision, suitable strategies may be employed to successfully bridge contemporary theory and advanced practice.

Although there has been a strong push from advocates of technology integrated education to adopt various models of technology-aided teaching and learning, it has not been fully realized. A major cause for such a failure is the mindless introduction of technology in the education process (Mishra & Koehler, 2006). It is vital to the success of this integration that the right knowledge of the content and an accurate awareness of student needs be coupled with the appropriate technology tools (Issroff & Scalon, 2002). The long standing debate on the benefits of technology use in education has left many educational leaders skeptical about the case. Nonetheless, there has been a gradual shift from whether or not to use it, to how to make the best use of available tools to making the learning experience richer and relevant to knowledge creation (Higgins, 2012). Efforts must, therefore, be directed towards thoughtful pedagogical use of technology theorized as Technological Pedagogical Content Knowledge (TPCK)—the interaction of content, pedagogy and technology (Mishra & Koehler, 2006). Despite the scowl of many educators, technology has permeated the industry giving it a surviving chance. Education is not new to cutting edge technology, in fact, it has already begun to take new form. Owing to these changes, education is becoming more accessible and current which is the good news. However, it could be more widespread if the possibilities were discussed and eventually accepted.

## **Technology Trends in Education**

Without a doubt, technology has changed the face of most, if not all industries. Trends in the education industries are largely a result of technological influence.

Some of these influences have required a redefinition of the role of both educators and learners, and consequently on the pedagogical rationale (Cloete, 2017). Some of these trends are discussed in subsequent sections.

***Knowledge Management Systems.*** Building on the premise that knowledge is the most valuable resource of an organization, its management is vital to success. Knowledge would then need to be created, stored, disseminated and used in order for it to have a desirable impact on productivity. In organizations, knowledge is not only information but the “know how” of applied action (Servin, 2005). Knowledge is generally classified into two—tacit and explicit. Tacit knowledge refers to the “hands on” knowledge that is passed on from one person to another through face-to-face interaction, while explicit knowledge is the “know-what” knowledge that can easily be documented and stored (Smith, 2001). Tacit knowledge or the knowledge of the people in an organization is what makes it unique and gives it a cutting edge over competitors. This recognition gave way for the adaptation of technology for the maintenance of tacit and explicit knowledge. As a result technology was devised to connect people and processes.

A common misconception in knowledge management is that it is all about technology. In contrast, it actually has much to do with the right mix of three components—people, processes and technology (Servin, 2005). To ensure that knowledge-related assets are constantly improved, knowledge management systems are designed and employed (King, 2009). These systems are designed to support the knowledge management processes—“acquisition, creation, refinement, storage, transfer, sharing, and utilization” (King, 2009). Thoughtless use of technology without the right internal structures would cause the system to fail. It is therefore essential for the organizational culture and structure to be aligned in such a way that it allows for the sharing of information. Subsequently, the use of technology would enhance the way knowledge is managed in an organization.

***Content Management Systems.*** A system that provides for the creation, storage, reuse, management and delivery of content is often referred to as a content management system (Tache, 2008). Such a system is characterized by the ability for multiple users to collaborate and create content. It cannot be argued, that the internet has become an essential commodity today. As a result information is readily available to users within moments. Owing to this ease of access, users today expect important information to be available whenever they need it. Especially, factoring in the low cost of internet for communication, content developers are consistently under pressure to generate relevant information. Content management systems are therefore, an efficient platform that serves to collaboratively create, refine and archive information that may be useful for users. Additionally, through this platform, information can be updated in real time making it more meaningful to users. The notable advantages of content management systems are that they empower content,

decrease costs, increase revenues, improve accountability and maintain consistency (Hannon Hill, 2010).

With the rise of the “internet of things” a lot of information has gone online, this holds true even for the education sector. Cutting costs and increasing the efficiency of available information for users has grown to become a top priority for educational institutions. In fact, it would be safe to say that a number of institutions have already employed such systems and have also benefited from them. The sad truth however, is that several of these institutions have only bought-in to the idea for the sake of imposed regulations. Consequently, the full advantage of these systems have only been realized by a few institutions who are efficiently making marked progress (Daniela, Visvizi, Gutiérrez-Braojos, & Lytras, 2018). A significant use of content management systems can be seen in the management of courses (Harrington, Gordon, & Schibik, 2003). Although, such systems have been accepted and used, they are not without challenges.

**Cloud Technology in Education.** Cloud computing has taken the internet world by storm. This is a system that is dynamically scalable and can be shared among diverse users (Jalali, Bouyer & Arasteh & Mouludi, 2013). It provides access to files anywhere and at any time. Additionally, collaboration is also a powerful outcome of the use of cloud technology. Users are able to collaborate remotely while working on files in real time. This technology has tremendously help cut costs for IT infrastructures.

In particular, the education sector has already largely benefited from the integration of cloud computing. GOOGLE, a big name in cloud computing services has tremendously changed the way education is being delivered in many institutions. It even developed a unique customized for education purposes—GOOGLE Classroom. This platform allows users to interact online providing access to the instructor and instruction as per the need. The other feature of the cloud storage is its ability to store and share files seamlessly via the internet. There are even services that are virtually free of cost for educational purposes (Katiyar & Bhujade, 2018). Such systems can be employed creatively to deliver instruction that has the potential to be engaging and a great learning experience. As is the case with everything online, the biggest question that arises is that of security. Even more for cloud technology, because the user has little to no idea where their files are physically stored.

Security is the primary focus of cloud services, as storage is at the heart of its functionality. Consequently, all data is encrypted automatically without any additional prompt required from the user. This is broken down into chunks and stored. Only through unique user authentication tokens that are typically generated during logins can the files be accessed. This system is a fairly secure system and is constantly being improved.

The education systems around the world that are able to integrate cloud technologies are typically those that have adequate infrastructure for it (Bouyer & Arasteh, 2014). In essence, it would require internet and digital devices with relevant configurations. Without these resources in place, and user knowledge, the experience of cloud integrated systems would be unfavorable. Although, it has a tremendous potential to transform the way education is packaged, it requires effective leadership to get it rolling. Especially, since the lack of awareness is the biggest deterrent of its use.

***Blockchain in Education.*** A blockchain may be referred to as a distributed ledger that provides a way for information to be recorded and shared by a community (Grech & Cailleri, 2017). It is a community that has a copy of the stored information and must validate any updates for it to be incorporated. No update is possible unless it is collectively done. The blockchain, as the name suggests is a chain of data that is linked and stored on each computer that is part of the community (Sharples & Domingue, 2016). Information can only be added or removed when all the participants are in consensus. There are largely two systems of block chains—public and private. The major difference between the two is about who can alter the information. The best known application of the blockchain technology is the Bitcoin system of digital currency (Nakamoto, 2008).

The blockchain technology has been identified to have four notable features—decentralization, traceability, immutability, and currency properties (Chen, XU, Lu & Chen, 2018). It is the distributed systems of the blockchain that governs data verification, storage, maintenance, and transmission, making it decentralized. It is traceable because information stored in the blocks is arranged chronologically, with each block linked with two adjacent cryptographic hash keys (Tschorsch & Scheuermann, 2016). Further, it is immutable since any alteration in the information would easily be detected by all participants and unless approved by all cannot be made. It is noted that any blockchain network is much like that of cryptocurrency, which is point-to-point transactions without the need for third-party participation. As a result, the circulation of digital currency is fixed with a pre-determined formula. Therefore, issues with traditional currency such as inflation, collapse and so on may potentially be non-existent (Chen. et. al, 2018).

In the education sector the blockchain technology may potentially be used to award, store and access degree certificates that may be verified by participating employers (Sharples & Domingue, 2016). Additionally, it can be used to copyright an original idea as the patent can be stored in a block which will be times-tamped. In doing so the idea cannot be modified unless the original owner chooses to create a newer version of it. These are already being employed by institutions such as the University of Nicosia, Sony Global Education, Blockai. Subsequently, the potential use of blockchain technology in education cannot be undermined. Although, there is much that is yet to be explored, its value is undeniable.

## Final Thoughts

For education to be sustainable and meet the needs of industry it must seek ways to incorporate available technological advances in academe. Entrepreneurial efforts in education can potentially allow for innovative permeation of creativity in education. Additionally, educational entrepreneurship gives educators the framework to see potential opportunities outside of clichéd educational practice and turn them into strengths for education. For both educators and learner the ideas put together in this chapter have a potential for broader application. Despite the fact that skills in technology use differ between students and instructors, the right leadership can mobilize the right infrastructure to incorporate entrepreneurial efforts potentially, leading to transformed education (Lorenz, Haeger, Nailos, & Rabourn, 2013). In order for education to be sustainable, educators would benefit by challenging the educational platforms making student-centered learning experience a reality. It is possible by harnessing all available technological advances and employing them as per the need of industry, and the limit of resources.

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# Chapter 5

## Adoption of Digital Solutions for Agriculture in Africa

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### **ABSTRACT**

*This chapter explores the digital innovations in the financial services sector relevant to sustainable agricultural production, the extent of their availability to the farmers and impact on productivity. It also assesses application of digital solutions on knowledge management and delivery of agricultural extension services to the farmers. Digital transformation in agricultural projects has also been covered in this chapter covering the entire project life cycle; production tasks are currently delivered as projects. Lastly, this chapter also looks at the digital innovations in marketing agricultural products.*

### **INTRODUCTION**

According to world population prospects of 2019 by the United Nations, World Food and Agriculture Organization projects the suitable and sustainable global food production to grow by 70% to effectively feed 9.1 billion world population and Africa's projected population of 2 billion by 2050. Farm productivity must thus accelerate faster than the global average to mitigate against mass hunger by 2050.

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### ***Adoption of Digital Solutions for Agriculture in Africa***

Africa currently faces a myriad of challenges threatening to aggravate food insecurity. These include a rapid population growth rate; more than half of global population growth between now and 2050 is expected to occur in Africa. The population of China is expected to decrease by 2.2% between 2019 and 2050. The population of most European countries is expected to reduce by more than 15% by 2050. This high population growth rate in Africa puts pressure on the current food production and the production techniques.

The second challenge to food security is change in weather patterns with low amounts of rainfall being experienced during long rains season. This prematurely leaves the crops at a stage they are not fully developed for optimum production. On the same note, extremely harsh weather conditions like very high temperatures reduce crop and animal yields. Thirdly, rural-urban migration has led to mass movement of young energetic population from the rural farmlands to urban areas; the consequence of this is that the farms are deprived of the much vital factor of production-the labor. Clearly, high food demand together with decreasing yield potential of farmlands warrants a redesign of the agricultural sector for better food security, more sustainable employment opportunities and foreign income for the continent from export of agricultural produce. The advent of digital innovations has produced a lifeline to the vision of having a food sufficient continent.

Agenda 2063-The Africa we want published in the year 2015 aspires for a prosperous Africa based on inclusive growth and sustainable development. Fundamental to this is modern agriculture for increased production, productivity and value addition for national prosperity and Africa's collective food security. Separately and more relevantly, the Sustainable Development Goals of the UN (2015) cites famine and drought among other issues as daunting cities, towns and villages of the 193 countries of the world that met. The second of the seventeen Sustainable Development Goals is ***zero hunger by the year 2030***; this goal focuses on ending hunger, achieving food security & improved nutrition and promotion of sustainable agriculture. Digital technologies available for application in agriculture are cloud computing, computing systems, connectivity, open source software among others. Entrepreneurs can now deliver solutions to smallholder African farms at cost models that farmers can afford. The specific practical applications of digital technology in agriculture include weather forecasts, soil sensors, satellite aerial images that make it possible to manage crop growth in real time. Automatic systems are programmed with normal parameters from which any deviations trigger early warning. This reduces waste and improves productivity. Another significant practical application of digital technology is on large data analysis that transforms farmers into a knowledge-based community designed to provide learning from each other and from experts. Digital solutions also focus on farmers' finances; this is by connecting the unbanked and underserved smallholder farmers to credit, the banks and financial institutions that

offer these credit facilities also benefit from the increase in their agricultural loan portfolios cost effectively.

According to an article by Ndubuisi Ekekwe on '*How Digital technology is changing Farming in Africa*' (extracted from Harvard Business Review), there are notable examples of both mobile based and web-based technologies making significant contribution to sustainable agriculture in Africa now. Farmerline and AgroCenta are Ghana-based mobile and web-based technologies respectively that bring farming advice, weather forecasts, market information and financial tips to farmers who are traditionally out of reach due to barriers in connectivity, literacy or language. He further contributes that major global corporations have tried to advance digitalization of African agriculture by launching payment system, credit platforms and digital insurance.

## **Digital Financial Solutions in Agriculture**

Digital financial solutions in agriculture play an important role in providing a more cost effective and secure innovative methods for financial transactions particularly rural small holder farmers that are underbanked. Improved access to digital finance in agriculture creates new market opportunities, access to flexible and valuable credit facilities, and most importantly increased production output. This leads to food sufficiency, better quality of life and improved income for both individual farmers and for the continent through exports. Mobile payments is a typical digital solution that offers farmers the convenience of *anywhere any time payments solution*; the farmers can conduct real time transactions in the value chain beating time and distance barriers. Furthermore, these solutions are cost effective. These solutions also offer reduced risk of loss, theft and other financial crimes posed by cash-based transactions among other benefits.

Success in mobile payments across the continent has influenced farming and farmers as shown in the following examples; in Uganda and Tanzania there is *Smart Money* which is a mobile saving and payments platform. Over 90% of farming households in Uganda have a mobile phone and 46% of farmers use mobile money products (Mercy Corps, 2013). It is observable that there exists a huge gap between mobile phone ownership by farming households and the actual usage of mobile money products; this presents an opportunity for research and innovation into the digital space for more appealing products to boost adoption of these solutions. Better still, it would be more prudent to integrate various services on the mobile platform to make the platform more useful than just for making and receiving calls. The case of Zambia portrays a scenario whereby mobile money is not yet developed, financial inclusion is still low and consequently the benefits of digital finance are yet to be enjoyed by the farmers. The country has about a million smallholder farmers of

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whom only 20% have bank accounts (Zanaco, 2013). In Ghana, there exists *RiMFin* (Rice Mobile finance) initiative of the ministry of Food and Agriculture of 2009 that include *TigoCash* that is one of Ghana's leading mobile network operators and other stakeholders. The initiative aimed at doubling rice production in Ghana by 2018 to supply urban markets which represent 76% of the total rice consumption.

The second aspect of digital financial solutions is savings. Savings products have been simplified, account opening costs eliminated and the farmers can now open savings accounts by touch of a button on their phones without necessarily having to visit the banking hall, this is a case of Kenya (Karlan *et al* 2014, Dupas and Robinson, 2013). Digital solutions have brought more innovative commitment savings products that have lock up periods, fees and other penalties for early withdrawal. This development seeks to commit the clients to the savings goal. More generally, savings accounts targeting smallholder farmers demonstrate strong potential to improve the farmer's welfare and his production output. The impactful savings accounts features are those that help the farmers overcome behavioral biases such as fortifying willpower and memory. Access to the savings should also be easier. These features will become easier to deliver with the advent of digital platforms which can be configured to create sub-accounts, labeling, real time information and other decision aids (Working paper on Research and Impacts of Digital Financial Services, 2016). In Kenya, this digital development in financial services sector has impacted the agricultural sector. It has led to increased account uptake, more savings and consequently higher investment levels in agriculture from the capital accumulated. In other places in Africa, Malawi serves as a typical success story for improved access to savings accounts brought about by development in digital solutions. According to Brune *et al* 2016, the farmers in rural Malawi cultivated more acreage by 7%, the crop yields went up by 15%. The farmers saved more money for longer period covering harvest to planting seasons.

The third significant contribution of digital financial solutions in agriculture is on lending. Lending to agricultural enterprises has become important to both the farmers and financial institutions for the reason that there is rapid sector expansion due to increasing demand for food and commodities, increasing development of profitable agricultural value chains and better functioning markets for agricultural goods. The financial institutions have invested substantial amount of their capital in digital innovation in lending and risk mitigation models in the agricultural sector. The digital innovations that work to enable banks and other financial institutions tap into the agricultural market and serves to create a symbiotic relationship where the agricultural sector also benefits; access to capital for startup and expansion is made easier. In lending, significant areas being addressed by digital innovations include risk assessment and mitigation, high loan application costs containment,

expansion of delivery channels and coordination of flow of farmer information for banks to assess opportunities (Wiggings, Kirsten and Llambi, 2010).

Investigation of case studies across the continent by International Finance Corporation reveals success in tapping into digital solutions by the agricultural sector in Africa. Kenya's Equity Bank has ventured into direct smallholder lending supported by enhanced security and reduced risk of default, this they have done by digital data analysis to cap maximum loan exposure at USD 17000 per farmer, application of group lending terms where six farmers act as co-guarantors and lastly reduced cash amounts in the farmers' hands as the farmers can pay agro dealers out of their *Kilimo Biashara* credit. A more convincing demonstration of contribution of digital solutions to success of agriculture is *Informed Lending* done by Opportunity International Africa to direct smallholder farmers in Ghana, Rwanda, Mozambique, Malawi and Uganda. Informed lending is a parametric lending model that exploits digital innovations to pick the exact mapping of the farmer's household profile and the crop profile. The information is subjected to comprehensive analysis by the bank to establish loan limit for the farmer, his default probability and collateral that can be attached. The lender thus better understands the farmer. The farmers use mobile phones to access the loans and also advance payments for their produce.

## **Agricultural Extension and Advisory Services**

Agricultural extension and advisory services (AEAS) refers to any organization in the public or private sectors (e.g. NGOs, farmer organizations, private firms etc.) that facilitates farmers' and other rural actors' access to knowledge, information and technologies, and their interactions with other actors; such an organization assists them to develop their own technical, organizational and management skills and practices, so as to improve their livelihoods and well-being.

Agricultural extension is the application of scientific research and new knowledge to agricultural practices through farmer education. The field of 'extension' now encompasses a wider range of communication and learning activities organized for rural people by educators from different disciplines, including agriculture, agricultural marketing, health, and business studies.

Agenda 2063- the Africa we want (2015) aspires for a prosperous Africa based on inclusive growth and sustainable development; fundamental to this is modern agriculture for increased production, productivity and value addition for national prosperity and Africa's collective food security. Agriculture thus can no longer be left for farmers alone; it must be given a multi-stakeholder consideration. The industrialists, research & innovation partners play a crucial role in driving the agenda towards realization of the African aspiration on agriculture and food security. Digitization provides a platform for integrated production process management

## ***Adoption of Digital Solutions for Agriculture in Africa***

where information is collected, analyzed and used to make decision for quality improvement. Digitization can also be used to simplify cumbersome business transactional procedures.

It is widely accepted that farmers' performance is affected by human capital, which encompasses both innate and learned skills, including the ability to process information (Jamison and Lau, 1982). Extension services are an important element within the array of market and nonmarket entities and agents that provide human capital-enhancing inputs, as well as flows of information that can improve farmers' and other rural peoples' welfare; an importance long recognized in development dialogue.

### **Use of Mobile Phones**

Mobile phones have reached some of the most remote parts of the globe. Their rapid spread offers opportunities to improve the lives of small-scale farmers across the developing world. Indeed, companies have already started to capitalize on this trend by using mobile phones to help farmers to access information, banking services or virtual markets. This section seeks to elaborate how mobile phone-enabled services (or m-services) could facilitate the participation of farmers in agricultural innovation processes. The focus is on Kenya which has emerged as a frontrunner in the development of m-services in Sub-Saharan Africa. The in-depth case study of the Kenyan company M-Farm, which offers price information and marketing services via text messages and the Internet, critically examines whether the m-service can live up to the expectations. It also evaluates current mobile technology trends to provide an outlook on potential future applications in the agriculture sector and beyond.

Farmers will no longer be required to physically seek advice from an extension officer on how to yield more crops. They will get information either through voice calls, text messaging, the internet, and digital libraries and have instructed agricultural officers to set up desks at the local market on the respective sale days. It is projected that 65 per cent of Kenyan farmers' use mobile phones a decision attributed to adopt innovative solutions. Prominent benefits of using these platforms are efficient delivery of information to users thus instigating appropriate action and intervention.

### **Radio and Television**

These mass media platforms have played, and still continue to play an important role in agricultural extension and in getting farmers in touch with key services. The Farm Radio international has played a key role in this regard and has documented many such use cases. Another example is the African Farm Radio Research Initiative

(AFRRI). Radio citizen and citizen television also have weekly programs on innovative farming and education of Kenyan farmers.

## Videos

Videos also continue to be useful in extension services, for example Access Agriculture offers an internet-based platform for agricultural research and development staff and other stakeholders including farmer organizations. They have branded this service AgTube. Another example is Digital Green in India which trained rural communities to produce videos by farmers, of farmers, and for farmers to exchange best agricultural practices to boost farm productivity and improve nutrition.

## Agricultural Extension Services

Nagel, 2003 observes that agricultural extension services are an important aspect of agricultural development agenda. These services have also been a major contributing factor in promoting agricultural development in many countries. The services have played a major role in the achievement of the Asian Green Revolution. The key driver of this extension services is the agricultural information that is available through the extension service officers (Regina et al.,2006). There is a significant potential of raising agricultural productivity through new technologies and improved extension but, these gains will not materialize without increased investment in Agricultural Extension services (FAO, 2011). Governments, aid bodies and Agribusiness around the world invest considerable amounts of funds on extension services. It is estimated that the USA alone spends about 1 billion USA Dollars annually on agricultural extension.

The world over, the expenditure is in excess of 6 billion USA Dollars per year, (Marsh et al.,2004). This shows that effective agricultural production, be it at regional, national or individual levels depends on effective delivery of agricultural innovation information to the famers. Okafor and Fabiyi 2011 asserts that it has been shown that in spite of the relevance of agricultural innovation to production, many farming activities are embarked on without or with minimal knowledge of production systems. Traditional extension meant dissemination of information on specific technologies but recently that scope has expanded to include issues of marketing as well as partnership with various agricultural service providers (Birner et al., 2006). The role of the extension has to be amended from mere consulting to supporting the processes of farm planning and evaluation. This cannot be achieved without facts and communication. With the declining national and international support for agricultural advisory services, proper access, use and effective dissemination of extension service information is paramount (Regina et al., 2006). However

### ***Adoption of Digital Solutions for Agriculture in Africa***

dissemination of this information is not only constrained by the agents, but also its form and the way it is accessed by the officers who have to use it. Omotayo (2005) notes that agricultural extension depends largely on information exchange between and among farmers and a broad range of other actors.

### **Monitoring of Climate Conditions**

Probably the most popular smart agriculture digital tools are weather stations, combining various smart farming sensors. Located across the field, they collect various data from the environment and send it to the cloud. The provided measurements can be used to map the climate conditions, choose the appropriate crops, and take the required measures to improve their capacity.

### **Greenhouse Automation**

In addition to sourcing environmental data, weather stations can automatically adjust the conditions to match the given parameters. Specifically, greenhouse automation systems use a similar principle. For instance, Farmapp and Growlink are also digital means of agriculture products offering such capabilities among others. Green Q is also an interesting product that uses smart agriculture sensors. It is a smart sprinklers controller that allows you to manage your irrigation and lighting systems remotely.

### **Poverty Alleviation**

Poverty alleviation, economic and social rural development- the first MDG of eradicating extreme poverty and hunger was in many ways the most ambitious and the most difficult to define in terms of implementation strategies. The goal of halving the proportion of people whose income is less than \$1.25 a day was met five years ahead of schedule, primarily due to the extraordinary economic growth rates in East and Southeast Asia, and the associated structural transformation of those economies. Reducing rural poverty still remains one of the more difficult development challenges because it requires sustained, socially inclusive economic growth, particularly in the agricultural sector.

Clear strategies to generate broad agricultural growth in Sub-Saharan Africa are needed. Farm sizes are shrinking due to population increase as well as current land tenure systems in densely populated areas, while there is continued reliance on area expansion where populations are sparse. Reliance on market mechanisms only may contribute to inequality in rural income distribution, as efforts to increase farm productivity, improve access to markets, and subsidize inputs may favor farmers with sufficient land and capital resources. Other policies can contribute to

inequality by favoring those with legal tenure over those without, male farmers over female, ethnic majorities over minorities or nomadic peoples, and farmers living closer to population centers and markets over those living in the most rural areas. In South Asia rural poverty tends to be concentrated in lagging areas that have not been integrated into the larger economic growth process. In Sub-Saharan Africa, particularly in countries that lack major mineral resources, the agricultural sector is the largest employer and contributes significantly to overall economic growth. Between 2010 and 2050 the rural population in East Asia is expected to decline by 50% and by 10% in South Asia, but is likely to increase by about 30% in Sub-Saharan Africa over the same period.

## **Digital Transformation in Agricultural Projects**

According to [businessdictionary.com](http://businessdictionary.com), transformation is a process of profound and radical change that orients an organization in a new direction and takes it to an entirely different level of effectiveness. With this definition therefore, we conclude that digital transformation is the use of new age technologies over traditional business processes to build a scalable process of innovation, optimization and growth. With the untapped potential in the continent of Africa, identified projects can be digitally transformed right from its initiation to its transition. This is a step by step process of changing in project atmosphere where project managers can witness little or no resemblance with the usual way of undertaking business of a project.

As far as Africa continent is concerned, organizations need to have plans to adopt a digital-first strategy. This is a true statement for the projects in the continent of Africa which is still grappling with initiating infrastructural projects that can sustain development. These key technologies driving digital transformations in companies include; big data/analytics, mobile, cloud, and APIs/embeddable.

## **Digital Transformation in the Life Cycle of Agricultural Project**

### **Project Initiation**

J. Westland, 2006 states that every project has a beginning, a middle period during which activities move the project towards completion, and an ending which can either be successful or unsuccessful depending on its implementation. He further notes that a standard project has the following four major phases that have their own agenda and tasks in every phase; initiation, planning, execution, and closure. Taken together, these phases represent the path a project takes from the beginning to its end and are generally referred to as the project life cycle. It is therefore important to consider digitalization of these phases as managers implement agricultural projects



in Africa. With the advent of digital gadgets, it is a high time that programming aspects of projects can be installed in the applications of these digital gadgets at every phase in the project cycle. Project managers should always be keen on using digital devices in collection of data during initiation phase of the project. This can be true when defining its objectives, scope, purpose and deliverables to be produced. All these steps can be included in a digital platform like pre-installing in computer software. Other start up activities which include; hiring project team, setting up the Project Office and reviewing the project can at the same time be digitalized as it will ease the work of the organization hence avoiding huge costs of flipping back into traditional non digital platforms which has proved to be costly and non-effective. Approval to the next phase can also be done electronically by the approving manager. This will make projects in Africa to have competitive advantage on other multinational organizations hence earn accolades that include increased funding for implementation. During initiation of the project, the organization should include technology expert in its project team so as to carry on with development of ICT software that sustains the project.

## **Planning Stage**

“Failing to plan is planning to fail” this is a true statement particularly in many projects that are implemented in Africa. For sustainability of projects in Africa, planning is key to successful project. It focuses on developing a roadmap that everyone will follow. This phase typically begins with setting goals. For the success of projects in Africa, it is prudent to realize expertise is key in the development of assignments in the planning phase. The project design should be SMART i.e. Specific, Measureable, Attainable, Realistic and timely. All these attributes should be digitally composed in a design document of the project. Digital platform dictates that the project team develops an integrated project schedule that coordinates the activities of the design and development of procurement plans. A detailed budget that enables the project team to track project expenditures against the expected expenses is also key in the master design of the project. It is at this phase that a (RACI-Responsible, Accountable, Consulted and Informed) tool is developed. This is a tool where roles and responsibilities are clearly defined, so everyone involved knows what they are accountable for. All these are computer developed tools which are designed by software engineers.

For success of project in Africa, there is need to embrace technology which is quick and simple to administer in projects. For project managers to make informed decisions there is need for them to hire technology experts. The managers themselves may need to have some guidance on managing the planning process. At this age of technological advancement, planning entirely depends on the personal knowledge on

the technology and the expertise one has and that of staff engaged in the business of the organization. Most projects started currently in Africa hire staff who do not have enough know-how on planning process, including deciding which type of network they need, or how best to connect to the Internet. These aspects of technological know-how should form an integral part in the success of projects hence assure sustainability. Many mega projects in Africa currently entirely depend on services drawn from outside. This is commonly known as outsourcing of services. When project managers undertake planning on their own, they will be able to save money since they can only define what it is that they want their organizations to gain from technological use. Planning technology solutions can require much more in-depth technology understanding. In some cases, if there is already an experienced IT person on staff, some nonprofits find that with web research and phone calls, a technology team can complete the plan on its own. However, if you do not have an experienced IT person on staff, it will be hard for someone to learn enough to make a reliable judgment. Whether or not you seek outside help, however, educating your own technology team is crucial to a successful plan. In order to understand the options a consultant presents to you, you need vocabulary and basic concepts. In conclusion technology planning is no simple matter, but it is a rich, powerful process. In the long term, it can reduce your headaches tenfold, and lead you to use technology to further your mission in ways you never dreamed of.

## Implementation Phase

Angela Bunner, 2016 states that technology has changed project management in every conceivable way. Advances in software, hardware, communication technology and other areas have transformed the world of project management over time. There are key nuggets for the success of the implementation of a project; these nuggets include; improved communication, efficiency in the project management software and reporting. During this phase, the project plan is put into motion and the work of the project is performed. It is important to maintain control and communicate as needed during implementation. Progress is continuously monitored and appropriate adjustments are made and recorded as variances from the original plan. In any project, a project manager spends most of the time in this step. During project implementation, people are carrying out the tasks, and progress information is being reported through regular team meetings. The project manager uses this information to maintain control over the direction of the project by comparing the progress reports with the project plan to measure the performance of the project activities and take corrective action as needed. The first course of action should always be to bring the project back on course (i.e., to return it to the original plan). If that cannot happen, the team should record variations from the original plan and record and

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publish modifications to the plan. Throughout this step, project sponsors and other key stakeholders should be kept informed of the project's status according to the agreed-on frequency and format of communication. The plan should be updated and published on a regular basis.

### **Transition Phase**

Status reports should always emphasize the anticipated end point in terms of cost, schedule, and quality of deliverables. Each project deliverable produced should be reviewed for quality and measured against the acceptance criteria. Once all of the deliverables have been produced and the customer has accepted the final solution, the project is ready for closure. During the final closure, or completion phase, the emphasis is on releasing the final deliverables to the customer, handing over project documentation to the business, terminating supplier contracts, releasing project resources, and communicating the closure of the project to all stakeholders. The last remaining step is to conduct lessons-learned studies to examine what went well and what didn't. Through this type of analysis, the wisdom of experience is transferred back to the project organization, which will help future project teams.

### **Application of Technology for Sustainability In Projects**

Doug Uptmor 2017 states that in today's complex, technologically advanced business environment, project managers have a distinct advantage. African continent has been experiencing tremendous technological increase. This technological increase is meant to enhance and reorganize project development with greater synchronicity, making a project manager's job simpler, more intuitive and more easily adaptable to the ever-changing technological landscape. Technology has proved to be a tool that is handy for changing the game in the sustainability of the projects.

### **Collaboration Tools**

Project management requires technological tools that are in tandem with outlining processes in project management since its initiation to its transition. Collaboration is a key factor especially when the continent is moving from high dependence on agriculture to adopting industrial economic base. Uptmor, 2017 further reiterates that recent innovations in social platforms reflect the growing need for team members who may not be working in the same space to keep updated project platforms in real time. Taking projects in Africa to a level where like in America project staff work from home. This idea can be made a reality when there is high collaboration of technology tools in any company. Platforms like Skype, twitter, WebEx and other

social tools can be adopted by high growing companies as a way of digitalizing their programs to achieve effective and efficient service delivery for the beneficiaries. As this trend grows and becomes the more practical standard for larger projects in companies, chat software and social tools are becoming one of the most crucial types of technology used in project management.

Using collaboration tools, employees can share relevant files without using a third party platform (although many software suites often third party file sharing integration). Providing easy access to a common document can greatly increase productivity by eliminating redundant revisions and knocking down barriers to access.

## **Project Tracking**

Technology enables companies have better accountability and productivity. This is enhanced by use of cloud-based project management system. For productivity purposes, time tracking software enables employers to establish a baseline of time spent per project, which they can then tie to other key performance indicators such as quality of work or amount completed. For non-office employees, the cloud is essential for measuring their output relative to their work hours. Cloud-based project management software also offers advantages when breaking down complex projects into manageable tasks. Robust task management software gives users a better understanding of their importance to the overall project. It also helps establish inter-connectivity between tasks by showing which goals are interdependent.

For this reason, more and more businesses are finding it crucial to use cloud-based project management software for collaborative projects. The closer you can track the progress and targets of a project the quicker you will be able to identify potential roadblocks and issues.

## **Information-Gathering Tools**

Africa needs high technology where project managers use sensors and other information gathering materials. This will provide managers with a specific type of informed, accurate market research within a short timeframe. It is also a high time that projects in Africa should start using wide ranging data especially in research based projects.

## **Scheduling Software**

Projects are initiated to accomplish a specific goal. It is within this platform that project managers should start working across cities, countries and different time zones to be able to learn and accomplish the set goals. For this to succeed,

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installation of scheduling software will be crucial in the projects implementation. Many countries in Africa are starting to decentralize services to the people. For instance Kenya promulgated a new constitution in 2010 which opened a new avenue for decentralization of government services. Group meetings can now be done at the national offices at the same time with the regional and county offices. When this is adopted in most project, there will be success in the implementation of projects. This means timelines will be adhered to and work will be accomplished within the set period as per the plan.

## **Workflow Automation**

Cichockis A. et al narrates that “project developing their own workflow has its own set of challenges, which is why workflow automation tools are so important. With workflow and reporting automation, you can free members of your team from ongoing administrative tasks so they can focus on what’s really important. In doing so, they can respond faster to important queries and complete the task at hand. When seeking out workflow automation tools, be sure to adopt a flexible system that can quickly adapt to changing market conditions.” Just as the cloud allows businesses to update and communicate in real time, modern scheduling software benefits from being built into certain social and chat platforms. This kind of technology is vital when it comes to team accountability, project progress tracking and advanced, team-wide communication.

## **Digital Marketing of Agricultural Products**

The interest of the farmer and that of the consumer in the value chain of agribusiness converge on quality and speed of delivery of the agricultural commodities. If this is met the farmer smiles for the returns and sustainability of the returns are optimized. The consumer on the other side gets value for his money. The need to reach out to a wider market by the farmers is motivated by the fact that not all regions can produce all commodities thus interdependence, this interdependence is not monopolistic and even if it were, still speed of delivery and quality would be paramount considerations. Despite challenges, there is concerted effort by various stakeholders to ensure sustainability in production.

According to Africa Agriculture Status Report of 2018 on catalyzing government capacity to drive agricultural transformation, agribusiness leaders identified the provision of infrastructure (roads, dams, irrigation channels, transport, storage, supply chains, agricultural marketplaces, power and digital technologies) and logistics, especially for import and export of products, as one of the critical elements of the enabling business environment. They argued that rural communities where most

African farmers reside are often devoid of basic amenities. Insufficient road networks hamper adequate access to markets. At the processing level, it is difficult to operate without power, and the rates charged for power continue to be prohibitive and reduce the profit margins available for re-investing back into the agribusiness. Agribusiness leaders argued that rural road networks should be improved. Provision of power, storage, facilities for value addition, and creation of channels for the international market will assist farming and agribusinesses in these countries. Infrastructure development is needed to promote free movement of goods and hence reduce the cost of moving the goods. They recommended assisting countries in the construction of roads that will link them to other African countries. The infrastructure provided by African governments is often neglected and abandoned after a few years. Respondents felt that including private partnership in provision and maintenance of infrastructure would assist in improving market access for rural farmers.

Today's world is a world of digitization and every country wants to digitize their services (Services like: Consumer distribution, subsidies, their education services, etc). Governments of developing countries now create a deeper understanding of the policies and practices that are involved in digital marketing. Digital marketing is the promotion of products or brands via one or more forms of electronic media and differs from traditional marketing in that it involves the use of channels and methods that enable an organization to analyze marketing campaigns and understand what is working and what is not – typically in real time (Ms.Arjinder Kaur, 2011. The use of digital marketing in the digital era not only allows for brands to market their products and services, but also allows for online customer support through 24/7 services to make customers feel supported and valued. The use of social media interaction allows brands to receive both positive and negative feedback from their customers as well as determining what media platforms work well for them. As such, digital marketing has become an increased advantage for brands and businesses. It is now common for consumers to post feedback online through social media sources, blogs and websites on their experience with a product.

A more direct and relevant application of digital marketing in agribusiness is demonstrated through a model whereby over 3,000 small-scale farmers across Kenya are now accessing 17 markets across the globe, in an elaborate arrangement that has embraced technology to correct major hiccups in the agricultural value chain. This is by pointing growers to ripe and lucrative markets, taming post-harvest losses while connecting buyers to ready produce that meets international standards. The model, spearheaded by a fresh produce start-up called Selina Wamucii, has courted mobile phones and the internet to pool together 3,156 farmers cumulatively growing 48 produce types ranging from fruits such as avocados and mangoes, vegetables including snow peas, herbs such as basil and chives on 9,152 acres. The model is solving farmers' poor earning problems, lack of steady market, difficulties in

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meeting market-driven standards, inconsistent volumes and inefficient logistics (Daily Nation- September 12, 2017).

Focus on East Africa reveals that a new generation of tech-savvy local entrepreneurs is building digital platforms to provide streamlined and more reliable to farmers and agribusinesses. Their applications cover improving productivity, strengthening market linkages and access to finance a month others. Notably, some enterprises such as Hello Tractor provides “uber” tractor services to over 250,000 farmers and Farmers Pride Africa has one stop “Digishops”, supporting 10,000 farmers to access inputs, livestock services, and agricultural insurance from reliable input providers and connecting them with buyers. Another example of an enterprise that provides a bundle of technology services to farmers is Agri-Wallet in Kenya. It offers a mobile financial platform to connect farmers and buyers to sell their produce or to input suppliers to buy inputs, with payments made through mobile money. It also serves as a digital wallet for savings or to obtain loans. Most of these entrepreneurs bundle services and make their earnings from the transaction markups from input and insurance companies, financial institutions, and commodity buyers (World Bank report, 2019).

## **The Future of Digital Marketing in Agribusiness**

The future of digital marketing is bright, the application of these innovations cuts across all industries agriculture being one of them. The following milestones have been witnessed; we are already seeing artificial intelligence applied to social media. A massive development in this area in 2018 was using chat bots on Facebook Messenger. Chatbots enhanced digital marketing campaigns as, when a user interacted with an advertisement; the chatbot can capture their details to feed into a company’s sales team. As such, digital marketers are able to increase the return on investment for each campaign as each lead becomes more qualified. The use of chatbots is still in its infancy and we predict that, in 2019, using this technology will become a common tool in the digital marketer’s arsenal as new features are added and it becomes more intuitive. Internet users are no longer clicking on display adverts. Recent research conducted by Wordstream states that the click-through rate (CTR) on these types of advertisements in 0.35 which is extremely low. This means that advertisers need to be smart when developing their advertising campaigns. They need to make their adverts not look like adverts so that they can capture the attention of their readers.

Social media networks have come a long way since they entered the market. They have developed new features, done away with some and reinvented others thereby offering huge potential for timely and deliberate marketing information to farmers. The creativity and ingenuity of social media channels will continue into 2019 and won’t stop there. The social media giants realize that they have one thing that start-up

channels don't have – the vast audience numbers – and to make sure that they keep them they need to be at the forefront of innovation and give them what they want.

## **CONCLUSION**

As mobile phones and, to a lesser degree, the internet have reached rural areas in developing countries, a number of studies have shown encouraging impacts on overall returns received by rural producers. But there is also evidence that these innovations often fail to scale-up and achieve wider acceptance. Access to information and the ability to communicate are only two of many constraints farmers face. Others include market fragmentation even though market consolidation will, over time, enhance growth prospects. Another reason could be the lack of financially sustainable business models that will attract private sector investments in providing innovative solutions for small scale agriculture. There is clearly high potential for the internet and related technologies to improve rural economies, but several lessons need to be kept in mind.

## **RECOMMENDATIONS**

Data, tons of data is collected by smart agriculture sensors, e.g. weather conditions, soil quality, crop's growth progress or cattle's health. This data can be used to track the state of your business in general as well as staff performance, equipment efficiency, etc.

There is also better control over the internal processes and, as a result, lower production risks. The ability to foresee the output of your production allows you to plan for better product distribution. If one knows exactly how much crops you are going to harvest, you can make sure your product won't lie around unsold.

There is cost management and waste reduction thanks to the increased control over the production. This enables one to see any anomalies in the crop growth or livestock health and one will be able to mitigate the risks of losing the yield.

To augment business efficiency process automation can be attained through the use of smart devices; one can automate multiple processes across your production cycle, e.g. irrigation, fertilizing, or pest control.

To enhance product quality and volume so as to realize better control over the production process and maintain higher standards of crop quality and growth capacity farmers should adopt automation through digital services for extension.



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## Chapter 6

# Smart Ideas for Smart City Development: An Integrative Approach for Now and Thereafter

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### **ABSTRACT**

*The concept of smart city is a burgeoning strategy that is fast becoming popular as a strategy that will be able to mitigate the problems emanating from the uncontrolled population growth and urbanization. Academicians have turned their attention to the smart city concept, but an in-depth understanding of the concept is still required. There is a dearth of information on the concept and hence the phenomenon is not well understood. This study, therefore, aims to fill the gap in literature regarding smart cities and propose a framework for grasping the concept further. Based on exploratory studies on the concept of smart cities, this chapter focusses on nine key factors that will form the framework for smart cities and the smart cities initiatives. These nine critical factors include the management, organization governance, technology, people, policy, economy, natural environment, built environment, and the implications of big data on smart cities. These factors provide the basis for the development of an integrative framework that can be employed to examine the manner in which governments around the world, including Kenya, are envisioning smart city initiatives. The framework provides the agendas and directions for smart approaches that can be implemented in cities and a road map for the attainment of smart cities.*

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## **BACKGROUND INFORMATION**

It is important for administrators of cities to understand that it is not technology alone that can make a city smart. Rawat & Ghafoor (2018) note that smart cities are not limited to the implementation of technology alone, but subsume other factors such as urban growth, education, management, administration, and human capital. As such, building a smart city is a multifaceted initiative that requires the collaboration of different stakeholders and the implementation of different technological components (Axelsson & Granath, 2018). This then implies that administrators in smart city implementations need to have the political angle of technology and how to integrate the various components that will work together towards the development of a successful smart city. Additionally, administrators should bear a great understanding of the factors that differentiate the appropriate policies for the implementation of smart cities (Almirall et al., 2016). Putting these things in perspective will ensure that there is a clear view of the strategic options that spring up when mapping smart cities.

The modern cities, in many instances, are a combination of different problems mainly e-waste, traffic control issues, health concerns, congestion, environmental degradation, water supply issues, inadequate roads, traffic control issues, and many others (Broere, 2016; Rajé et al., 2018). Additionally, cities are expanding at such high rates leading to organizational and social issues. As a matter of fact, with the rate of growth of cities, social and organizational issues are almost surpassing the technological aspects that encompass cities. The issues surrounding cities are further made more intricate by competing interests, unclear objectives and values, multiple stakeholders, and intricacy in social and political landscape (Bibri, 2019a). This makes the smart city concept complex and entangled.

Good standards of living then becomes the core agenda to make the cities smart in the context of rapid population growth (Taylor Buck & While, 2017). There is definitely a need to understand the concept of smart cities deeper. Various authors, including Zubizarreta et al. (2016) have noted that this concept has evolved over time, and there is still no consensus on what a smart city entails to the letter. The urgency around these challenges triggers a lot around the world as stakeholders in the concept seek ways to manage the issues. The consideration of technology is usually common in order to assist in delivering smart services to citizens. As a matter of fact, the scaling down of computers and associated technology and the now ubiquitous and faster means of communications that are at the helm of our fabrics are the constituent elements of smart cities (Mora & Deakin, 2019). The end result, obviously, is to make the cities “sustainable and livable cities.”

Although, in the recent past, the term “smart city” has become a cliché, there is still shadows of unclarity and lack of clear consensus among researchers on what exactly a smart city entails. There is a need to clear the air around the phrase and

### Smart Ideas for Smart City Development

provide a consistent understanding of the concept among practitioners, researchers and industry experts (Bholey, 2017). This paper, then, makes the scholarly attempt to fill in the gap through the identification of critical trends and suggests research agendas regarding cities as they invest in novel ways to become “smart.” Through exploring the extensive literature from myriad fields including e-governments, urban studies, information science, and public administration, this paper identifies and discusses the meaning of the smart city concept. The main focus in the definition of smart cities is explored.

Against the above backdrop, it is clear that the concept of “smart city” itself is dynamic and there is hardly a consensus on its definition. All through the world, the concept is employed within different contexts, definition, implications, and applications (Zuzul, 2019). Many authors have in a manner replaced the concept with

Table 1.

	Definition	Area of focus
1	Smart city refers to a wide array of concepts that subsume social, human, and technological infrastructure Davidson & Infranca (2019)	This perspective consents that the concept of smart cities comprises of broad aspects.
2	Smart cities have been perceived as a focus on those aspects of urban development that lead to the enhancement of the quality of life to citizens and has, in the recent past, generated huge debate as one of the biggest agenda for policy developers (Serag El Din et al., 2013).	In this explanation, policy makers are perceived as a critical aspect of smart cities.
3	The concept of smart cities has attracted various technological industries and players including entities such as IBM. These firms have placed great focus on technology and how it can be embedded in almost every aspect of life such as on roads, in buildings, in hospital infrastructure, environment, water management, just to name a few of the various developments in Internet of Things (Lima et al., 2020).	Views the industry as a critical player in the smart city concept and also the collaborative component coming into play.
4	A city that monitors its critical infrastructure like roads, railway, airports, seaports, buildings, communications, power grids, agricultural infrastructure, by the use of technologies while maximizing its resources for its citizens. Al-Hader, M. et al (2009).	Focuses mostly on the integrating infrastructure and systems that monitors the resources for sustainable developments
5	Connecting the people, social, business infrastructures to leverage the artificial intelligence of the city (Alvarez, 2017).	More integrative approach connecting various aspects to leverage the city. Seems a more comprehensive definition.
6	A city striving to render itself sustainable, smarter, livable, efficient, effective (Bibri & Krogstie, 2019).	More general definition
7	A city that focuses on investing on ICT to enhance quality life through governance and public participatory processes for sustainable development for smart management of its resources (Bibri & Krogstie, 2019).	

other terms and objectives such as “digital city”, “electronic city”, and “intelligent city.” Some note the application of smart city as an urban labelling phenomenon is applied in myriad inconsistent ways (Davidson & Infranca, 2016). In this paper, the following conceptualization of smart city are brought forth in order for a clear understanding and for reference.

## **Methodology**

The methodology of this paper was divided into three main sections: the general search of literature where a general search for the “smart city” concept was done to retrieve papers related in this field; selection of the articles with the relevant objectives and focus on the smart city spectrum mainly achieved through reviewing of abstracts and ascertaining the relevance of the collected material in order to narrow down to papers that focus on the required area.

An in-depth search was done in different databases in the domain of technology, and specifically urban technology. All through the search, the key words “smart city” were employed in order to retrieve relevant journals, books, book chapters, sessional papers, and academic work on smart city. During the selection phase, review of the abstract was done in order to identify those that were relevant and elimination was based on the technical focus on the material in focus.

Finally, the selected materials were critically analyzed for relevance according to the inclusion criteria for the paper. Only papers that met the inclusion criteria, i.e, they addressed the objectives of this paper were retained. In this case, the analysis was based on the papers that met the criteria. The literature retrieved and deemed to have insignificant contribution towards the objective of the paper were eliminated. At the end, the final selection of material comprised of published work, conference proceedings, and books.

## **Challenges of Smart City implementation**

The discourse on the concept of smart city has continued to spur novel challenges between private and public entities within the cities ecosystems. Some of the core issues include:

- i. Accessing support from residents or simply attracting the involvement of the public through partnerships.
- ii. Lack of sufficient personnel trained in the area of information technology with capacity to guide in the planning and implementation of smart cities.
- iii. Sustaining the interests of stakeholders and participants in the smart city conceptualization and implementation process.

- iv. Resourcing and funding programs considering the high cost of development (Ojo et al., 2014)

To meeting the ambitions and goals of smart city implementations around the world successfully, key players, companies, and the administrators of cities will need to develop strategic public-private partnerships that ensure full citizen support. The need for these partnerships is to provide high priority to projects that narrow down to smart cities. There is a need to give public-private partnerships high priority (Wolfram, 2012).

Procedural and technical limitations have been cited as hindrances to cities, preventing the harnessing of the potential of information communication and technology and to join forces in the creation and delivering of genuinely smart business and citizen centric services. The world economic crisis, together with growing expectations from citizens, is also increasing pressure on cities in overcoming the current barriers (Paskaleva, 2011).

## **SMART CITY MODELS**

### **Triple Helix Model**

The first theory in the understanding of the smart city implementation is the triple helix model. It was introduced by Etzkowitz and Leydesdorff and is founded on interaction of three main components: universities and their endeavors in research, industries and their involvement in the production of commercial goods, and also the government and its function in regulating markets (Leydesdorff & Deakin, 2011).

As the degree of interactions between the core components increase within this model, each section progresses to espouse the characteristics of the other components, which then give rise to hybrid institutions. Bilateral associations emerge among institutions of higher learning, players in industry sector, and governments (Leydesdorff & Deakin, 2011). However, even as the relationship exists, the helix model is poised to suffer from the aid of key stakeholders to assist in the implementation of smart cities.

### **Quadruple Helix Model**

The deficiencies of the triple helix model led Elias Carayannis and David Campbell to propose the quadruple helix model that has an additional component making it a four-component model with the fourth component bringing in the perspectives and contributions of the civil society and media. The objective of this model was to

Figure 1. The Quadruple Helix Model (Steenkamp, 2019)



categorically bridge the gaps that exist between the innovation world and the civil society (Borkowska & Osborne, 2018).

Indeed, the initial perception was that the triple helix model did not match the needs of the society fully and thus the need for an additional model. Therefore, the four-sided model goes ahead to surpass the restricting of potential in its predecessor. It brings in the role of the society as a very important aspect of the interaction in the implementation of a smart city. This framework placed great emphasis on the role that media and the civil society plays and bears the necessary measures in checking that universities are able to undertake their role in educating the society and conducting due research to ensure proper growth of a competitive and digital society. Initially there was a perception that triple helix model did not entirely match the needs of society, thus restricting their potential role as a major player in the implementation of knowledge-based society (Borkowska & Osborne, 2018). Adaptations of the quadruple helix model by the Civil Society in National Innovations Systems show demonstrate that its four components are involved in a multi-layered, bi-directional, and dynamic interactions. This indicates the place of society in national innovation systems and the criticality of actively involving the public in projects of innovation (Schütz et al., 2019). In reality, government, academia, and businesses have devised ways to collaborate with society in order to achieve the intended innovations (Sturgis, 2014).



## **Giffinger's Smart City Framework**

This smart city model subsumes of six main elements namely; smart living, smart governance, smart economy, smart transport, smart people, smart environment and the manner in which these components interact together to give rise to a digital economy (Al-Alwani, 2018).

## **Chourabi's Integrative Framework**

This framework was introduced by Chourabi et al. (2012) in the publication dubbed "Understanding Smart Cities: An Integrative Framework". According to, there are eight critical factors of smart city that contribute to the smart city initiative. These factors subsume; technology as a base foundation and backbone, management & organization of entities and the city itself, people, policy context, governance, natural environment, societies, economy, built infrastructure.

In his framework Chourabi et al (2012) alludes to the distinction that is manifested in two levels of influence. The first level involves the most direct and influential level formed by a triangle and the components in this level include policy, technology, and organization (Nam and Pardo, 2011).

The second level focuses on the five major factors of influence. There are five factors that provide influence at this level. All the factors can by themselves influence the objectives of smart city initiatives. For instance, a look at the economy reveals that it can be negatively influenced or influenced positively through the strengthening it and addressing its needs.

Chourabi et al (2012) contends that this model is inherently integrative and stands in the best position to elucidate the integration of all the factors required for the success of smart cities. This argument plays a critical role in the analysis of other frameworks for the implementation of successful smart cities. The number of highlighted factors of influence, and the additional components make this framework better and highly regarded by several authors across the spectrum. The integrative framework's eight components are discussed in the next paragraphs.

### **(1) Management and organization**

According to Chourabi et al. (2012), there is a dearth of information in the field of smart cities and that is a bother and hindrance in addressing the issues that are related to managerial and organizational aspects in smart city initiatives. Smart cities differ from general managerial and organizational initiatives that means that there should be specialized attention that should be accorded to such initiatives. For the success of smart city initiatives, there should be managerial and organizational

support in terms of technical expertise and provision of the required ICT resources that will enable proper serving of the citizens.

## (2) Technology

ICTs stand out to as the key catalyst for smart city initiatives around the world. Ensuring proper integration of technological components in a city can ensure the unlocking of great opportunities for enhancing the management and functioning of the cities (Bifulco et al., 2016). Regardless of the ever-increasing benefits of ICT applications in myriad cities, the effects still stand ambiguous. While ICTs have the capacity to improve the lives of citizens, they have also been accused of promoting digital divide. Therefore, top level managers in city planning need to consider the technology factor keenly when implementing smart city initiatives. Training, careful integration, and consideration of the organizational or inherent culture and how to change the perspectives should be at the epicenter of the introduction of novel technologies.

## (3) Governance

Smart city initiatives require the involvement of governance in the process of implementation. Upholding the right rules as well as regulations and working in a bid to ensure that the smart city framework has a functioning governance ensures that all stakeholders coordinate effectively. There is need to ensure that smart city initiatives can meet the intended objectives and goals. In this sense, governance covers four critical aspects: leadership, ability to coordinate the different initiatives of the stakeholders, and working well under the various jurisdictions (Al-Alwani, 2018).

Different cities have profited from the ICT developments that enhance their governance. The ICT based governance is also referred to as intelligent governance. It widely represents a wide range of technologies, guidelines, people, practices, resources, and data that supports the governance activities.

## (4) Policy

Smart city-based initiatives around the world face different challenges, policy being one of them. From the creation of government agencies to provision of rules that provide guidelines on the application of ICTs in cities, policy issues need to be clearly considered. Conventional readiness would involve removal of regulatory and legal barriers.

Development of decisions by top management should include a consideration of the restrictions and regulations imposed. A clear understanding of how the

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regulations made affect smart city initiatives negatively is also key (Monzón, 2015). While policies are key, city managers and policy makers also need to take keen consideration of the universally accepted norms, practices, and behaviors that people accept as ideal and adhere to. Therefore, in the process of planning, citizens are to be involved in every step.

#### **(5) People and communities**

People are a very critical component in smart city initiatives. Allowing people to participate fully in the implementation of smart cities is critical to ensure success. Active users not only make the management and governance of the smart city initiatives easy but also ensure efficiency and effectiveness of the measures and technologies (Sarkar, 2020).

Once key players gain the opportunity to engage in initiatives to the extent that they can influence the efforts for success, smart city initiatives can begin to take shape and gain acceptance. It is important to consider the users as part of the groups and communities and to consider their needs within the cities when implanting initiatives. Communities and people are components that need proper balancing in order to ensure that projects are successful.

#### **(6) Economy**

This component includes all the factors that surround the economic competitiveness in a smart city initiative.

#### **(7) Built infrastructure**

ICT infrastructure subsumes the infrastructure, information systems, network technologies, and their implementation. There is a dearth of literature on the barriers related to ICT infrastructure hindering the implementation of smart cities. Challenges related to IT can be grouped into: IT infrastructure, operational, and security and privacy (Bibri, 2019b).

#### **(8) Natural environment**

The natural environment is a key component to consider when implementing smart city initiatives. Of keen interest is the manner in which the natural environment can be sustained and natural resources managed in a better manner. While smart city initiatives are underway, natural resources such as waterways and sewers and green spaces should not be compromised (Sarkar, 2019).

## **Smart City and the Big Data Concept**

Data is perceived as a critical component required in the realization of the smart city vision. As such, big data can be perceived as giving a clear and core objective towards the development of the smart city, with the weight of data playing an inherent role in the social and economic relations and hence offering robust empirical evidence for practice and policy (Pas et al., 2016). Yet, there still lies a huge shadow of ambiguity as to the focus that is required in having a clear understanding of the needs in terms of information of cities and its citizens. There are various aspects that come into play with regards to information such as the sources of information, the role that information plays, the destination of information, and the forms that information should take. As such, the manner in which information is mobilized in businesses, citizens, and governments and the impact of real time data analytics has not been realized fully.

The explosion of data that has taken place over the last decades has been seen to have direct influence on the roles of the cities and the manner in which the data is used to regulate urban life. The role of data in urban life is critical and hence a critical component of smart city implementation. In specific, the analysis focuses on the big data phenomena and the creation of huge, varied, interconnected, and dynamic datasets that hold the promise of what some perceive as a truly smart city; one that can be managed through real time data and offers solutions to a great degree of current age issues (Townsend, 2013).

A lot of data is generated by various levels of governments; i.e., national governments, local governments, state agencies, and some by private companies and institutions. Most of the data that is generated at the mentioned levels is open in nature (Bibri, 2019a). Nevertheless, for city administrators these forms of instruments give dynamic and relatively cheap data about city activities and processes, enabling the city governance considering this aspect as a critical components of smart city concept and even adopting it in the integrative framework.

## **CONCLUSION**

As more than 50% of the world's population reside in cities, it is critical to consider how the cities can be made smart, sustainable, and livable. The cities face a wide array of challenges and they need to develop and innovate in a manner that is sustainable. Cities are to be green, safe, and also culturally vibrant amidst all the forces that may force them to be otherwise. On top of this, the cities are to be enabled to integrate with different populations and people from diverse backgrounds. The city government is crucial to solving the overarching global issues and this importance has made urban

governance to develop into a full-blown area of study. In this paper, the various aspects of smart city implementation, particularly the models of implementation have been considered and discussed. In the discussion key elements and factors have been highlighted and a keen consideration of these aspects will ensure that implementation of smart cities become successful.

## **RECOMMENDATIONS**

In conclusion smart cities and their implementation stand as a function that is dependent on myriad factors. The factors that determine the successful implementation of smart cities include better policy development, keen consideration of the people, understanding the role and influence of technology, preserving the natural environment, and ensuring proper governance. As such, the following best practices will go a long way in ensuring smart city implementations are successful in developing countries round the world and also within the continent of Africa:

1. Consider the opinions of citizens important and provide a platform for the inclusion of views from the public.
2. Adopt a global perspective of issues when developing policies while adhering to international standards and norms.
3. Understand the positive as well as negative influence of technology and balance the two.
4. Provide and adopt governance structures that support bottom up approaches and the involvement of people and communities
5. Consider the role played by big data and provide technologies that accommodate real time data analytics while measuring the impact of such data in the smart city implementations.
6. Follow rigorous design and development of models, having well trained human resources, utilizing simulation models and being well prepared and well supported by the governing entities.

With all success factors in place and better understanding of the concepts, making a city smart will be possible and further enhancing it for smarter models and services will be an attainable and sustainable goal.

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# Chapter 7

## Digital Remediation of African Folklore

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### ABSTRACT

*This chapter examines the transformation of oral and written storytelling practices in African folklore industry to online digital platforms. The chapter engages the complexities, limits, and constraints of the stakeholders participatory model as it informs digital storytelling, and applies theoretical tactics to community media and the digital storytelling movement to develop an analytic framework for understanding how these stories can be used to give a voice to the voiceless, raise awareness, increase education, and promote democracy. Folklores serve a descriptive as well as prescriptive role by consistently depicting societal and cultural norms. The increasing usage of new media technologies amongst the producers and audiences of these folklores cannot be ruled out in Africa.*

### INTRODUCTION

Languages sourced from various cultures have been used by people to tell stories. Whether these stories are elaborate fictions intertwined together by many, or carved by one from the barest bones; whether they are tiny fragments of truth told with a careful intention, designed to convey a message, expose an identity, or nurture a community, it is not unreasonable to suggest that the art and activity of folkloric storytelling is an ancient and universal part of most of the world's cultures (Hertzberg & Lunby, 2008). As something that surpasses time and space, the implications of storytelling's and other formats of folklores transformation into digital mediated

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form calls for some deeper investigation specifically as it concerns its contribution to sustainable social change. By “sustainable social change” this chapter refers to a lasting process of empowerment and transformation that aids in the reduction of poverty and makes possible greater social equality and the larger fulfillment of human potential (Quebral, 1975).

The initial part of this chapter analyze the movement of folkloric productions such as songs, drama, tales etc to online digital storytelling, and look at examples of digital storytelling projects in Africa. Digital folkloric stories and songs are being used as a tool in activist organizing and education, as a technique for increasing understanding of social stigmas such as people living with AIDS/HIV, Cancer, diabetes and as a way for victims of trauma and violence to speak out about their daily life experiences. Digital storytelling’s growing popularity suggests that it is part of a larger shift in the media industry toward grassroots, citizen and participatory based journalism in a new public sphere.

In the second part of the chapter, analysis of the ways in which the participatory method and multiplicity model inform the process of creating the digital folkloric stories is done by exploring these critical questions: To what extent can the digital folkloric storytelling movement be participatory if the model is based on a unified structure developed in the West? How are cultural differences addressed during the story telling process? For example, in some cultures the experiences of abuse and oppression are private and never spoken about publicly. What are the access issues in relation to the distribution of a digital story particularly in the developing world? Who is going to see it? What are the best ways to know and or measure its impact?

Finally, the chapter demonstrate that the four theoretical approaches to the definition of community media (Carpentier, Lie & Servaes, 2003) may also be applied to the digital story telling movement (and by movement, I make references to the content, production processes, distribution, and viewing audience) in order to situate digital storytelling within a framework for analysis and to demonstrate support for the idea that the application of digital storytelling in a community and its subsequent effects, will always be in relation to the community itself (cultural), and the relation that community has to the larger society, state, market and structures of power.

## **What is a “Digital Story?”**

The concept of a “digital story” cannot be separated from the process of creating it. A digital story can mean many things. In this context the term ‘*digit*’ means number and originate from the word *finger* and counting on the finger (Bratteteig, 2008). Digital also means, “being represented in a digital electronic system, a computer” (Bratteteig, p. 273). Cisler (1999) refers to the process of digital storytelling as a combination of traditional storytelling techniques, sometimes combined with live

performance techniques, and with the use of multi-media to provide sound and video to supplement the spoken word. “In some creations, everything is online, and the listener or computer user, explores in a non-linear fashion the mix of narrative, photographs, video clips, and sound archives. The act of creating this can be a single folklore artist working with the aid of computer equipment and memories, or it can be collaborative” (para. 23). Couldry (2008) refers to digital stories as the range of personal stories now being told in potentially public form using digital media resources...online personal narrative formats such as MySpace and Facebook, textual forms such as weblogs (blogs), the various story forms prevalent on more specialist digital storytelling sites or the many sites where images and videos, including material captured on personal mobile devices, can be collected for wider circulation (such as YouTube) (p. 388). The existence of folkloric productions from African artists such as *mulongo* songs, *mbe mukhasi* songs among the luhya community online is a real manifestation of digital story telling. It is impossible to know the exact number of “digital stories” on the Web today.

### **Digital Storytelling as “Public-Oriented” Citizen Journalism**

Communication experts in the digital age are moving toward a more public-oriented communication model which utilizes new technology to displace the formerly hierarchical, bureaucratic, and sender-oriented approach with a more Freirian and Marxist inspired vision of a participatory and receiver-oriented approach. Freirian, because the “oppressed” are treated as fully human subjects with the authority and capacity to tell their own stories, and Marxist because the power of the content itself may contribute to fulfilling, at least in part, that the “human species has a destiny that is more than life as a fulfillment of material needs” (Servaes, 1999, p. 84). In this instance, an argument may be made that digital stories, insofar as their content may be used, shared, dispersed and replicated to educate and dispel stereotypes in a community, that it is more valuable than relying solely on traditional oral storytelling whose audience will be limited to one time and space or than the mass media, whose messages often come from a source outside the community, and are disseminated throughout (Sparks, 2007). While the way in which each community interprets the digital stories will be relative to each community, this is true too for the ways in which local people from their communities view digital stories on the Internet even when the story itself does not come directly from that geographically-located community. The potential here for sustainable social change is only just beginning to be explored. Drotner (2008) notes that, “the increasing range of communication channels available and the complexity of their uses help push social boundaries of knowledge formation. Established institutions such as the education system, the

workplace and broadcast media increasingly need to demonstrate their loci of socially accepted discourses and legitimate meaning-making practices.” (p. 65)

When applied in this context, digital folkloric storytelling contributes to a reconceptualization of the notion of “community” which formerly referred predominantly to geography and ethnicity as structuring notions of collective identity or group relations (Wellman, Boase, & Chen, 2002). Now that the Internet has made cyber-communities possible, digital stories serve as part of the mirror and glue that both reflects and informs these communities. Such communities that do not depend on geography to define them, and digital storytelling could include narrations on survivors of domestic abuse, children who have been through the foster care system, and people living with HIV/AIDs. But the list goes on captured and disseminated electronically.

From a grassroots perspective, making these stories public online, makes them available to human rights and labor organizations all over the world as documented real-life data to contribute to engaged research. It also creates a space for the oppressed to speak on their own terms and to be potentially heard by others like themselves in similar situations around the world, thus aiding in the creation of aforementioned communities.

## **Participatory Method and Multiplicity Models**

It is inevitable to examine the framework for digital folkloric storytelling without discussing the paradigmatic influences, particularly on the process of digital storytelling itself. As a direct challenge to the notion of information dissemination, digital storytelling signifies a representation from the contributor, distributed in a public space that makes the story accessible to others in a way it was never before. Daniel Meadows, a photographer and journalism teacher, coordinated the ‘Capture Wales’ project in cooperation with BBC Wales (Meadows, 2003). A series of digital stories were shown on regional television and several hundred are available at the BBC Cymru (Wales) website ([www.bbc.co.uk/wales/capturewales](http://www.bbc.co.uk/wales/capturewales)). Meadows notes, “Contributors are not just originating their own material, for the first time they are editing it too. This is so unique— about Digital Storytelling, for no longer must the public tolerate being ‘done’ by media – that is, no longer must we tolerate media being done *to* us... If we will only learn the skills of Digital Storytelling then we can, quite literally, ‘take the power back’. Not for nothing is the computer we use called the ‘PowerBook’. ‘Think Different’ the Apple advert tells us. Digital Storytelling isn’t just a tool; it’s a revolution (p. 192).”

Participatory model simultaneously incorporates the cultural identities of local communities and democratization at all levels in the context of working toward sustainable social change (Servaes, 1999). Taking its roots from the Freirian concept

that all people have the right to individually and collectively speak their word, the participatory model replaced industrialization and urbanization as the stepping stones of development (Pearce, 1986). Along with these ideas came a shift in the perceived role of the media. It's previous emphasis had been on "telling and teaching" (Sparks, 2007, p. 58) but the new paradigm emphasized a more dialogic mode of media development where the primary aim was no longer the dissemination of information but rather creating media that became the voice of a community rather than for a community (Berrigan, 1981). Digital storytelling reflects this emphasis in the roots of the movement's development, and in the process of creating the stories themselves.

Folklore producers such as narrators, singers, dancers etc. must learn the techniques associated with the technology to be able to tell their story in this way. McWilliam (2009) addresses the inconsistency between the intentions of the movement and the reality of the top down expert-led training: "Digital storytelling emerged as part of a wider shift away from one-way, top down models of communication (traditional broadcast media) toward two way, bottom-up models of communication (community and/or participatory media)... Yet digital storytelling is inconsistent with either model: it occupies a middle ground as a user-consulted, but expert-led media pedagogy that developed through and alongside these emerging technologies, but not because of them (p. 146)." This point is particularly relevant to digital storytelling's role in the context of media development. Hartley (2009) makes a similar argument that engages the complexity of the theoretical paradigms under which digital storytelling operates. Although he claims that digital narrations or storytelling fills a gap between everyday cultural practice and professional media that was never adequately bridged during the broadcast era by reconfiguring the producer/consumer relationship, he argues that the dialogic approach to the production of the digital story must acknowledge the asymmetrical relationship between expert facilitator and amateur participant.

Such acknowledgement addresses that this kind of self-made media may be in reality only transforming the 'authenticity' of participants into the 'authorship' of the expert. He suggests that there cannot be an all or nothing approach toward the process of making a digital story: Expert or Everyone. Instead of choosing one paradigm over the other, he argues that Digital Storytelling calls for both on the grounds that knowledge production and acquisition is a dialogic process that comes from our interaction with others. Here digital storytelling is consistent with more participatory forms of communication for development in that it rejects the linear model of communication and replaces it with one found in dialogue (Hartley, 2009) —a dialogue which in this case, addresses the power relationship head on, and perhaps even goes so far as to decontextualize the role of the facilitator as "translator" versus "transmitter."

## **Does it Matter That it's Digital: Internet Access Issues?**

It is crucial to analyze when and how digital storytelling on the Internet is relevant to a given community and when and how it can be used to contribute to sustainable social change. This section makes two arguments that address this. One: Politically, insofar as one is concerned with contributing to new forms of democracy, participating in a form of public media that is participatory, self-authored, and produced, digital storytelling plays an important role in the empowerment of people who have before been voiceless in the public arena. Couldry (2008) states: "One important reason is that digital storytelling represents a novel distribution of a scarce resource – the ability to represent the world around us – using a shared infrastructure. Digital storytelling occupies a distinct stage in the history of mass communication or perhaps in the supersession of mass communication; as such, it has implications for the sustaining or expansion of Democracy. (p. 54)"

The consequences of these self-represented voices in the public sphere cannot be explored fully without closer scrutiny regarding who has access to the Internet. According to the CIA Factbook, as of 2005, approximately 1,018,057,389 people use the Internet out of 6,790,062,216 people, which is less than 18 percent of the world's population. In the U.S. alone, according to the CIA Factbook, more than 225 million people use the Internet and the population is more 307 million, which means nearly three quarters of Americans, arguably the most powerful country in the world, use the Internet. These numbers confirm that analysis of the success of these stories for promoting social change should not be measured necessarily by how many people "see" them, it should be measured by how much they influence the people who do see them and who partakes in the process of creating them. Although the era of top-down mass communication has often served to replace the pertinent role of folk media in communities around the world, the tenets of oral culture have actually returned to the technologically savvy digital storytelling movement—and it is these tenets that contribute to positive social change, in the content of the story itself, but more particularly in the personal and community building process that goes into production of the digital piece. While many scholars claim that digital storytelling offers opportunities for new representation not to be confused with the features of oral storytelling (Couldry, 2008; Lundby, 2008), argues that it is actually by returning to more traditional forms of storytelling via digital means that sustainable social change becomes more probable.

## **Digital Storytelling and Folklore**

One of the most ancient and useful forms of communication was the tradition of oral storytelling whereby the collective memories, myths, morals, histories, beliefs,

victories and defeats of a community were passed orally from one person to another, one family to another, one generation to another. “Folk media,” a term applied to a type of information dissemination that existed all over the world long before the written word, incorporated this storytelling in the form of traditional music, drama, dance and puppetry. Each society, race and religion used different kinds of folk media to create, reflect, educate and entertain their community with culturally specific and unique features relative to the context of the group (Cisler, 1999). These traditional live communication processes served many purposes. They contributed both to the preservation and transformation of community identity, were effective in educating and building awareness around issues important to the community, and were more often than not sites for resistance and reclamation (Agovi, 1994).

Digital Storytelling and Folklore (folk media) share two roots. One: they both may (but are not required to) rely on art, song, and performance in the context of the storytelling, and two: the story itself is subject to transformation via the participation of a live audience or via the expectation of interaction that is now reflective of a participatory new media culture. Bruns (2007) writes, “Before the emergence of the ‘fixed text’ model, textual performance was re-creative, collective, and collaborative; we are now returning to a similar textual engagement based on remix, sharing, and mash-up. At either time, such reworking was based in performance built upon performance: an ongoing process of reinterpretation and change; Elizabethan theatre, then, was a pre-parentetical mirror image of the cultural processes we experience today.

Digital media technologies provides an opportunity for folklore artists to share their stories in a supportive environment, listen to others, learn new skills collectively and individually, while providing and receiving feedback. Certainly oral stories undergo transformation as they are passed from one person to another, one community to another, as the needs and desires of the people changes and evolve. It is also important to note that the capacity for digital stories to contribute to sustainable social change is not entirely dependent on being published and viewed online. As mentioned earlier, copies of the stories are often made into a DVD, published online, and accompanied by guides used to facilitate educational discussions and/or screenings of the DVDs in the community. This technological archiving of story and culture is something that can be shared, replicated and dispersed throughout a community and used by advocates to inform policy change, but does not depend on being published online.

## **Digital Technologies Used for Folkloric Remediation**

Digital technologies are online means of interactions among people; involving computer-mediated tools and Internet based applications that allow people to create, process, share or exchange information, ideas, pictures and videos. Kaplan and

Haenlein (2010) define digital media technologies as “a group of Internet-based applications that build on the ideological and technological foundations of web 2.0, and that allow the creation and exchange of user-generated contents.” According to Kaplan and Haenlein (2010) digital media technologies include: facebook pages, whatsapp accounts, youtube myspace, flickr, linkedin, orkut and buzz. From the list above, it is clear that new media technologies are the commonly known social media platforms in Nambale Sub County such as Facebook, Instagram, Twitter, YouTube, LinkedIn, MySpace, blogs, Flickr, Buzz, MySpace, Orkut and other highly interactive websites. These social media are media for interaction and relationships; largely informal and they are now popular means of communication and quite accessible. They are popular because they can be accessed with ease on a variety of platforms – laptops, PCs, tablet computers, and smart phones (Dominick 2012, p. 94). Social media takes on different forms including internet forums, microblogging, podcasts, social networking, bookmarking, wikis, social curation, weblogging.

Digital media technologies are about conversations, community, connecting with the audience and building relationships. It does not only allows users to hear what people say about them, their preferences and choices, but also enables users to respond and make comments. Digital media embodies features like interactivity, adoptability, portability and convergence. These features have led to their phenomenal growth and usage. The total estimated global active internet audience is now 625 million. Mobile internet usage has now reached nearly a fifth of all active internet users. From [www.matthewingram.com](http://www.matthewingram.com) it is stated that there are two hundred million active users of Facebook with a hundred million users logging on at least once every day in 170 countries/territories in 35 different languages. It is also estimated that there are an average of a hundred friends for every Facebook user (Morah and Uzochukwu, 2012). Another obvious characteristic of digital social media is its lack of strict institutional gate keeping as present in other types of media. Users of social media have freedom to write and post all sorts of materials, which might not be socially responsible, and unethically right to people connected to them.

Furthermore, digital social media outlets are not paid for. This is one reason that accounts for the large number of users on these sites all around the world. Most of these social media sites are free; users just need to be connected to the Internet, register and they are open to use any social media channel for interaction and communication. Here are examples of popular digital social media forms: Facebook is a popular free social networking website that allows registered users to create personal profiles, add other users as friends, give status updates, send messages, upload photos and video and keep in touch with friends, family and colleagues. It is the world’s largest social network, with more than 1.32 billion monthly active users (Tufts, 2015). Users create a personal profile, add other users as friends, and exchange messages, including status updates.



Groups of people among them folk media artists and brands create pages and Facebook users can “like” brands’ and cultural works pages. Twitter is a free social networking and micro blogging platform that allows registered members to stay connected and broadcast short posts (140-character limit) called tweets. Folk media artists on Twitter can follow each other and their fans and rebroadcast other users’ tweets. LinkedIn is a social networking site designed specifically for professionals with similar areas of interest. It enables users to share information and participate in conversations. The goal of the site is to allow registered members to establish and document networks of people they know, trust and connect with professionally. This could be folk media artist, professionals in this area and even fans. Pinterest is a social curation website for sharing and categorizing images and photos found according to individual interests and preferences. Clicking on an image on Pinterest will take you to the original source of the image. Example, if you click on a picture of an artist’s folk production, the user will be taken to a site where he can purchase or access them. Instagram: it is a free photo and video sharing platform that allows users to apply digital filters, frames and special effects to their photos and then share them with followers and on other social networking sites. Flickr: It is similar to Instagram; it is an image and video hosting website with a community of friends. Photos can be shared on Facebook, Twitter, and other social networking sites. YouTube & Vimeo: They are websites on which users post videos free of charge which can be accessed and viewed by anyone in the world.

## **The Influence of Digital Technologies on Folk Media Industry**

The increasing usage and prominence of new digital technologies amongst folk media fans and artists cannot be ruled out. Forms of digital technologies such as the social media have a growing population of users and audience. Digital media technologies have advanced digital storytelling. These technologies have enabled easy access to recorded productions from artists online. You simply have to be their friends on facebook and ones they post their works there you will be able to find out what they have produced. In fact you can download what they posted and listen or watch them from your house. The *mulongo* narrations and the *mbe mukhasi* song on facebook and other online visible arts are good examples. During performances you can record many scenes with your smart phone. Thereafter you can decide to share on the various social platforms for multiple access by the various audiences.

Cisler (1999) refers to the process of digital storytelling as a combination of traditional storytelling techniques, sometimes combined with live performance techniques, and with the use of multi-media to provide sound and video to supplement the spoken word. “In some creations, everything is online, and the listener or computer user, explores in a non-linear fashion the mix of narrative, photographs, video clips,

and sound archives. The act of creating this, could be a single Folklore artist working with his or her computer equipment and memories, or it can be collaborative” (p. 23). Couldry (2008) refers to digital stories as the range of personal stories now being told in potentially public form using digital media resources, online personal narrative formats such as MySpace and Facebook, textual forms such as weblogs (blogs), the various story forms prevalent on more specialist digital storytelling sites or the many sites where images and videos, including material captured on personal mobile devices, can be collected for wider circulation such as YouTube (p. 388). This is demonstration of digital media technologies as a platform of remediation of content from folk media which is in agreement with Bolter and Grusin’s (1999) argument that most new media platforms have no content of their own but depend on other media for content to disseminate to their audiences.

Digital storytelling is consistent with the move toward a more public-oriented communication model which utilizes new technology to displace the formerly hierarchical, bureaucratic, and sender-oriented approach (Servaes, 1999) with a more Freirian and Marxist inspired vision of a participatory and receiver-oriented approach. This resonates perfectly with folklores since most of them are participatory in nature. Freirian because the “oppressed” are treated as fully human subjects with the authority and capacity to tell their own stories, and Marxist because the power of the content itself may contribute to fulfilling, at least in part, that the “human species has a destiny that is more than life as a fulfilment of material needs” (Servaes, p. 84). In this instance, an argument may be made that digital folklore stories, insofar as their content may be used, shared, dispersed and replicated to educate and dispel stereotypes in a community, that it is more valuable than relying solely on traditional oral storytelling whose audience will be limited to one time and space or than the mass media, whose messages often come from a source outside the community, and are disseminated throughout.

While the way in which each community interprets the digital stories will be relative to each community, this is true too for the ways in which local people from their communities view digital stories on the Internet even when the story itself does not come directly from that geographically-located community. The potential here for sustainable social change is only just beginning to be explored. Drotner (2008) notes, “The increasing range of communication channels available and the complexity of their uses help push social boundaries of knowledge formation. Established institutions such as the education system, the workplace and broadcast media increasingly need to demonstrate their love of socially accepted discourses and legitimate meaning-making practices.” (p. 65).

When applied in this context, digital storytelling contributes to a reconceptualization of the notion of “community” which formerly referred predominantly to geography and ethnicity as structuring notions of collective identity or group relations (Wellman,

Boase, & Chen, 2002). Now that the Internet has made cyber-communities possible, digital folk stories serve as part of the mirror and glue that both reflects and informs these communities. Such communities that do not depend on geography to define them, and who have used the CDS model for digital folklore storytelling include survivors of domestic abuse, children who have been through the foster care system, and people living with HIV/AIDs. But the list goes on.

The global Nature of digital technologies has made it possible for folk media fans and artists to access diverse folk media contents from all across the world. Uploading contents on African culture – values, lifestyle, dressing, arts, music, and food on social media afford the world to see and appreciate the various aspects of African cultures and Nambale in particular. The internet is like a source for everything we need on folk songs, today I can access any production of my favourite local musician online from any part of the world. Once I get it I can tag or post it on my various online platforms for easy access for my friends. The ease of access to folk media production online makes it possible for crucial cultural information to get into discussions and writings thus making it easy for the perpetuation of the culture. Social media has enhanced more than ever better the opportunity for African countries to make their own socio cultural statements. In the words of Ohiagu (2010), social media and other internet powered technologies have helped African society develop, enrich and preserve its own cultural values and ensure that it is conspicuously represented in the emerging global culture. An example of utilising the social media for global display is Nigerian Events and Aso-ebi – an Instagram account solely dedicated to the display of Nigerian traditional wedding attires made with Ankara, Asooke and different local fabrics. This page has thousands of followers giving them opportunity to see various styles and appreciate the Nigerian culture and fabric. From these sites, people replicate the styles for their own use; and in turn making for the sustenance of an aspect of the African culture. The use of social media for the display for African styles and dresses has led to the infusion and diffusion of African prints and materials in the designs of foreign clothes designers. Designers now use African materials to make fabulous attires that are displayed on runways and sold around the globe. This definitely helps in sustaining and nurturing the African culture.

Digital media technologies have served as archives for cultural materials (folk songs, dances, narratives. Being a mass medium that is not transient, new media technologies especially those that form social media can be a repository or archive for African cultural materials thus enabling the sustenance of the culture. Contents on social media are available 24 hours a day; 7 days a week and users have the opportunity of viewing previous content on a site any time. This will mean that social media sites, pages or accounts that are dedicated to African culture displaying - videos, poems, literature, drama, music, images - can be stored and accessed anytime, even in many years to come.

Digital media technologies have created virtual cultural and ethnic communities that may be beneficial to folk media industry. Social media builds close interactions among folk media users. It facilitates greater connectedness among users of the same ethnic group; reinforces existing ethnic links and ties. Namulunda (2016) puts it this way “internet use also has the effect of linking together web users with the same ethnicity, into a tightly knit online community.” Folk media artists and fans that use social media can create pages displaying African folk media culture. This would offer consumers of African folks in other parts of the world and Africans raised outside the continent a window to fully appreciate African folk productions and its culture/values/heritage. Today there are now pages displayed in African languages showcasing African cultural heritage among them folk media forms. For example, Google luhya folk songs, the bull fighting events etcetera, you will easily find them online.

The Multi-media nature of new media technologies has improved the sharing of folk media productions. Social media is multi-media in nature, that is, it allows for written, graphic, pictorial and video elements to be uploaded and shared on it. With this feature of social media, plays, images, skits on different aspects of African culture can be portrayed. Examples are drama on family values, short documentary on preparing an African dish. This extent the traditional productions to a wider hence making the more popular and giving them a bigger reach.

Digital media technologies have perfected the art of piracy. This study revealed that well-known and older folk musicians who could previously afford to sell their audio cassettes and CDs have lost a substantial portion of their potential earnings due to the widespread sale of pirated recordings. Lesser known musicians do not have the notoriety or resources to obtain recordings in the first place. As a result, the folk music market is currently dominated by local individuals and businesses that use low-cost recording devices to obtain recordings from live performances and sell them at low cost to interested listeners, almost always without permission from the folk musicians.

The traditional way of distributing music has been affected by the changes that the music industry has gone through. The changes have been caused by the new technologies and the use of the Internet for distributing folk music and other performances as a digital information good (Bockstedt, Kauffman, and Riggins 2006). The different platforms that have given consumers the chance to upload music have presented major challenges to both folk artists and music distributors as they have negatively impacted on music sales.

The move from vinyl records and cassettes to compact discs has made it much easier for illegal reproduction of music due to technological advancements. Borghi and Stavroula (2013, p. 38) notes that, digital technologies and the environment of networking have dramatically changed the way by which copyright works are

reproduced, distributed and used. This is because digital information goods have become as easily reproducible and exchangeable as never before in the history of media. It is not surprising that online distribution of copyright content has attracted much litigation, legislative response and public attention as one of the major issue of the so called digital age.

Record labels and artists have over the years faced massive losses because of the file sharing platforms on the Internet. Goldschmied (2008, p.35) contends that, — The record labels' losses in revenue are correlated to the widespread dissemination of copyrighted folk sound recordings via peer to peer networks created for allowing people to unlimited access to folk productions for free. The folk media industry commercial practice has been said to have been slow to catch up with technology. Anikulapo-Kuti (2011). is of the view that the blame of the decline in global folk production's sales should not be entirely on illegal downloads from the Internet. There are other factors that include the slowing global economy and the continuing corporate concentration of the music industry leading to the reliance on formulas and reluctance to invest in new artists. Instead of artists criminalizing Internet users, Anikulapo-Kuti (2011). urges artists to compete with Internet piracy by looking at other options like legitimate online music distribution and making use of the marketing possibilities provided by the Internet.

## **Digital Storytelling and the Four Theories for Community Media**

The last part of this paper is an argument for the applicability of the four theoretical approaches to community media (Carpentier, Lie & Servaes, 2003) to the role and purpose of digital storytelling. This is important because the four approaches could be used as analytical framework for exploring the broad range of perspectives found in digital stories, increase our understanding of the ways they can offer an alternative for a wide range of hegemonic discourses. Although it is not a prerequisite for digital stories to resist hegemonic discourses in society, as is often the case with the development of community media, the very act of producing and making a digital story public can in fact serve this purpose. The four theories of community media are born from a framework that acknowledges that identities are “relational, contingent and the result of articulatory practices within a discursive framework” (Carpentier et al. p. 52). The first takes an essentialist approach, and argues that community media's role is to serve the community from which it originates. The second approach claims a more relationalist perspective and views community media as an alternative to the mainstream. The third approach sees the media as part of civil society, and the fourth approach, sees community media as a rhizome, allowing the incorporation of aspects of contingency, fluidity and elusiveness in the analysis.

Digital storytelling in the context of any community draws direct parallels with the first approach as both the process and the story is almost always oriented “towards a community, regardless of its exact nature (defined geographically/spatially or otherwise). A primary goal of the digital storytelling workshop is to create a community among the storytellers, where ideas and narratives can be exchanged, shared, discussed and created in a safe space, in an environment where topics are not chosen by “professional communicators” but indeed by the participants themselves. The end result—the narrative moved to digital form—has the potential to create and sustain communities via cyberspace that are not bound to geography, but can inform and nurture it nevertheless. This comparison becomes potentially problematic when considering access issues, as not everybody in the “community” may have access to the Internet, but here again it is important to note that the digital stories are not being used just online, but as part of educational and advocacy packages by NGOs in the local communities, and as part of local screenings accompanied by guided talks.

The second approach emphasizes community media’s relationship to the mainstream media, and defines it as existing as a supplement or alternative voice. Mainstream media is often viewed as large-scale, state or corporate-owned, vertically-structured, voice of dominant discourse and representations (Carpentier et al. p. 56). Community media can represent just the opposite: Small scale, independently owned, horizontally structured with active participation from the community, carriers of non-dominant discourse, emphasizing self-representation. The digital storytelling movement has, at its roots, an emphasis on self-representation. The stories are made using small-scale equipment, which participants learn how to use during the course of a three-day workshop. The fact that mainstream media often imitate what was once perceived as

smaller-scale media, independent project is addressed briefly by Carpentier, et al. 2003: “At the same time, the critical stance towards the production values of the ‘professional’ working in mainstream media leads to a diversity of formats and genres and creates room for experimentation with content and form. In this fashion, community media can be rightfully seen as a hot bet for innovation, later often recuperated by mainstream media.” (p. 57).

The third approach views community media as part of civil society, holding its position as the ‘third voice’ (Servaes, 1999, p. 260) between state media and private commercial media. If civil society is to be defined as a group of intermediate organizations, separate from the privately owned economic organizations operating in the market economy, personal and family relations, and from the state and quasi-state organizations, (Carpentier et al. 2003), then community media’s relevance and connection to this civil society remains crucial for democracy. If communication is a human right, then community media is one place where that right is exercised and opportunity for participation in the public sphere is realized. Digital stories,

when viewed through this approach are an active vehicle, removed from the state and the market, with the potential to promote more authentic forms of democracy by contributing an additional voice to the public sphere particularly, the voices of people who have been marginalized and oppressed, and who largely remain voiceless in the mainstream media of the host country.

The fourth and arguably most important approach builds on “non-linear, anarchic and nomadic” (Carpentier et al. 2003, p. 61) concept of the rhizome and uses it as a metaphor to both “highlight the role of community media as the crossroads of organizations and movements linked with civil society.” (p. 61). This approach argues for the contingency and elusiveness of community media, but recognizes the many connections community media has to civil society, the market and the state without having to lose its identity. Taking a less antagonistic (though potentially idyllic) view, this community-media-as-crossroads approach acknowledges the different types of relationships the media has to the institutions that make up society and emphasizes the importance of the movements of diverse oppressed people to come together in order to allow the “common articulation of for example, antiracism, antisexism and anticapitalism,” (Mouffe, 1997, p. 18).

## **CONCLUSION**

Digital storytelling is a mediatized transformation of a timeless process and a product—the implications of which are just beginning to be explored. At the risk of sounding somewhat contradictory, I end this chapter by acknowledging Hartley’s argument that digital storytelling should be used for more than self-expression (2009). He warns that the cultivation of the personal as sufficient ambition for the majority (while those ‘in the know’ disappear behind closed institutional doors) can lead to the very evils of relativism that experts rail against, encouraging the general public to believe that anything goes, that knowledge is only a matter of opinion, or that self-expression is the highest form of communication. (p. 208) This chapter suggests that it is indeed possible to have both a democratic space for the self-expression of people who have heretofore been ignored and neglected in the public sphere, and to use the digital storytelling process to generate new argumentation, new forms of journalism and new works of the imagination. Hartley (2009) goes on to argue that digital storytelling needs to be understood as an extension of the possibilities of knowledge, even while their experiential self-expression may be an assault on the closed expert system as such. He suggests that when large numbers of otherwise excluded (or neglected) people are emancipated into the ‘freedom of the internet,’ it will, if successful and if pushed beyond a ‘look at me’ stage, assist not only in self-expression and communication but also in the development of knowledge...”

(p. 208). Further exploration is needed of the ways this “development of knowledge” can be used to promote sustainable social change.

This chapter engaged the complexities of the participatory model as it informed the intention behind digital storytelling (but not always the reality) and situated digital storytelling as a direct challenge to the notion of mass media information dissemination, signifying a representation from the contributor him/herself, distributed in a public space that makes the story accessible to others in a way it was never before. The participatory model, building on a Freirian notion that all people have the right to individually and collectively speak their word, is reflected in the capacity for digital stories to give people a voice in the public sphere who formerly did not have a voice. Each narrator is responsible not only for his/her story, but for producing it and editing it as he/she sees fit. Addressing the inevitable expert/amateur binary in the context of the participant method as it relates to the digital storytelling workshops becomes of crucial importance in order to create the dialogic community required for the process.

The chapter has also explored Internet access issues and made two arguments for digital storytelling’s potential to contribute to new forms of democracy. One: Engaging in a form of public media that is participatory, self-authored, and produced, digital storytelling plays an important role in the empowerment of people who have before been voiceless in the public arena. Two: Despite the fact that less than 20 percent of the world’s population has access to the Internet, it is important to view the success of digital storytelling and its ability to promote social change relative to the impact the stories and the process of creating them have on the local community that is making them. Digital stories share a lot with oral storytelling as do the digital stories themselves by incorporating music, drama, art and poetry into the process of sharing and creating digital stories. Most ancient societies, races and religions have used different kinds of folk media to create, reflect, educate and entertain their community with culturally specific and unique features relative to the context of the group. By returning to that, we are also returning to more horizontal and participatory forms of communication.

Finally this chapter made an argument for the applicability of the four theoretical approaches to community media (Carpentier et al. 2003) to the role and purpose of digital storytelling in order to begin to develop an analytic framework for understanding the multiple ways these stories can be used locally and globally to promote sustainable social change— both in the potential for promoting a more authentic democracy in the public sphere and in the local community-centered processes of creating them in the first place. Storytelling—as art form, media text, and practical means of communicating—will no doubt continue to endure the cycles and various manifestations that come with changing times and technologies. As we are decentered and transfigured by the multiple effects of globalization, the



implications of storytelling's transformation into digital mediatized form necessitates deeper analysis particularly in the context of its potential contribution to sustainable social change.

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## Chapter 8

# The Relevance of Feedback Mechanisms to Library Databases in Academic Libraries

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### **ABSTRACT**

*This chapter studies the relevance of the feedback mechanism on the library database in academic libraries. The study is a systematic literature review which uses Kitchenham and Charters methodology. The chapter has three objectives, which are to enumerate the concept of information retrieval and its problems and the relevance of feedback mechanism to the database in academic libraries. The findings indicated that feedback is very important in the information retrieval systems most especially in relation to the database in an academic library. The contributions of this chapter show that the feedback mechanism is relevant to information retrieval. It also creates awareness among librarians of the importance of these mechanisms and encouraged them to seek for a database with these components whenever they want to buy a new database for their various institutions. The chapter, however, recommends further empirical studies on the subject matter.*

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## **1. INTRODUCTION**

Library database provides online storage systems for the library materials which includes books, serials, and non-books material. According to one of the foremost Librarian Ranganathan who stated as part of his established laws for librarianship defines Library as a growing organism. This, however, implies that the Library acquired material in a different format every day and stored them in a limited space. It is expected that a time will come when there will be no space to store those materials. Based on this, therefore, the library database is expected to provide an alternative storage place for the libraries where a large number of materials is expected to be kept for use. According to Oluwadamilola & Martins, (2018) database provides an organized collection of related data. It also provides support for the day-to-day operations of the library. It provides access to resources across subject areas and topics (Lasya & Tanuku, 2011). Some of the information contained in a library database includes books, users details, book status, authors and categories of library resources (Oluwadamilola & Martins, 2018). Chowdhury, (2012) stated that it provides resources such as books, monographs, serials, and circulation. It also gives room to online searches through the internet. It provides access to the news bulletin, newsgroup and electronic journals and conferences. Other items on the library database are multimedia resources. Based on these benefits of library database, the librarians in Africa have to shift their purchase of books and journal to the digital mode purchase as this will give the users unlimited and unrestricted access to all library resources which may not possible in the traditional print era (Shafiq & Wani, 2018). The online database has removed the bottleneck of keeping the library materials within the four walls of the library, the library can now serve local, regional and international users (Hamza Ukashatu Musa, Aliyu Ahmad, Maryam Bello Yunusa, & Abbas Hamisu, 2015).

In furtherance to this, however, Ferreira et al., (2011) are of the view that though the database provides huge resources, it must also provide effective retrieval mechanism to the users. Azad & Deepak, (2019) explains that there are a huge amount of data in an online database, but it has not been accompanied by the technical approaches for extracting relevant data. The database may not yield relevant results. This may be that the keyword used belonging to many topics, the result may not be the focus on the topic of interest. Similarly, the user may not know how to formulate query or the search term used by the library users may be too short to capture what they want. Based on the foregoing, therefore, it is expected that the feedback mechanism will help in solving the aforementioned problems. This paper has three objectives which are (1) to analyse what is information retrieval? (2) what are the problems with information retrieval devices?, (3) what is feedback mechanism and how relevant are the feedback mechanism to library database?. The other sections of this paper are

arranged under the headings such as Digital Libraries, related works, methodology, conducting literature review, the findings from the literature review, information retrieval, problems of information retrieval, feedback mechanism, types of feedback mechanism, its relevance to the library database, discussions and conclusions.

## **2. RELATED WORKS**

Library database provides access to accurate and relevant information in a given field. The searches on some library database are carried through keywords such as subject, author and title (Lasya & Tanuku, 2011). Databases is an online document management system used in the integration and storing of information. It is capable of linking and sharing of information and facilitates the navigation among related document (Reeves & Stenstrom, 1999). It stores huge data and provides access to information retrieval. Information retrieval is the process of storing, searching and the retrieval of the information that matches the interest of the library users (Madankar, Chandak, & Chavhan, 2016).

However, Balakrishnan, Ahmadi, & Ravana, (2016) observed that finding materials in the African library database that stored thousand of the document can be very difficult. There have been concerted efforts made by the researchers to ensure or guarantee the best way to conduct searches and to improve the search result (Balakrishnan et al., 2016).

Some of the problems of information retrieval has been attributed to the inability of the database to consider the meaning or the context of those word contained in the document. Similarly, the frequency of the word in the documents is also considered useful information. Some researchers have argued that the meaning of the word used in the document varied according to the context in which they are used. The information retrieval system does not take cognizance of the synonyms. In addition, the order of the word also is not considered. In furtherance to this, the information retrieval needs to recognize the group of words. Other items needed in the information retrieval include the subject and the knowledge of the document (Chouni, Erritali, Madani, & Ezzikouri, 2019).

Ma & Lin, (2014) explains that the feedback mechanism is the important technique needed to resolve the aforementioned challenges. This feedback can be done automatically without looking for extra efforts.

### **3. DIGITAL LIBRARIES**

Digital libraries stores their materials in electronic or digital format and make them accessible through computers. The resources may be access remotely or stored locally (Bamgbade et al., 2015). Digital libraries may also be described as those organizations with inter-networked data storage systems which can be accessed by the users from anywhere in the world. It is provides accessibility to it resources through the internet facilities. It exposes it users to advanced knowledge and improve on the peoples' lives in Africa (Uzuegbu & McAlbert, 2012). Zirra, Ibrahim, & Abdulganiyyi, (2019) stated that the resources and services of the digital library are made available through electronic form. Witten, (2005) while explaining some of the benefits of digital libraries in Africa observed that the collections of the digital library are usually large with well-designed library software.

Bamgbade et al., (2015) explains some of the functions of digital libraries in Africa as stated below:

- It provides access to primary information sources;
- It also contains both print and multimedia;
- The resources are made available through the internet;
- The interface is user-friendly;
- It has some hypertext which can be used for further navigations;
- It has advanced search interface for retrieval purpose;
- It is usually integrated with other digital libraries; and
- It is more convenient to use.

In the same vain, Bamgbade et al., (2015) & Uzuegbu & McAlbert, (2012) further enumerate the purpose of digital libraries in Africa as:

- Efficient delivery of information to users.
- Enhance systematic procedures for the collection, organization and information in digital format.
- It promotes collaborations and communications among the institutions.
- It provides leadership roles in the information dissemination and generations.

However, despite the huge purpose and benefits of digital libraries in Africa, Balakrishnan, Ahmadi, & Ravana, (2016) observed that finding materials in the African library database that stored thousands of the document can be very difficult. Ma & Lin, (2014) explains that the feedback mechanism is the important technique needed to enhance efficient delivery of information and helps the users in retrieving accurate results for their queries. Still, the review of this study has shown that there is

dearth of researches on the use of feedback mechanism for the information retrieval of digital libraries in the African settings hence the need for this work.

#### **4. METHODOLOGY**

This systematic literature review (SLR) aims to evaluate the topic under discussion. This paper uses Kitchenham & Charters, (2007) methodology. The method is used because it is capable of providing a credible evaluation of the topic under review. The methodology consists of three steps which are:

- **Planning the SLR:** This involves the establishment of the needs and the objective of the review. A set of research question must be stated and review protocol needs to be established.
- **Conducting the SLR:** This is where search strategy is conducted to select the relevant literature. This is done according to the protocol. In this, the relevant literature is included while the irrelevant ones are excluded.
- **Reporting the SLR:** In this phase, the result of the study is communicated using effective means.

#### **5. PLANING THE SYSTEMATIC LITERATURE REVIEW**

This section discusses the planning step of the SLR. It shows the research questions and the research protocol.

##### **5.1. Research Questions**

The research questions were defined with the aim of establishing the needs of discovering the state-of-the-art feedback mechanism in the information retrieval process. The research questions emanated from the contents of literature under review.

**RQ 1:** What is information retrieval.

This question is aimed at providing what information retrieval is in the library database.

**RQ 2:** What are the problems associated with information retrieval.



### ***The Relevance of Feedback Mechanisms to Library Databases in Academic Libraries***

The question is aimed at understanding what problems are associated with information retrieval.

**RQ 3:** What is a feedback mechanism and its relevance to the library database.

The question is intended to understand how the feedback mechanism can help to achieve better information retrieval.

## **5.2. Developing the Systematic Literature Protocol**

This section explains in details how the search query was conducted and the criteria used for inclusion and exclusion.

In order to retrieve relevant literature, an automatic search was conducted using the various database such as Scopus, IEEE Xplorer, ACM, Web of Science, Science Direct. Search queries that will help in the achievement of the objectives of the study. During this process, terms used to conduct the searches include Library database AND information retrieval, Library database, AND feedback mechanism. Information retrieval AND feedback mechanism. Information retrieval AND feedback technique. Table 1 below shows the search strings.

*Table 1. Search strings*

Library database AND information retrieval, Library database, AND feedback mechanism. Information retrieval AND feedback mechanism. Information retrieval AND feedback technique.
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## **6. CONDUCTING THE LITERATURE REVIEW**

This section discusses how the research protocol was conducted. Similarly, works relating to the identification and selection are discussed.

### **6.1. Identification and Selection of the Research Paper**

During this study, seventy relevant papers were identified. Ten (10) of them were removed because they were duplicates. Some of the research works were available in more than one database. In furtherance to this, another ten was removed because it was discovered they were written in another language. Finally, 50 research work

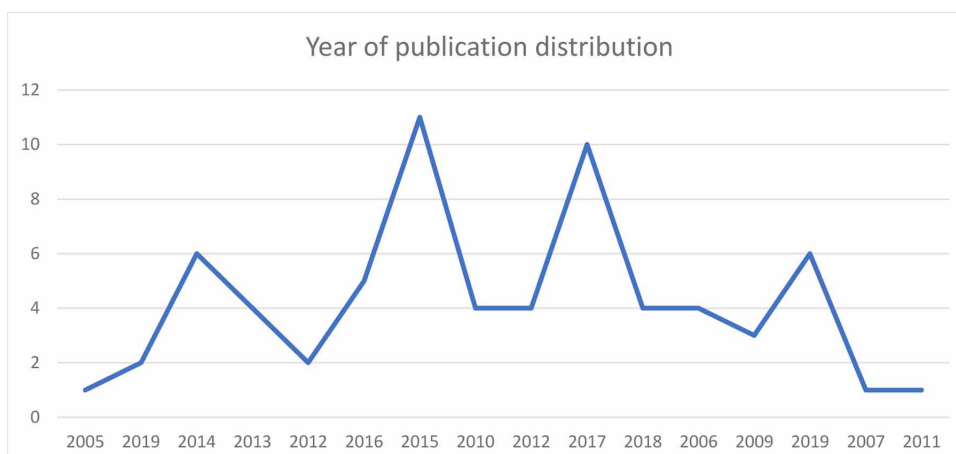
was included in the final analysis. Some of the criteria used for the paper included in the study include:

- Was the paper based on research or it is only a mere lesson?
- Whether the paper has a clear statement of objectives.
- Is there an explanation on the context in which the paper was conducted?
- Whether the paper addressed the stated objectives.
- Whether the paper used a rigorous method to achieve the stated aims and objectives.
- Are the findings clearly stated?

## 7. THE FINDINGS OF THE SYSTEMATIC LITERATURE REVIEW

In this section, the result of the SLR is presented. The general information about the data collected is discussed followed by the consideration of the research questions. The first section display publication distribution by year in a line graph. Figure 1. Shows the publication distribution by year.

*Figure 1. Publication distribution by year*



From the above figure, it can be seen that from 2005, the research work started to increase but stated decreasing from the year 2015. Also, up till 2015, the figure continues to show the increasing relevance of this topic under discussion. Similarly, over 58% of the research work was published before the year 2015. But, only six

percent of the publication was published in conferences while large percent were published in various journals.

## 7.1. What is Information Retrieval?

The RQ1 aim is to shed light on the concepts of information retrieval. It considered the definition of five different authors for this study. Table two below shows the various definition. The authors have explained that the purpose of information retrieval is to enhance access by the users to the stored materials in the database. It will enable the users to get the desired materials which are expected to be used to satisfy their information needs. The retrieved document must be able to satisfy or meet with the demand of an individual. Therefore, the concept of information retrieval includes searching, storing and the retrieval of information. The detail is summarized in Table 2.

*Table 2. Definition of information retrieval*

<b>Author</b>	<b>Definitions</b>
(Madankar et al., 2016) (Sangiaco, Leoncini, Decherchi, Gastaldo, & Zunino, 2010)	Information retrieval is the process of storing, searching and retrieval of information that is capable of meeting the request of the users.
(Din, Yahya, & Haron, 2013)	Information retrieved must meet with the demand of the users. It is an important activity which is conducted daily by the users to get their task done.
(Koolen, Kamps, & de Keijzer, 2009)	Information retrieval process provides access to the endless resources on the library database which created more impact on the life of professional and their personality.
(Madankar et al., 2016)	Information retrieval is a process that involves data storage, searches, and retrieval of information which must meet with the request of the users. When users find the materials in a language understood by them, such materials are accepted and used.
(Myall, Bls, & Weihs, 2016)	Information retrieval includes elements such as documentation classification, modalities, categorization, system architecture, users interface, filtering, language, data visualization, and behavioral science.

The research question 2 (RQ2) dwell on the problems confronting the users during the information retrieval from the library database. The below factors are discussed as the basic problems of information retrieval.

### 7.1.1. Information Retrieval Problems

- **Uncertainty:** Myall et al., (2016) explains that it is difficult to predict the needs and wants of the users. Most at times when the users hit on the library database interface to get what they need, they tend to get more than their desired results. Based on this, the users are frustrated. He further explains that information technology was produced to satisfy human ambitious desires with little or no considerations on how they can be used to satisfy human needs. Such information sent to everybody leads to information overload and subsequent frustrations on the part of the users;
- **Finding literature rather than the content:** Ruixiang, Yao, Feng, & Hui, (2019) added that traditional information retrieval is geared towards finding the literature rather than the content of the literature. The scenario removed the position of the users in the intelligence information retrieval process which lead to inefficiency in the information retrieval. The information retrieval system is devoid of the users' evaluation. Based on this, therefore, the returned results of the information retrieval is not welcomed by the users. He, however, suggested that a one-step information retrieval system will remove the burden of the users greatly;
- **Lack of consideration for word synonyms:** Chouni et al., (2019) stated that the meaning of the words varied based on the context in which they appeared. But most information retrieval systems do not give considerations to the synonyms and the word order or the appearance is not taken into consideration. He also argues that a group of words is needed to be taken into consideration If the information retrieval system is to function properly.

### 7.1.2. Contributions

Stewart & Schmetzke, (2005) observes that most of the Librarians most especially in Africa rarely raise questions when they are selecting electronic materials including database for procurement. He adduced the reason for that as lack of or inadequate knowledge of the African librarians on issues relating to the required technology in the library. They relied on the expertise of other people on both accessibility and usability of the technology. Similarly, the database producers also used to capitalize on the ignorance of the African librarians when advertising their product by not given adequate information on what their technology can do and what it can not do. In view of this, therefore, this study has contributed to three areas such as:

- Explaining the problem of inefficiency arising from the use of library databases information retrieval in Africa settings;

- It also creates awareness among the African librarians on feedback techniques needed in information retrieval by stating different types of feedback mechanism and their importance;
- The third contribution explains the relevance of the feedback mechanism to the information retrieval system while using the library database in the African settings.

## **7.2. Feedback Mechanism (Technology)**

In this section, the RQ3 discusses the feedback mechanism or techniques, types and its relevance to the library database information retrieval.

The feedback mechanism is an interactive process of improving retrieval performance. In this process, the user submits the query and the information retrieval system will return an initial result and wait for the user to make the judgment on the relevancy of the document presented to him (Lv & Zhai, 2009). Wu, Luk, Wong, & Nie, (2012) stated that it is expected that the user will use his/her effort to make a judgement whether the returned document is relevant to his information needs and the retrieval system will reformulate the query based on the judgment provided by the users and produce new results.

### **7.2.1. Types of Feedback Mechanism (Technology)**

There are different types of feedback mechanism which are summarized in Table 3. Three types of feedback mechanism identified they are implicit technic, explicit technique, and the pseudo feedback technique.

### **7.2.2. The Relevance of Feedback Mechanism to Library Database in Academic Library**

The relevant feedback mechanism is a technique used in reformulating patron's query based on the result of the initial retrieval. The result of the initial query can be used for the second retrieval which serves as an improvement to the first retrieval. The feedback mechanism provides an automatic reformulation while the patron evaluates the first retrieval results by judging the relevance of each document presented from the library database. The existing library database expects the library patron to formulate their information needs using the Boolean query by making use of AND, OR and NOT with the combination of index terms such as author, subject and the title. However, no provision was made for the subject reformulation when the patrons are not satisfied with the initial results. The patron themselves have to continue to use different approaches to look for more relevant materials (Rooney,

Table 3.

Author	Types of Feedback Mechanism	Definition and the Importance
(Balakrishnan et al., 2016), (Núñez-Valdéz et al., 2012)	Implicit feedback	This technique estimates the relevancy of the document based on the users' behavior without expecting any additional efforts from the users. Although it contains more noise and it does not show relevancy.
(Balakrishnan et al., 2016),	Explicit feedback	The explicit feedback requires the efforts of the user to determine the relevancy of the document initially presented by the information retrieval system and after the evaluation, the system will represent new result based on the judgment of the users. This type of feedback mechanism is more accurate than the implicit mechanism.
(Zhou, Truran, Liu, & Zhang, 2013)	Pseudo Feedback	This technique extracts terms from the top-ranked document which was initially returned by the information systems. The term extracted are assumed to be relevant and added to the sources query and Subsequently resubmitted to the information retrieval systems which produce a new result which will be of a high quality results.

Patterson, Galushka, & Dobrynin, 2006 & Arevalillo-herráez & Ferri, 2013). The relevance feedback mechanism is an important method to improve feedback accuracy. It gives the opportunities to the patron to make an accurate judgment on the number of the document provided in the initial query. (Lv & Zhai, 2009). The main idea in the relevant feedback mechanism is to choose the important terms in the relevant document and enhance it by adding them to the new query formulation. This will de-emphasized irrelevant document in the future query and provide a more relevant document in the new query result (Balakrishnan et al., 2016).

## 8. DISCUSSIONS

This section discusses the relationship between information retrieval, the problem of information retrieval and the feedback mechanism. In furtherance to this, types

of information retrieval are discussed and their relevance to the academic libraries database.

The database housed both book and nonbook materials in an academic library. It provides an alternative storage place for the library materials. It has made the library to house more materials than the number of physical material they would have ordinarily housed in a traditional library. Nevertheless, materials kept in the library without access to them will remain useless. When such a situation occurred, the value of the library would have been reduced to an ordinary storehouse. Based on this, therefore, the library needs to provide access to their materials through an information retrieval system. Most library database has information retrieval system through which the library users gained access to the stored materials in the database. Information retrieval is the process through which the library patrons searched the stored materials in the database and retrieved those capable of meeting their information needs (Madankar et al., 2016 & Sangiacomo, Leoncini, Decherchi, Gastaldo, & Zunino, 2010). However, the existing studies have revealed that finding materials in the library database is not that easy. Sometimes, the results provided by the retrieval system is not relevant. The users have to spend a lot of time going through many irrelevant documents to fitch out the relevant ones. Some of the problems with information retrieval include (1) uncertainty. Patrons are faced with the problem of how to get what they want from the numerous results provided by the information retrieval system. (2) the meaning of the words depends on the context in which they appear. Most retrieval systems do not incorporate synonyms to enhance varieties of meaning and their contextual relevance. (3) another factor is based on the fact that the retrieval devices are more prone to retrieving the document rather than the content of the document hence the need for feedback mechanism (Balakrishnan, Ahmadi, & Ravana, 2016).

Feedback mechanism provides an iterative process for the improvement of the retrieval performance. It gives the users the opportunity to submit a query and when the information retrieval system provide the initial result, the patron will make a judgement on the relevancy of those document and resubmit for a new retrieval results. By this, therefore, the number of irrelevant materials are reduced while the number of relevant ones to the information needs of the users will increase (Lv & Zhai, 2009 & Wu, Luk, Wong, & Nie, 2012). The library database can make use of three types of information retrieval feedback mechanism which are implicit feedback, explicit feedback mechanism, and the pseudo feedback mechanism. The implicit feedback determined the relevancy of the document based on the behavior of the users and the patrons need not put other efforts. The explicit feedback requires information retrieval feedback to present an initial results. The patron has to make a judgement on the result and further resubmit a new query based on his judgement. The information retrieval system will provide a new result which will be free of

an irrelevant document. The Pseudo feedback on its own extract important terms assumed to be relevant from the top-ranked document from the initial results from the information retrieval system and add them to the source query and resubmit to get new result devoid of the irrelevant document.

These mechanisms are very relevant to the library database which only rely on the Boolean logic such as AND, OR and NOT. The African academic librarian needs to request from the database provider to include a feedback mechanism in any database which they are about to purchase. This will help the library patrons and librarians inclusive to achieve precisions in their searches. It will also reduce the frustrations and waste of time by the users.

## **9. CONCLUSION**

In this paper we are able to achieve all the objectives by defining the information retrieval system through the comparison of different authors' definitions, the second of objective include the explanation of what the problems of information retrieval are and the third objective is to explain the concept of feedback mechanism, types and their relevance to the database in the academic libraries. However, this paper is not without limitations. It is a systematic literature review therefore the *future studies* should be an empirical study on how relevant feedback mechanism can be used to improve on the information retrieval on those databases in academic libraries.

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# Chapter 9

## Framework for Technology- Enriched Active Class Learning of Physics in Secondary Schools in Kenya

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### **ABSTRACT**

*Active learning transforms the learning process and activities from tutor focused to learner-centered and is driven by the learner's learning ability. In other words, active learning provides an opportunity for self-directed learning that enables the learners to engage with the learning materials at personal level and pace. Thus, this chapter argues that active learning can provide equal learning opportunity for every single learner irrespective of the differences in their personality traits that would otherwise affect how they learn. Hence, this chapter proposes a framework for technology-enriched active learning for young learners that provides a personalized learning that deviates from the traditional "fit-for-all" classroom setups that tends to favour only the extrovert students. The proposed framework leverages advancement in technology such as personal learning network, virtual physics labs, massive open online courses, and crowd-sourced expert opinions to provide the learners with just-in-time active learning opportunity.*

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## **INTRODUCTION**

The current increasingly changing world shows the influence and effects of technology in all aspects of learning. Teaching and learning of Science, Technology, Engineering and Mathematics has undergone drastic changes with countries such as Singapore, Finland and North America adapting new teaching paradigm in post-secondary institutions over recent decades (Deslauriers, Schele, 2011). This change over towards the active engagement of students was prompted by the realization that traditional teacher centred pedagogies are largely ineffective for promoting conceptual understanding and positive attitudes about science (Adams & Wieman, 2011). The recognition that engaging all students in STEM learning is important and the availability of new educational technologies to promote the active engagement of student's also further advance the shift in the teaching style from teacher centred to learner centred (Milner Bolotin, 2012). Mulhall et al (2008) disclosed that Physics is one of the science subjects that is predominantly recognized as being conceptually difficult to teach and to learn. The prevailing notions among Secondary school students' is that they view Physics as being difficult, irrelevant and boring (Owen et al, 2008). This is due to the changing nature of Physics over the secondary school period from less descriptive to more mathematical. Nonetheless according to Carter et al (1989) students and teachers live in different worlds and they have different languages. This dissimilarity leads to lack of student – teacher communication and in such a case the teachers fail to identify the learners' needs. There have been various extensive attempts to teach Physics in a better and more efficient manner and to make Physics more attractive. Primarily the identification of the perception of learners about Physics course is thought to be important to overcome the problem in teaching Physics (Yagbasan, 2012). However Angell et al (2004) found that students find physics difficult because they have to contend with different representations such as experiments, formulas and calculations, graphs, and conceptual explanations at the same time.

Western countries especially Ireland has registered a decreasing career interest in Physics among students, whereas Physics has a very significant role in Science and Technology (Department of Education and Science, Ireland, 2002). Mergan et al (2006) pointed out the high rates of international recruitment of Physics teachers to developed countries from the developing countries. In order for better learning out comes in Physics, developed countries like Europe, Israel and America have adapted the strategies where the learners interest, goals and motivation must be identified and put in the instructional objective (Reddish et al, 1999). In this way the negative feelings and prejudices about Physics courses and the difficulty of using mathematical formulae is minimize. The use of creative experiments in the

teaching process has been observed in Dortmund, Germany to increase the level of understanding and attention of students (Bussei, 2003).

New digital technologies in Sub-Saharan African (SSA) countries have the potential to revolutionise the quality of subject teaching and learning when carefully integrated into the classroom (Unwin, 2005). The role of the teacher is utterly critical notwithstanding their readiness and confidence in using ICT, despite general enthusiasm and belief in its benefits for learners. The instructor's primary challenge may be as a result of their lack of relevant preparation, either initially or in-service. Research bespeaks that, training opportunities have remained limited in availability and inconsistent in quality. This has resulted in irrefutably low proficiency in using ICT, and a general lack of knowledge about technology particularly in teaching and learning of Physics. There are some recent examples of successful practice in developing ICT use in SSA schools through its integration in teacher education. However, according to Unwin (2005), there have been goodwill to render ICT training to teachers and students, but misplaced, supply-driven initiatives across the continent have proved wasteful and inappropriate, with limited impact. Moreover, the global economic downturn has amplified the shortage of public funds to devote to the already expensive business of training teachers to use ICT (Commonwealth of Learning, 2004). Increasingly, large school classes and the designation of ICT as a distinct subject, lead to a dire lack of subject teachers trained to integrate technology into learning in their areas. These are fundamental challenges to be overcome before ICT capacity building can become a reality in African education.

Active learning has been shown to significantly improve educational outcomes and learner engagement compared to traditional classroom approach (Scott et al 2014). This is because active learning transforms the learning process and activities from tutor focused to learner-centred and driven by the learner's learning ability. This way, the learner can personalize the learning process according to her pace of learning. Besides, it gives the instructor a platform to engage with the learner at an individual level and to provide the learner with just-in-time teaching based on the need of the learner as opposed to one-size fits all approach that is accustomed to traditional learning setting. So despite the great variance of student learning styles and ability that may exist in a classroom, active learning puts the learners in the driver's seat and allows them to engage with the material at their own pace, review confusing concepts, or break the sessions' learning content into easily-digestible chunks. This gives the learner the flexibility and freedom to explore the subject learning resources, to collaborate with their peers and to discuss the learning contents. Weaver et al (2005) argued that students battle with participation due to factors that relate to their personal traits, as well as the formal and informal structures of the classroom environment.

Weaver et al (2005) argued that students battle with participation due to factors that relate to their personal traits, as well as the formal and informal structures of the classroom environment. In response to low participation rates, educators have focused efforts on implementing numerous strategies to increase student participation. Studies indicate that students continue to remain passive members of the classroom environment and as a result do not capitalize on the benefits of participation (Hyde & Ruth, 2002; Myers et al., 2009; Weaver & Qi, 2005). This further shows that critical factors associated with classroom participation are not being addressed appropriately in order to increase student participation. While learners may have different temperaments and personalities that may in some way affect their learning, ICT active learning provides opportunity for learning Physics across these personality behaviours. Notably, it would be relatively easy for the teacher to notice when the extrovert learners are not involved in the learning activity but would be pretty difficult for the teacher to notice when an introvert student is not engaged and involved in the learning activity. However, computer aided learning, so called ICT integrated learning, has been shown to motivate learning and learning engagement for both introvert and extrovert students (Costa and Murphy, 2018).

To make active learning effective, there is a need to create Supportive and accommodative classroom environments yielded higher rates of participation and showed trust amongst students as there was visible encouragement from peers and professors to express opinions (Fassinger, 2000). Teachers play a key role in fostering this type of environment by ensuring cooperation through activities that create a positive climate in the classroom and ensure the dialogue is carried out with respect within the classroom. Reznitskaya et al, (2001) established that pedagogical components like the course, topic, lecturer and teaching style could influence students' participation. Despite all emphasis on student participation, Reda et al (2000) iterated that speaking alone does not automatically result in learning, classroom participation at secondary level involves a variety of activities. In spite of the fact that some students may learn more by verbal interaction, there might still be some who silently absorb and process the material being taught. Therefore class participation may assume different types of engagement activities. This definition is more holistic as it includes the quality of discussion as well as respect within the group which Weaver and Qi (2005) indicated was a direct factor that affected levels of class participation. To this end there is a need for a structure to deploy active learning approach towards improving learning of physics. Thus this study proposes a framework for learning of physics that leveraged all the learners by providing an equal learning opportunities that surpass the barriers of learners different temperaments.

## **THE PROBLEM STATEMENT**

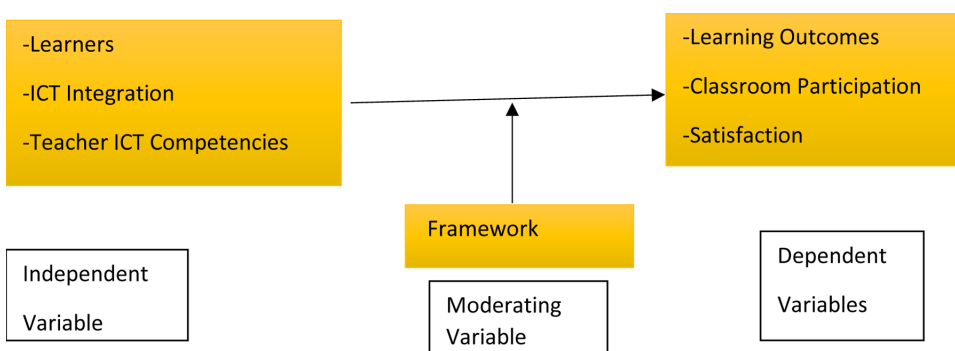
Physics is one of the subject offered in the secondary schools in Kenya. It is a reality that knowledge obtained from the Physics is applicable in any technological and engineering work and also its benefit for developing countries like Kenya is unquestionable. Majority of students in Secondary Schools especially in form two and one had no interest to learn Physics and in addition to that it registered lower enrolment of candidates compare to other sciences. Physics has been mystified as difficult, resulting in some Kenyan schools opting not to offer it after Form Two in secondary school. Pedagogy should value variety and diversity as there exist learners with varied individual differences in our classrooms. Recent findings show that students who hold stereotype images of scientists, science and technology in society are not only easily discouraged from pursuing scientific disciplines like Physics, but also usually perform poorly in them (Mwambela,2013). Retnawaty et al (2017) on the other hand affirmed that for effective application of Mathematical abilities to be able to realize in teachings and learning of Physics, then the mastery of mathematical concepts becomes indispensable. Nonetheless most students lack the ability to comprehend these concepts hence they fail to establish correlation between concepts to solve problems.

Having said that, the teachers may be neglecting a large number of learners with assertion that they are disinterested in learning, where as it may be a case of timid learners. This is a pointer that a concept that has not been understood may take several days before the misconception is detected by means of sit in continuous classroom assessment or end topic quizzes more so in an introvert dominance class. Continuous accumulation of such misconstrued concepts in a given subjects especially in Physics connotes that the learner continues to acquire a contradictory concept to the one anticipated by the teacher. The problem addressed in this paper is that, the teachers put to use generic Physics teaching and learning matrices that majorly results in declining performance in Physics and the subject has become less popular among students in Kenya's public secondary schools as compared to other science subjects. This paper thus explores the need to improve learning of Physics in Secondary Schools. Physics teachers need to make teaching very interactive through good pedagogies such as peer Instruction (PI) and Dialogical Argumentative instruction in Physics class. Overwhelming results points to ICT as a very effective modality in elucidating science concepts especially in the micro-level. This approach will demystify the perception of difficulty and abstractness of certain topics in Physics and bridge the gap of the mismatch that exist between the language of instruction and the commonly used language.

## RESEARCH OBJECTIVES

1. To establish the competencies of Teachers' in ICT integration in active learning and how it improves classroom participation and learning outcomes in Physics.
2. To identify how ICT integration encourages classroom participation based teaching learning process.
3. To develop prototype for technology enriched active learning that will enhance active class participation.

*Figure 1. Conceptual framework that guide the study on implementation of ICT integrated teaching and learning*



## TEACHER EDUCATION AND PROFESSIONAL DEVELOPMENT

Teachers' professional development is all important in order to keep up with innovations and trends in the profession. The essential role of 'teaching' is to develop cognition, acquire skills, and attitudes for the growth and development of an individual and the society at large. In connection to the use of ICT in education and teacher training, teachers are at the center of this development (Khan, 2014:1), since they are responsible for creating different teaching and learning models that will ensure a positive learning outcome. Vrasidas et al. (2018) observed that continuous teachers' improvement is necessary for school development as it will enable teachers to deal with the problems and challenges they encounter in their daily routine. Professional development is now a growing concern as schools make an effort to transform and to fit into new guidelines and procedures established for school accountability and teacher recognition. Khan (2014) advance for pre-service training, in-service training models for effective ICT integration. Vrasidas



et al. (2018) suggested that universities offering Education courses should make it a priority to come up with strategies that will aid ICT integration into student teacher training processes and various subject curriculums so teachers can know, understand, appreciate and develop instructive methods for pedagogical use. ICT is viewed as an instrument that can potentially endow teachers to successfully develop learners' thinking skills and also promote teachers' professional skills. The DOE (2007) emphasised the need for the development of ICT knowledge and skills to be a fundamental component of pre-service and in-service teacher training and empowerment strategies. It is indispensable that there is for government to frequently organise trainings, workshops, conferences and self-development strategies in order to acquaint teachers with the reasons, significance and proper integration of ICT into their classroom practices to achieve maximum benefits (Vrasidas et al., 2018). This argument is also supported by Khan (2014) who maintains that because teachers are able to use ICT in performing their administrative tasks, they can incorporate it into their teaching. She advocates for more extensive training, commitment and effort.

The real challenge for educationists is, therefore, how to harness the potential of ICT to complement the role of a teacher in the teaching and learning process. There is an understandable apprehension, even fear, as to the role of a teacher in an ICT-equipped classroom (Futurelab, 2010). To this end, Ertmer (2017) proposes pedagogic strategies as well as technical and organizational approaches such as: initially introducing teachers to relatively simple uses of technology; engaging teachers in explicit belief exploration; and providing opportunities to examine new practices supported by different beliefs. Furthermore, these strategies can help teachers progress beyond initial low-level uses and should support them in the adoption of higher-level uses. Tondeur et al. (2017) remarked that, schools should be committed to the professional development of teachers. Training has to be carefully designed and implemented to provide continuity between what is learned by teachers and what will happen in their classrooms, and to support them in transforming their practices (Zhao, et al 2017). Based on the role of ICT, especially in complex computational subjects, such as mathematics and sciences, Adams (2017) proposes regular scheduled professional development to keep teachers conversant of the need to continually improve their technological practices. The curriculum should be conscientiously designed to relate the learning context to what occurs in classrooms. According to Hohlfield et al (2010), the curriculum should heavily focus on supporting teachers to incorporate new approaches into their instructional practices. Godfrey (2001) recommends that, teachers should be abreast with the multiple facets of technology, critical thinkers and creative users of technology. Besides needing models of best practice and relevant information, teachers should acquire personal technological expertise and support the rationale behind integrating ICT into learning. They should be able to keep up with rapid technological advances and associated changes in

practice. The rate at which students master and use ICT-based learning applications should advance in a similar manner.

## **TEACHERS ACCESS TO INFRASTRUCTURAL SUPPORT**

Across Africa and most developing countries there are many challenges in bringing ICTs into the education process in general. Angulo (2010) observed that lack of access to electricity, limited technology infrastructure, inadequate software; geographical factors such as country size, terrain and communications; demographic factors such as population size, density and dispersion affects the execution of ICTs integration in teaching and learning. Moreover, teachers find it difficult to integrate technology into their teaching practices if they are not provided with good infrastructural support in the classroom and in the school. In the absence of such foundations, they will struggle to overcome barriers to the use of educational technology (Bingimlas, 2017). Bingimlas, further, provided a meta-analysis of relevant literature which confirmed that the lack of appropriate infrastructural support and access to resources is a major barrier to e-learning in schools. Teachers in Saudi Arabia confess their desire to integrate technology in their teaching, but alluded to infrastructural obstacles as a serious impediment (Antony et al, 2017).

Teachers need technical, pedagogic and administrative support from their schools to effectively integrate e-learning in their lessons (Amado et al, 2016). Technical matters causes problems related to both hardware and software. It is of the utmost importance to provide technical support and, in particular, to troubleshoot technology-related problems so that the teachers can concentrate on didactic factors, such as preparing and conducting actual lessons (Moller et al, 2015). Ideally, schools should employ reasonable technical assistants (Marcovitz et al, 2019), or outsource hardware maintenance. Teachers not only need administrative support to manage and maintain hardware and software, but should also become knowledgeable in selecting suitable ICT materials and resources. To support this view, Yang (2015) in his research found that students in the higher technology-learning environment are likely to perform well compared to students learning in a classroom where technology is less applied. Further than that, his research showed that there is a general belief among technology advocates that the classrooms facilitated by the use of technology can produce positive learning outcomes (Yang, 2015).Based on these factors, Ballu et al (2016) explain that adding value to teaching and learning activities through the integration of ICTs is impossible without the proper technology tool, which has to be supported by a stable IT infrastructure and flexible support and training programmes for both educators and learners.

## **TECHNICAL AND PEDAGOGICAL TRAINING FOR TEACHERS**

It is imperative to note that, open mindedness, curiosity, statistical reasoning, collection of data and demand for verification and proofs, are the ferments which characterize the learning of Physics. These are skills that cannot be acquired by using traditional teaching methods such as lecture method, as students leave the Physics classroom with vague understanding of Physics as a science and a way of understanding our world (Trivedi et al, 2013). Teachers do not only need support in the form of trainings and workshops, but also require access to career support in order to effectively incorporate technology into the curricula and develop their teaching skills (Albion,2017). Technical and pedagogical support as defined by teachers refer to technical assistance, casual or informal online network for learning and frequent training tailored to suit teachers' needs. Incorporating ICT becomes much facile when teachers are provided with the necessary equipment, technological and pedagogical support from time to time either by government or the school administration (Luckin,2017). Findings in a given study indicated that having an on-site technical support can trigger teachers' interest for the use of technology (Sweeney, 2017). Kiili et al (2016) identify the following as technical barriers: use of outdated computers, websites not responding, internet connection failure, printers not responding and computer breakdown. Lack of technical support demoralize teachers from using ICT during lessons; school administrations must be cognizant of the fact that the support of a technician is very crucial to the implementation of ICT in schools. The absence of incentives and support for teachers are other factors hindering their use of ICT. The SRI-World Links evaluation Petko, (2018) revealed that teachers enthusiastically engage in collaborative projects and often portray a constructivist pedagogy. Based on these factors, Andrew (2018) explain that adding value to teaching and learning activities through the integration of ICTs is impossible without the proper technology tool, which has to be supported by a stable IT infrastructure and flexible support and training programmes for both educators and learners.

Misirli (2016) concurs with this notion and states that technology integration varies according to individual teaching beliefs, perceptions towards technology innovations, and how the educator practises and puts technology to work in the classroom. Similarly, a study by Ghavifekr (2016) determined that technical and associated issues were major barriers to progress in the adoption of ICT. Technical malfunctions and faulty equipment distract and discourage the teacher, particularly if they occur during an actual lesson. For the teaching of science, Fabregat et al (2014) advises that ICT integration should be supported by technical personnel or that comprehensive technical training should be scheduled for the teachers themselves. In countries such as the UK and the Netherlands, the role of technicians

in supporting teachers has been recognised and implemented. It should be noted 3rd world countries especially Kenya needs to recognise the role of technicians for smooth implementation of competency based curriculum particularly in STEM subjects.

## **ACTIVE LEARNING AND TECHNOLOGY INTEGRATION**

Learning with technology has become essential in today's schools. Worldwide, governments, education systems, researchers, school leaders, teachers and parents consider technology to be a critical part of a child's education. The adoption of ICT tools in educational institutions is unavoidable as it makes learning attractive and interesting. Awareness of ICT applications has improved due to the evident benefits (Tochukwu, 2017). ICT tools help to enhance learners' knowledge and learning. Moreover, ICT help to improve collaboration among learners. Active learning generally refers to activities that learners engaged in during learning towards constructing knowledge and understanding of the learning goal. These activities require both intensive and extensive engagement from the learner (Freeman et al, 2014). Different from passive learning that is teacher-centred and presents limited opportunities to assess learner's comprehension, active learning shifts learning process to student focus as it empowers learners to discuss, argue, analyse and derive a conclusion on their own. In active learning, it is essential to check for content understanding, which can be accomplished by using technology in the classroom that offers immediate feedback from assessments. Several approaches have been proposed to promote a high level of student engagement.

According to engagement theory (Kearsley and Schneiderman, 1999), students need to be engaged in learning activities through interaction with others and learning tasks. Shadieva et al. (2015) suggest that active notifications or alerts through communicating tools increase student engagement. Okono et al. (2019) observed that students bear expectation in active learning Physics classroom which they nurture to achieve their targeted objectives. This reveals that majority of students enrolled in courses that incorporate Active Learning Strategies display positive changes in their conceptual understanding. Freeman et al (2014) noted that "active learning" during physics lesson such as the use of small group problem-solving tasks in classrooms, produces better learning outcomes than simply listening to lectures alone. Moreover, by engaging students more deeply, active learning techniques can prepare students to learn more from subsequent lessons by rendering concepts more immediate or relevant. Engaged students try harder and learn better (Hollingshead et al, 2019).

Learning Physics through active learning enhance collaborative learning among the student and, improve the level of student's contributions in the classroom by electronic network or promotes more activities that have impact beyond the course.

In addition when active learning was incorporated into a college level physics course, understanding of the topics increased 40% to 60% in comparison to traditional teaching methods (Brame, 2016). Active learning strategies have been shown numerous times to promote student engagement and have a significant impact on student learning when implemented effectively throughout the course. Teacher involvement plays a significant role during the active learning process, lessons in which the Teacher was more involved all exhibited higher degrees of student engagement and conversely, lower levels of passive resistance. In particular, Teachers who approached passive student groups and gently encouraged students to participate in the activity saw more positive results, not just for that particular activity but in subsequent lesson activities (Shekhar et al, 2014). Thus the teacher need to give clear procedures for effective active learning to take place and the teacher need to encouraging introverts students through non-confrontational teacher are statistically significant and predicts the student's response to any given instruction.

Thus the Teachers strategies are the biggest determinant of how students of how students respond to active learning. Andrews and Lemons (2015) further emphasized that any active learning strategy employed should be compatible with one's teaching style, beliefs and pedagogical training approaches to be effective. In addition, they should purpose to use variety of active learning techniques and to engage the learners. Nguyen (2016) established that instructional strategies used by the teachers are statistically significant and predicts the students' response to any given instruction. Thus, the instructors teaching strategies are the biggest determinant of students' response during teaching learning session. Teacher training is a strong pillar that help the teacher as an instructor to establish an active learning strategy that is all inclusive irrespective of the learners' behavioural traits and makes the teacher shifts his role from content deliverer to learning coach and facilitator (Hernández-Lara et al, 2019). At this point, the teacher do not need to fret over which Active Learning Strategy they incorporate into their classroom but rather need to determine which strategy is feasible for them and allows them to be best equipped to maximize student learning. Sawang, O'Connor, and Ali (2017) confirmed that introverts interact better with electronic response devices in the classroom than the extroverts, which was hypothesized to be due to the more reflective nature of introverts as compared to oral responses preferred by extroverts. Students can learn with computers where technology is applied to a variety of goals in the (more active) learning process, and is construed as a resource to help develop higher order thinking, creativity and research skills (Theodorou et al, 2019). What makes active learning fundamentally active is the cognitive processing demanded to find patterns in materials provided, organize these patterns into meaningful clusters, understand under what conditions this knowledge is useful, and retrieve it fluently (Chin et al, 2016).

It has been shown that clickers could tackle two fundamental challenges in teaching, namely student engagement and determining whether students understand what is taught (Duran, 2015). The use of clickers in education is growing fast because of their ease to use and their contribution to an increase in students' involvement in the learning process (Park, 2015). Clicker technology, an audience or classroom response system, has become more popular in recent years as a means of engaging the millennial learner who seeks an interactive learning environment. These devices engage all students in the classroom without the fear of being put on the spot to answer a question. Students respond to polling questions during a lecture, and responses are tallied and projected for the entire class. The feedback gives students an awareness of where they need remediation in course content, and gives the faculty insight into where to focus that content according to student needs (Hedén et al 2016). Clickers can also increase student preparedness and attentiveness in class (Sheng, 2019). In addition, McLoone, et al (2019) explored student satisfaction with the use of clickers in an undergraduate health-assessment course. Students reported satisfaction with the use of the clickers and enjoyed the feedback and the interaction that the clickers provided. The enhancement benefit brought about by clickers is the ability to provide immediate feedback and to measure student understanding (Hunsu, 2016).

Clickers can be used to ensure that students understand basic concepts (Knottenbelt, 2015). In agreement with (Cook et al, 2018), their study pointed out that clickers are useful in enhancing teaching and learning experiences. The mastery of complex concepts can be monitored through clickers. Lecturers report a dramatic decrease in students' nodding off at the back of the room, as clickers keep students involved (Sheng, 2019). The lecturer presents the problem or question to the class, without introduction. According to Carroll et al (2018), clickers increase student engagement and improve their learning. This is observed when students are encouraged to debate answers with other students before answering the questions in class. Students were interested in the tool because it made them participate during class. The benefits of clickers are its ability to provide immediate feedback and to measure student understanding (Wang, 2015). Students indicated that with the immediate feedback provided by the system they could have discussions with each other as well as with the lecturer to clarify some concepts and to enable them to link the content with the real life situations. Their relationship with the lecturer improved. Despite these apparent advantages, and their overall impact on promoting active teaching and learning, clickers have not been fully utilised in the Kenyan context. Most of the existing findings stem from international studies (Gould, 2016). In this study, the challenge was for the lecturer to understand whether students grasp basic concepts and to keep them actively involved during the learning process. Immediate feedback to students poses certain problems, but through the use of clickers, immediate feedback and the measurement students' understanding is possible (Javed, 2018).

Clickers thus enhance active learning that provides an opportunity for interaction and collaboration between students and content, student and student, and students and lecturers. Cohn et al (2016) found that students are no longer passive listeners, as they become active participants throughout the lecture when clickers are employed during learning.

The extensive introduction of interactive whiteboards systems into UK primary classrooms in recent years has been encouraged by policy initiatives and the provision of substantial financial resource (Alfaki et al, 2018). The result is that, in many UK primary, IWBs have almost completely replaced other classroom equipment such as 'ordinary' whiteboards and are in daily use by teachers and pupils. It seems clear that many teachers have found IWBs to be an important and highly motivating teaching resource (Beauchamp, 2016). Studies have indicated some positive developments in whole-class teacher-led sessions, including teachers' engagement with surface features of interactive teaching (Duran, 2015). Indeed, the embedded use of the IWB in teaching and learning has been evidenced in some studies as a 'major factor that leads to attainment gains' in literacy and numeracy in UK classrooms (Hennessy, 2017)

Despite these positives, however, it is clear that IWBs have often been made to fit pre-existing instructional practices (Almoaiqel,2015) and that students may, ironically, feel themselves excluded from the use of this 'interactive' resource (Balta et al, 2015). This is unsurprising, as the introduction of new technologies has not usually been accompanied by an adequate understanding of what their take-up might imply for pedagogy (Sanders et al,2017). Active learning has been revamped further by the use of virtual reality and augmented reality. Augmented reality spell out a view of a physical, real-world environment whose elements are integrated with computer-generated sensory input (Freina, 2015). Augmented reality uses mobile phones to provide animated content by adding graphics and sounds to the natural world. Augmented reality involves blending of technology and the environment to heighten the experience whereby the real world is enhanced by virtual details. Virtual reality is a computerized simulation of a real environment but an individual actually interacts with the virtual environment using specialized gadgets or headsets (Zhou, 2009). According to Sanare et al (2012) the use of mobile phones in education specifically for virtual and augmented reality application is scarce. Even though this technology is already in use in developed countries, in Kenya the adoption of virtual and augmented reality specifically in in teaching of Physics is not common. Pantelidis (2010) established that virtual reality provides better visualizations, interactivity and motivates students. Lee (2012) reported that augmented reality as interactive, simple, efficient and effective, and thus can be implemented from kindergarten level to Higher Education in subjects like Chemistry, Physics, Biology, Astronomy, Mathematics and Geometry. Augmented reality improves knowledge

acquisition and memory for the learners and has the capabilities of generating learner motivation for learning (Chen et al, 2017). Manrique-juan *et al* (2017) revealed that learning through augmented reality is highly interactive, entertaining and encouraged students to quickly learn anatomy.

## **FRAMEWORK FOR TECHNOLOGY-ENRICHED ACTIVE CLASS LEARNING OF PHYSICS**

In this section, we present the proposed framework for technology enriched active learning of physics guided by constructivist theorists that argue that humans construct knowledge and meaning from their experiences. Active learning is therefore based on Vygotsky's (1978) social constructivist view of learning, which suggested that interaction between humans in the classroom is key to the success of learning. Active learning increases the ability to synthesize the content being presented. In active learning, it is essential to check for content understanding, which can be accomplished by using technology in the classroom that offers immediate feedback from assessments. Kolb (2014) an experiential learning theorist which is a constructivist-based theory believes that learning requires the whole person and not just the mind and so interaction with one environment (experience) is key. Blooms (2010) emphasized on the whole person by proposing that for effective learning, then the teacher must be cognizant of the cognitive, affective and psychomotor domain of the learners. Constructivist believes that in a classroom situations, students do not reinvent the wheel but, rather, attempt to understand how it turns, how it functions they become engaged by applying their existing knowledge and real-world experience, learning to hypothesize, testing their theories, and ultimately drawing conclusions from their findings. The proposed framework thus is based on aforementioned theories.

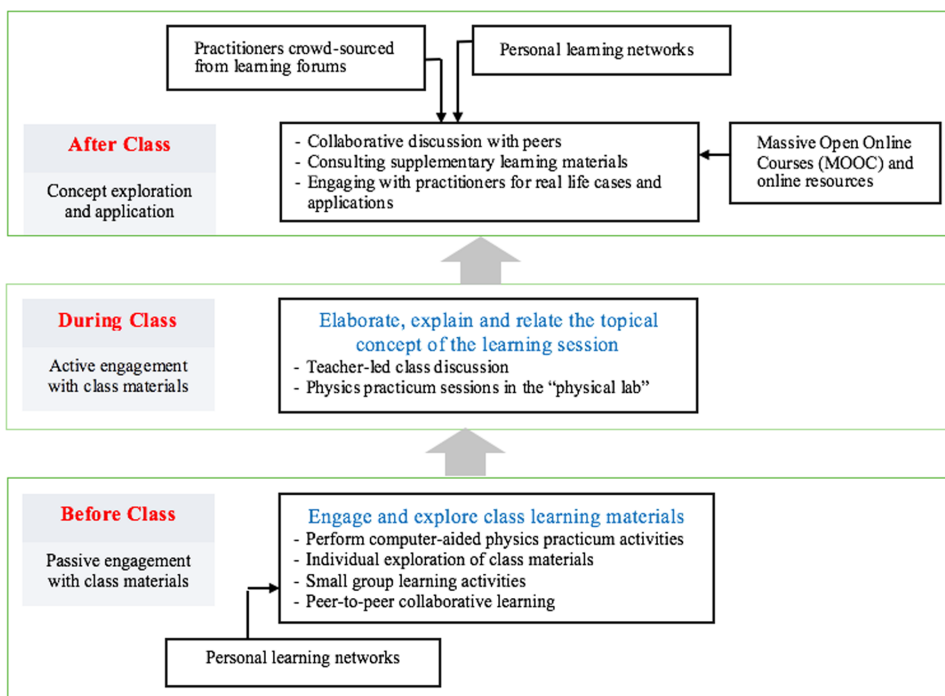
The proposed framework is divided into three sections, i.e., before class, during class, and after class learning sessions. The Before Class session allows the learner to interact and engage with the learning materials passively at individual level in preparation for the class learning activity. At this stage, the learner is required to explore the class learning materials in small group activities and to discuss and share course learning materials with their peers. This can be done by leveraging personal learning networks that support collaborative learning. The learner may also be required to conduct physics practicum session on virtual labs to aid comprehension of the topical concept of the class learning session. In the During Class session, the learner is expected to actively engage with the session learning topic from the elaborations, explanations and concept relations provided by the instructor. This session is teacher-guided and involves class discussions and physics practicum activities in the physical laboratories. The learner exploits this session to consult



## Framework for Technology-Enriched Active Class Learning of Physics in Secondary Schools

with the instructor at individual level on all the concepts that were not understood during the before class phase.

Figure 2. Technology-enriched active class learning of physics



The last section is the After Class session that focuses on allowing the learner to explore the learnt concept and its application to everyday life. Specifically, during this session the learner could leverage personal learning networks so as to discuss with his peers and/or consult supplementary learning resources such as online resources, massive open online courses (MOOC) among others to improve concept comprehension. Moreover, the learner can also engage with practitioners and concept domain experts crowd-sourced from online learning forums to assist the learner appreciate the application of the learnt concept to everyday life.

Notably, the proposed framework leverages advancement in technology such as personal learning network, virtual physics labs, MOOCs, crowd-sourced expert opinions etc to provide the learner with just-in-time active learning opportunity. It enables the learner to interact with the learning materials prior to class at a personalized level including attempting virtual labs, and to engage with peers about

the session's topic. This promotes individual learning which has been shown to lead to mastery of concepts (Siddaiah-Subramanya, 2017) as the learner tends to explore and discover knowledge. This leads to appreciation of physics as a carrier subject which most learners tend to perceive as a difficult subject. That is, this approach makes the learning of physics eventful and intuitive. The framework exposes the learners to the beauty of physics by connecting them to everyday life problems that can be solved by the various concepts learnt in any session.

In developing such a learning platform, we basically need a simple client-server application that provides for collaborative and peer to peer small group discussion among students built on personal learning network. This personal learning network may be integrated with MOOCs, crowd-sourced learning forums and online learning resources to enable the learner's access supplementary learning materials to enrich their learning experience. We may also need virtual reality to build the virtual lab for physics practical activities for the learner to explore and engage with the learning materials at personal level. This learning platform can also run on smart mobile phone as an application so as to provide the learners with ubiquitous and pervasive learning opportunities that goes beyond the confinements of locations and time. While in this paper we report on the design of the proposed framework for technology enriched active class learning of physics, we are currently developing its prototype, and hoping to evaluate the proof-of-concept in the near future. Then, we will report on contribution of the framework towards improving the students experience on learning of physics and how it contributes towards learner engagement and achievement, and how it improves the learning outcome and learning attitude towards physics in secondary schools in Kenya.

## **CONCLUSION**

This paper argues that active learning can provide an equal learning opportunity for each and every learner irrespective of the differences in their personality traits that would otherwise affect how they learning. Thus this paper proposes a framework for technology enriched active learning of physics for young learners that provides a personalized learning to both extrovert and introvert that deviates from the traditional "fit-for all" classroom setups that tends to favour only the extrovert students. The proposed framework leverages advancement in technology such as personal learning network, virtual physics labs, MOOCs, and crowd-sourced expert opinions to provide the learners with just-in-time active learning opportunity. This enables the learner to interact with the learning materials prior to, during and after class at a personalized level including attempting virtual labs and engaging with peers about the session's topic. Notably, this approach makes the learning of physics eventful and intuitive,

and exposes the learners to the beauty of physics by connecting them to everyday life problems that can be solved by the various concepts learnt in any session.

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# Chapter 10

## Higher Education

### Governance of Big Data: A Systematic Literature Review

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#### **ABSTRACT**

*In this chapter, the authors conducted a study on higher education governance of big data. Big data can be described as the amount of data created which is beyond the technical capacity to be efficiently processed, stored, and managed. There are six objectives for the study, which are to investigate the characteristics of big data in higher education, in how big data contributes to higher education, how to govern big data in higher education, the higher educational governance models, the roles of government in managing higher education and the big data initiative in the developing nations. Kitchenham methodology is adopted in this study to carry out a systematic literature review. The finding, therefore, reveals that the characteristics of big data include value, velocity, volume, veracity, and variety. The findings show that big data contributes to higher education by given real-time feedback, monitor students' school performance. It shows that big data can be used for the detection of attrition risk, data visualization, students's skill estimation, and grouping and collaborations among the students. It also shows that big data can be governed through provisions of information security, compliances, and ensuring privacy. This chapter, therefore, contributed data quality and accountability as other methods of governing big data. Therefore, the authors recommend the future study to cover data stakeholders in higher education.*

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## **1. INTRODUCTION**

Higher education generates a vast amount of data on a daily basis but faced with the challenges of how to effectively collate and analyze all the information at its disposal for the benefits of the stakeholders. Johnson (2014) is of the opinion that big data can add values to the way higher education process their data and transform the process of teaching, learning, academic work as well as the administrative process which will improve the decision-making process and resource management. It can also be used for the monitoring of the students' success by identifying those factors impeding their successes at an early stage. Big data is regarded as those data which have more capacities that exceeded the processing of the conventional database systems. They are regarded too big, moving too fast or does not fit into the database architecture (Al-Badi, Tarhini, & Khan, 2018). Mukthar & Sultan, (2017) added that they go beyond the traditional rules which made them difficult to be captured by the comon software tools. Big data is usually described using three Vs which are volume, variety and the velocity. The Vs described the volume at which the data are generated. The velocity is the different format of information generated through different channels such as laptops, desktops, smartphones, social media, and other digital formats. Big data can also be described as the amount of data created which is beyond the technical capacity to be efficiently processed, stored and managed (Segooa & Mathias Kalema, 2019). However, the big data analytics provides a new approach to data analyses, discovery and the extraction of value from a large volume of data. Some of the features of big data analytics include sharing and transferring of data, capturing, searching, predicting and visualization of data. It covers volume, velocity, and variety. Big data is very useful in the learning process because it provides access to reliable data in its source. It supports student's interaction, knowledge delivery, and student engagements. It has the ability to explore data and provide a prediction on the student behaviors and their consequence. It has the ability to personalize and customize services based on the already identify predictions of the student's behaviors (Sidi, 2014). It has changed the way students are studied and monitored. Tulasi, (2013) identifies other benefits of big data to include the provision of effective and transparent data. It provides a model for the transformation of higher education usage of the social network. Problems solving and productivity are enhanced. Based on the foregoing, big data has opened the door of many benefits to higher education through the provision of new effective methods of handling data. Nevertheless, big data analytics is still confronted with number of challenges which include problem of data acquisition, management, storage and analysis (He et al., 2016 & Sarker, Wu, & Hossin, 2018). Eynon (2013) is of the opinion that big data is faced with challenges such as privacy, ethical considerations, protection, consent and what type of data are needed to be combined for the analysis and for what purpose the data

must be combined. Wang (2016) in his own case identified data security, privacy, and protection of data, ethical boundaries and the data access as the challenges being faced by the big data. Based on the aforementioned factors serving as a hindrance to big data in higher education, data governance is the solution. Tallon (2013) defines data governance as the organizational procedures that describe the method to be followed in the management of the organizational data. It is the formulation of policy to secure, optimize and leverage information as the asset of higher education. It includes the formulation of policy, set of procedure, the execution of the procedure and the technology required. It identifies those that will carry out the process. Some of the benefits of data governance include improving the confidentiality of the data, improve access to data, and provide accuracy, trustworthiness, team coordination and better decision-making using reliable information. There are six objectives for this study. They are (1) to identify the characteristics of big data (2) to identify the contributions of big data to higher education and (3) to identify how higher education can govern big data to further enhance its benefits (4) to identify the higher education governance models, (5) to investigate the roles of government in managing higher education and what are the big data initiative in the developing nation. The arrangement of the other section is as follow. section 2 related works, section 3 methodology, section 4 Planning the systematic literature review, section 5 Findings from the literature, section 6 critique and contributions 7, Discussions, section 8. Conclusions.

## **2. RELATED WORKS**

Tulasi (2013) identified various sources of data in higher education to include social network sites, data from library usage, learning management system and the course management systems. All the data generated through this mean are voluminous and in petabytes'. He, however, added that identifying the important data from this huge volume is important. Doing this will require a system that will retain the important information while discarding the irrelevant ones. Reyes, (2015) added that the stakeholders are faced with the challenges of how to work with various database across settings, how to use technology to resolve ethical issues and how to move the traditional analytic to learner center analytics. There are also challenges of how to transform teaching and learning. In his contribution, Begg et' al (2012) Stated that the major aim of big data analytics is to carry out the extraction of value from big data. This is done through the provision of insight from the data which are not known before. This insight can be used to make a good decision on the business of higher education. According to West (2012), this technology can be used to create a predictive and formative assessment of the academic performance of students in

higher education. Big data provides a framework which can enhance the efficient utilization of vast array of data for the progress of higher education. Big data is a technological innovation and development that catalyzed the growth of analytics in higher education. It has made it possible for the higher institution to collect, manage and maintain huge amount of data and turn them into meaningful information. It has also brought many benefits into higher education such as increasing the educator's effectiveness, gaining insight from the learning experience, tailoring education to individual's needs and equipping students with requisite knowledge for the future (Murumba & Micheni, 2017). It improves the learning outcomes, reduced cost of relationship with the students and leverage the data collected at enrollment stage, finance sourcing and the instructional process to support the learning outcome. Murumba & Micheni, (2017) stated that Pig, Hive, Mahout, and RHadoop are examples of big data that can be deployed in higher education. Big data has the capacity to positively impact on the major areas of of learning such as integrated management and reporting, retention, cost management of operations, regulatory compliance and research (Murumba & Micheni, 2017). Logica & Magdalena, (2015) while explaining the importance of big data to higher education stated that the teachers will better understand their students in terms of of their current knowledge. The teachers will know which part of the lesson is too difficult or too easy for them to learn. Big data provides rich communications which expose the students to endless learning opportunities. It also provides infrastructure both hardware and software resources for e-learning. It guarantees the confidentiality of scholars records, teaching and personnel data. It uses the collaborative tools for both the students and their teachers. It has the capacities for gathering and processing of the unstructured data (Logica & Magdalena, 2015).

Begg (2011) pointed out that big data is faced with the challenge of how to resolve the privacy issue. In addition to this, Kaisler et' al, (2013) identify other challenges in big data analytics, which include data input and access, data quality, data growth and expansion, speed and scale, data ownership, compliance, and security. Daniel, (2015) identifies some of the challenges associated with the implementations of big data to include the acceptabilities among the stakeholders. Another challenges is the cost of collecting, storing and the development of algorithm for the data mining. This process is complex and consume a lot of time. Similarly, aggregating the administrative data, classroom and online data can pose additional challenges. There is also the problem of data integration of both structured and unstructured data. Data cleansing is another factor which is required during the data integration. For the data collected and reported to be of good quality, they must be appropriately cleaned but lack of standard and rules and regulation cannot guarantee the quality of the data. Daniel, (2015) itemized some of the challenges of bid data as

lack of disaster recovery plan, lack of security procedures for data collections and inadequate policies.

Data governance can be used to resolve big data challenges. Data governance covers data management systems, data quality, data security and data administration (Begg 2011). It established framework for accountabilities, desirable behaviors, decision right, data policy, guidelines on the creation and use of data and make them to be consistent with the organizational norm and culture, mission, value and strategy (Weber et al. 2009). Begg & Cairra (2012), Bunkle (2016) pointed out that the benefits of data governance are information-centric and organizational culture. It laid down the accountability procedure for information asset. It provides information security. It promotes usefulness and quality of information asset. He added that data governance reduces the cost of managing information and data sharing (Bunkle 2016). Koltay (2016) stated that data governance ensures that data are trusted by making people accountable for their responsibilities.

### **3. METHODOLOGY**

This study is SLR, which aim to present the evaluation of the research topic by using a rigorous, auditable and trustworthy methodology. Kitchenham (2007) is adopted in this study. It was primarily developed in the field of software engineering but we consider it useful because it provides a credible method for the research under study. The methodology consists of three steps, which are:

- Planning the Systematic literature review (SLR). In this phase, the needs and objectives of the study are clearly identified. The necessary research questions are formulated and the review protocol is established.
- Conducting the systematic literature review (SLR). The search strategy is determined with the aim of selecting the relevant literature. The search was done based on the established protocol. Sequel to the search strategy, the relevant literatures are included while those deemed not to be relevant are excluded. In order to avoid result bias, a quality check was conducted on the included research work.
- Reporting of The systematic literature review (SLR). This stage involves effective communication of the result by addressing the identified research questions.

## **4. PLANNING THE SYSTEMATIC LITERATURE REVIEW (SLR)**

This is the section where we introduce the research questions and the research protocol. The research questions are introduced to discover the state-of-the-art on the higher education governance of big data. The research questions are formulated after a series of brainstorming by the authors.

### **4.1 Research Questions**

**RQ 1:** What are the characteristics of big data? This question intends to show those feature of the big data as identified by previous researches.

**RQ 2:** What contributions can big data bring to higher education? This question is aimed at identifying various contributions the big data had brought to higher education.

**RQ 3:** How can higher education govern big data to enhance their benefits? The question is established in various ways higher education can govern their big data.

**RQ 4:** What are the higher education governance models? This question intends to investigate the various higher education governance models.

**RQ 5:** What are the roles of the government in managing Higher Education? This question is meant to investigate the roles of government in the management of higher education.

**RQ 6:** What are the big data initiatives in the developing nations? This question is meant to state various big data initiatives in the developing nations.

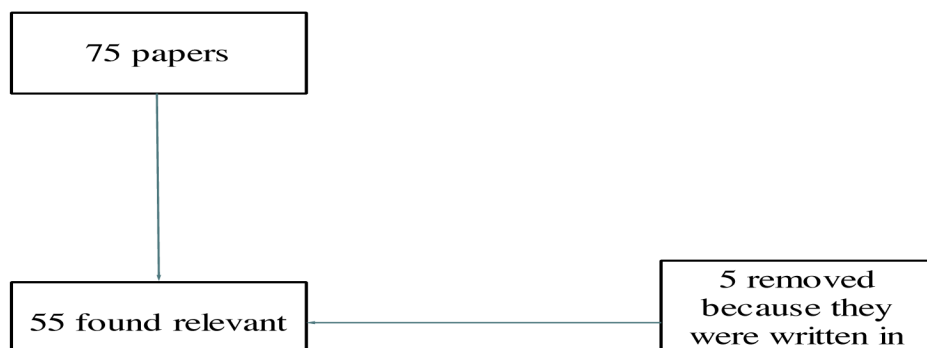
### **4.2 Review Protocol**

In this section, we states the research query, which involves both the inclusion and exclusion criteria.

The relevant research works were searched from the various database. In the process of conducting this systematic literature review, keywords were formulated. Those keywords include big data and governance, big data and higher education, big data analytics and data governance, big data governance and higher education, higher education and governance models, higher education management and the roles of the government, big data initiatives and the developing nations. The sources used are Scopus, Science Direct, IEEE explores, Web of science and springer. The year covered in the study covers 2010 to 2019. Sequel to this, seventy-five datasets were retrieved. Five were found to be written in another language. During the process of inclusion and exclusion criteria, twenty papers were removed due to lack of relevance to the subject of discussion. And five paper were removed because

they were written in another language. The remaining dataset were analyzed under higher education, big data, big data challenges, governance and the critic of the existing work. Figure 1 depicts this process

*Figure 1. Inclusion and exclusion criteria*



We also used two criteria for paper inclusion. The first criterion means that the literature to be included must propose novel solutions and only include the primary studies, not a review work. The second criterion considered the period for the study. Which mean the study must start between 2010 until 2019. In the exclusion criteria, those research work written in other language and perceived not to be too relevant to the study were removed.

Quality evaluation was also done on the included research work. The criteria for quality evaluation include:

- Whether the paper is an output of research or is it just a lesson learned based on the expert opinion.
- Is there a clear statement of objectives?
- Whether the context of the research is clearly stated.
- Whether the research design is appropriate.
- Whether the objective of the paper was achieved.
- Was the finding clearly communicated?

## **5. THE FINDINGS OF THE LITERATURE REVIEW**

This section presents the findings from the systematic literature review. The section address all the research objectives.

## **5.1 Characteristics of Big Data**

The big data has five characteristics. According to (Chaurasia, Kodwani, Lachhwani, & Ketkar, 2018; Höchtl, Parycek, & Schöllhammer, 2016; Riffai, Duncan, Edgar, & Al-Bulushi, 2016; Segooa & Mathias Kalema, 2019; Shirخورshidi, Aghabozorgi, Wah, & Herawan, 2014) the characteristics of big data are:

- **Volume:** This explains the amount of data generated in higher education. The data are generated on a daily basis.
- **Velocity:** This involves the exponential rate at which the data are generated, which need to be processed, stored and retrieved.
- **Value:** This explains the significance of the information inherent in the big data and some of the challenges faced before retrieving the data.
- **Veracity:** The accuracy of the data in the big data is being referred to as veracity.
- **Variety:** This referred to both structured and unstructured data, which appear in a different format such as video, audio, text, number, and image.

## **5.2 Big Data Contributions to Higher Education**

According to Huda et al., (2018) big data can contribute to higher education in nine major ways:

- **Real-time Feedback:** Big data can use in monitoring the students learning performance. This is because it could help in detecting various issues early. It is effective, efficient and better in performance than the traditional means of doing that. Similarly, any student who is moving towards the wrong direction may be alerted and guided in the right direction. This may be done by tailoring the learning towards the context and the interest of the students. The study can be personalized while the teachers observe their students pattern of learning.
- **Monitoring behavior and sentiment:** Big data is capable of revealing the students' work and social habit and compare them with their performance in the school. This will enable them to know which of them may likely have a problem. In addition to this, the staff data, their research output, teaching score, sick day's vis-à-vis the student experience, sentiments could give more insight on the student performance and their teachers' effectiveness.
- **Student retention:** Many factors can be responsible for the good or bad retention by the students, which include inadequate preparation, lack of interest, or poor delivery method by the teachers. It could also be psychological factors such as emotional issues or social factors such as lack

of finance may be responsible for poor retention of the students. The big data has that capacity to reveal all these attributes to the higher education for proper diagnoses and resolutions.

According to Nazarenko & Khronusova, 2017 & Reidenberg & Schaub, (2018), big data can bring about *Better learning*. The in-depth and fast diagnosis of the essential needs for learning, difficult courses, skill assessment such as collaborations, systematic thinking, assessing subject area knowledge, and providing targeted intervention to improve the students' performance could lead to better learning among the students.

- **Attrition risk detection:** Big data has that capacity to analyse the student behaviours and reveal the possibilities of students dropping out of the program can be known on time and consequently, appropriate measures can be deployed (Sin & Muthu, 2015).
- **Data visualization:** Big data has data visualization techniques which can be used to analyse and display the relationship among the complex data in a simple way (Sin & Muthu, 2015).
- **Students' skill estimation:** Students's skills can be estimated with the aid of big data (Sin & Muthu, 2015).
- **Course recommendation:** When the student skills and behaviours are analysed, courses may be recommended to them to further enhance their skills or it may be based on the interest of the students (Sin & Muthu, 2015).
- **Grouping and collaboration:** Big data has the capacity of providing medium for the grouping and socialization of the students (Sin & Muthu, 2015).

### **5.3 Higher Education Governance of Big Data**

Big data governance is the process of formulating a policy that bothers on the privacy, optimization, and monetization of big data (Soares, 2011).

#### **5.3.1. Risk and Security**

Risk and security have been identified as one of the greatest threat of big data in higher education. Moghadam & Colomo-Palacios, (2018) stated that information security is beyond the provision of security for the computer system in dealing with both technical and non-technical information activities. The security has to be provided to mitigate risk in information processing and dissemination. Higher education needs to provide an information security framework to enhance the success of the program. The information security should be able to provide context and the



coherence for the compliance of the institution with the legal framework of both the national and institutional legal framework. Chaurasia et al., (2018) explains that planning and analysis can be done through many perspectives, which may include the service point, decision support solution, and infrastructure. Higher education may need to outsource this if they do not have the expertise or the competency required to do it. Cybersecurity therefore can be used to safeguard firewall and other systems and instruction detection system. The governance of big data may come to inform of the following.

### **5.3.2. Reporting and Compliant**

Chaurasia et al., (2018) observes that higher education should see as a matter of priority their compliance with the legal and regulatory framework. The institution is expected to generate a report to both internal and external and all the stakeholders. The internal include the staff, student and governors. The external people are the government, regulators, reporters and voluntary organizations. Higher education must, therefore, integrate both the internal and external data. Those data expected to be provided by the higher education include curriculum, teaching and learning, academic progression and achievement of the students, productivity and research, attendance records, discipline incident and academic records, carrier goal, attitudes towards staff and hobbies. Nevertheless, Chaurasia et al., (2018) observe that most of these records are not easily analyzable or transferable. This due to the absence of large-scale techniques to monitor academic learning and outcome.

### **5.3.3. Privacy**

Reidenberg & Schaub, (2018) stated that privacy breach in higher education occurs during information processing and dissemination or information collection, inappropriate use or disclosure of students information affect the students social development. A privacy breach can also occur during wrongful surveillance, interrogation, data aggregation, storage and security, data subject identification, and secondary use. Privacy harm may be mitigated through the transparency for the data collection and use. Transparency gives room for informed consent and ensures accountability in data processing and use. The university determines how data will be used but transparency provides great contributions to accountability.

## **6. CRITIQUE AND CONTRIBUTIONS**

Governance of big data in higher education is still at the lower ebb. There are few studies on higher education governance of big data. Those few studies only capture data security, reporting and compliant as well as privacy. However, the main reason for data governance is data quality. There has been no study in this regards hence, the reason for its consideration in this study. The contributions of this paper, therefore, are two folds, which include data quality and accountability.

### **6.1. Data Quality**

Data quality is the extent to which the data meet the needs of the users. Some of the factors to be considered when looking for a quality data are reliability, relevance, validity, objectivity, integrity, utility, completeness and generalizability (Radhakrishna, Tobin, Brennan, & Thomson, 2012). Jesiļevska, (2017) added that data quality is contextual because the user determines the extent of the quality of the data. The purpose of the data usage is considered as multi-dimensional which consist of a set of characteristics. However, Radhakrishna et al., (2012) & Sidi et al., (2012) identified some of the attributes of data quality which include the following:

- **Validity:** It refers to the judgment between the provided value and the actual value of the data.
- **Reliability:** This measure the extent at which the data similar after the repetitive measurement.
- **Completeness:** This ensures all data value are complete. The missing data must be carefully sought for and included.
- **Integrity:** This refers to those data free of errors. The data must be checked to ensure that they are error-free.
- **Relevance:** This refers to the usefulness of the data to the intended users. The degree of its usefulness is used to determine its relevance.
- **Accessibility:** This is the ability to locate the data which are deemed useful.
- **Timeliness:** This suggests the collection of data in a timely manner. The data must be up-to-date.
- **Consistency:** There must be consistency between two related data in one or multiple tables.

### **6.2. Accountability**

This is the process of defining governance to comply with both internal and external criteria. It ensures that appropriate actions are put in place and justify those actions.

It also provides a remedy in case of default (Felici, Koulouris, & Pearson, 2013). Johnston, (2016) describes accountability as various procedures, which are in accordance with the established rules and regulations, which stated the acceptable process, outcome and ensures that officers followed the process. There must be transparencies in accountability.

Felici et al., (2013) enumerated three mechanisms used to support the accountability practice namely:

- **Accountability attributes:** This is the elements of accountability as used in the entire data governance domain.
- **Accountability practice:** This refers to the practice of accountability in higher education.
- **Accountability mechanism:** This refers to all those tools that support accountability process.

## **7. HIGHER EDUCATION GOVERNANCE MODELS**

Higher education governance is the structure and process by which decisions are made and implemented as a result of interplay between the relevant actors. It could be regarded as the relationship between the government and the individual institutions. It could also mean the pattern of governance between institutions (Findikli, 2017). However, there are different types of higher educational governance namely state-control and state supervising model, the new managerialism as a distinct mode of governance, the governance equalizer model, systematic governance in HE policy and analytical framework for the comparative analysis of HE governance.

### **7.1. State-Control and State Supervising Model**

Findikli, (2017) stated that Van Vught (1993) described governance in higher education as the combinations of dynamic actions and interactions among the categories of actors. He identified for basic elements which are essential to the process and outcome of governance. The first one is the extent of influence of market. The second one is the steering strategies of the government. The third one is the management process in higher education and the influence of the academic oligarchy. The first approach i.e market influence was overlooked because it was considered not to operate according to market logic. It was argued that there is only quasi-market structure and market like behaviours in higher education. However, while analyzing the role of the government in a systemic higher education governance, distinction was made between the state control model and the state supervising model. These two

were considered as the two primary steering strategies. In the state control model, the central government agencies regulate and control higher education in all areas. Conversely, in the state supervising model, the government has little influence on higher education. The third one which is the management process which involves the university management and leadership. The control of higher education here is done by the combination of government official, bureaucrate and the academic professionals. The last which is the academic oligarchy is shaped by the strong internal administrators and the powerful academic community (Findikli, 2017).

## **7.2. The New Managerialism as a Distinct Mode of Governance**

Findikli, (2017) explains Dietmar Braun's Heuristic Framework which explains the belief systems that affects the governance of higher education. The belief sees higher education as the cultural institutions that contributes to social cohesions and the economic development of the modern communities. University is also considered as the public service institutions serving social, political and the economy of the country.

## **7.3. The Governance Equalizer Model**

Findikli, (2017) identified governance equalizer model as analytical tool proposed by Boer, Enders and Schimank (2007; 2008). This model has brought shift in the higher education governance of higher education. This model believed that governance in higher education should be rethought based on the underlisted reasons which are:

- The economic recession and the decline in the public expenditure. The reforms in higher education are geared towards economic sustainability (Findikli, 2017);
- The globalization and internalization in higher education has intigated new coordination problems which has to do with the all actors on the scene (Findikli, 2017);
- Lack of encouraging achievement of the government which has caused distrust of the state centered steering of higher education in many countries (Findikli, 2017);
- Higher education is now confronted with the problem of how to sell their goods and services in the various market (Findikli, 2017).

Based on this therefore, five dimention for the governance in higher education were identified as follow:

- **State regulations:** This regards to the top down approach where the government give directives and prescriptions (Findikli, 2017);
- **Stakeholders guidance:** In this model, the government is considered as the stakeholders in the university settings and provides guidance when necessary (Findikli, 2017);
- **Academic self-governance:** It involves collegiate decision making and self steering by the university professionals and academic community (Findikli, 2017);
- **Managerial self governance:** The shows hierarchies within the universities and the role of the leaders in the regulations and the decision making process (Findikli, 2017);
- **Competition for material and symbolic resources:** The final dimension of higher education resources include prestige, personnel and fund between and within the university (Findikli, 2017).

## **8. ROLE OF GOVERNMENTS IN MANAGING HIGHER EDUCATION**

Higher education is an important sector in any nation because it contributes to the knowledge and economic development. Based on this, the government in every nation tends to be concerned about acceptability and competitiveness of their educational system. In order to achieve this, the government has to institute a body for the management of the institutions (Yinka, 2015). The established body has to ensure the quality of the higher education sector. The body will regulate and dictate the activities of the various institutions. In some African countries such as Nigeria, the established body is known as National University Commission. This body accredits the institution programs and monitors the universities to ensure that they comply with the established standard. They also ensure peace and stability within the system (Yinka, 2015). According to Asiyai, (2014) the National University Commission (NUC) regulates both the private and public universities in Nigeria. The body ensures the quality assurance of the Nigerian university systems. It demands accountability and checks the overall effectiveness of the system. It sets standards for the quality of teaching and the academic qualifications of the teachers. It states the number of students to be admitted and monitors the activities of the universities. They also conduct the needs assessment of various universities. Asif, (2012) stated that 80% of the fund needed by the Nigerian universities is provided by the governments. Asif, (2012) added that the government defined the roles and established the process for quality assurance, train teachers and the faculties, establish standards for accreditations.

## **9. BIG DATA INITIATIVES IN HIGHER EDUCATION IN DEVELOPING NATIONS**

Developing nations are those nations with underdeveloped industrial base, low living standard and low human development index. Most of the African countries fall within this categories. Big data can be used by any of the African countries to develop and move their economy forward (Apenteng, 2014). However, the reseach into big data in higher education in developing countries is still at infantry stage. However, there is no study on the application of big data in Africa.

## **10. DISCUSSIONS**

Big data is the amount of large data created in higher education which is beyond the technical capacity of the process, stored or manage. Big data is usually described by its feature of volumes, velocity, value, veracity, and variety. It provides a new approach to how data are discovered, analyze and extracted from the huge amount of data generated. It has the capability for sharing, capturing, transferring, predicting as well as the visualization of the data. Big data is very useful because it provides access to vital data, which can be used, for the decision making in higher education. Big data has great contributions to the perspectives of monitoring students' performance and provide real-time feedback. With big data, higher education management can have firsthand information about the students' performance and the teachers' efforts in the classroom.

Similarly, big data also reveals the student's habits, their sentiments as well as their performance in school. The extent of the teachers' effectiveness also can be seen clearly discovered through big data. The teachers' key performance indicators also can be measured. Big data can be used to monitor some of those factors that inhibits or enhances the students' performance. Those factors may be psychological or social factors. It is expected that all the discovered factors discovered during the process will be used to the advantage of both the teachers and the students. When the management used the knowledge gained through big data for the students, it can enhance better learning and improved the teachers' performance. Big data has the capacity to show attrition risk. In this the strength and the weakness of the students can easily be detected and those students that may likely withdraw can easily seen and so that resque strategies can easily be deployed. Big data has that tendencies to display the relationships among the complex data through it data visualization components. It can be used to estimate the students' skills. Based on this therefore, courses can be recommended to students either to improve or aquire more skills. The student can also socialize through big data components.

Based on the aforementioned factors, therefore, higher education must provide good data governance program capable of enhancing the potentials of big data. Big data governance is the process of formulating a policy that bothered on the privacy, optimization, and monetization of big data (Soares, 2011). Some of the ways to govern big data include the provision of security for risk-related activities in both information processing and dissemination. The security framework must be provided within the context of regulatory compliance. The security of big data may be outsourced when the higher education discovered that they do not have the required expertise. Higher education is expected to integrate both the internal and external information and must be ready to generate and disseminate the reports to the stakeholders within the stipulated law as established by both the government and the institution. During the process of disseminating the data, the breach of the privacy of the stakeholders must be avoided. The avoidance of the privacy breach can be achieved through transparency. The transparency is the information of consent for the data during the information processing and use. Accountability is also important if the security breach is to be avoided. Those who are saddled with the responsibility of information security must be the only one given permission to do so. There should also be constant monitoring of the access to such a vital aspect of the information activities.

Data quality is an important aspect of big data governance. The data stored in the big data must be of good quality before it can serve important purposes. However, there are important attributes data must have before they can be regarded as having quality. The data must be valid, reliable, complete, consistency, relevance, accessible, timeliness and must have integrity. Data with these attributes will serve the higher education intended purpose and help them in taking important decisions.

Similarly, there must be accountability in data governance. This accountability gives room to identify different roles, the officer that will be responsible for the roles, and while the roles are, require. Accountability also brings about transparency.

There are different models that can be used for the governance in higher education. One of such models is State-control and state supervising model. This model can come in two ways. It can come in form of state control or state supervising model. The state control stipulates that the state regulates and control higher education. All the directive and control come from the state. But the state supervising model is the situation in which the state is only part of the stakeholders and only advise and supervise when necessary. Another model is the New Managerialism as a Distinct Mode of Governance which sees higher education as a cultural institutions that brings about social cohesions and as a public institutions that support the socio-political and the economy of any nation.

Another model is the The Governance Equalizer Model which stated that the governance of higher education should be rethought do the the economic recession

which has brought about the decline in the public service expenditure. Also the internationalization and globalization which demanded new coordination methods. Also the poor achievement of the government has led to the mistrust of the state central steering of higher education in many countries. And lastly, the problem of how to sell the higher education product and services in the market. Based on this five dimension governance approach were developed which include (1) state regulation. In this approach, the government give prescription and directive (2) stakeholders guidance. In this the government only provides guidance (3) academic self governance. this is a collegiate decision making process, the professional and the academic communities take the decisions. (4) managerial self governance. the hierarchies within the universities are in charge of the decision making process. (5) The final approach is the competition for material and symbolic resources. In this, there is competition for personnel, prestige and fund within and between the universities.

In the management of the higher education, the government has some vital roles to play such provisions of policies, laws, directives, standards. The government have to monitor higher education to ensure that they follow the laid down rules. Similarly, the government have to provides funds for both recurrent and capital expenditures.

This study has shown that the study of applications of big data in the developing nation and there are no studies on the application of big data in African's higher education. This is a gap that is needed to be filled.

## **11. CONCLUSION**

In this paper, we are able to discourse the characteristics of big data, its contributions to higher education and how to govern it. The limitations of the paper are that there are limited studies on big data governance most expeditiously in Africa. The existing studies, therefore, have only considered security, compliance, and privacy. We have, however, contributed by discussing data quality and accountability. The future direction, therefore, can be the study of data governance stakeholders in higher education.

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