Artificial Intelligence (AI) and Inclusive Innovation: Examining Contemporary AI Initiatives in sub-Saharan Africa.

By

Kofi Yeboah

Submitted to the Faculty of Arts

University of Alberta

In partial fulfillment of the requirements for the degree of

Master of Arts in Communications and Technology

July 2020

ACKNOWLEDGEMENTS

Thank you to my supervisor, Dr. Gordon Gow, who was instrumental in building my confidence in completing my first ever academic research paper. His support and openness to new concepts were a significant factor in my choice of research topic. His ability to identify the needs of students and assess their level of capabilities are extraordinary skills that have contributed to the completion of this research project.

I am also extremely grateful to the research participants - International Business Machines (IBM) Research Centre, Africa, World Wide Web Foundation, Mino Health AI Labs, and International Development Research Centre (IDRC). They shared their expert thoughts and insights to help address the issue of inclusivity in AI initiatives in sub-Saharan Africa.

The 2018 MACT cohort has been one of the supportive groups during this research project, and I would like to thank them for their collective goal of seeing everyone in the cohort succeed. I am also grateful to Razak Oduro, PhD candidate at the University of Alberta, for his timely guidance and contribution to improving my understanding of my choice of research methodology.

I would also like to thank Mr. Sebastian and Mrs. Stephanie Spio-Garbrah, and Dr. Jared Wesley for their continuous professional advice throughout my journey as a graduate student.

Finally, special gratitude to my parents and my brother, Kwaku Tweneboah-Yeboah, for their emotional support and motivation during this research project and my graduate school journey.

ABSTRACT

Africa is increasingly becoming a market for foreign global technology companies to implement artificial intelligence (AI) projects. Most of the AI research centers, serving as subsidiary companies of major big technology companies, are developing innovative AI solutions or products to solve some of the most challenging and critical problems in the sub-Saharan African region. This research seeks to understand better which groups within this region are involved with AI innovations. This research helps find answers to the research focus, which is, "How inclusive are AI initiatives in sub-Saharan Africa?"

The research explores why inclusion gaps exist and what factors contribute to these inclusion gaps in the region. Using a qualitative research design, this study interviewed four key informants who are AI researchers working with subsidiary AI research and development centers in sub-Saharan Africa, advocates of AI inclusion in the region, and founders of local AI initiatives.

The findings from this study indicate that there is an intention of making AI initiatives in the region more inclusive. Still, there are also factors impeding the achievement of this goal. Some of the factors identified through this study include the high cost of innovating for low-income groups compared to the low cost of innovating for affluent communities. Other factors include the non-existence of comprehensive national AI policies or strategies in sub-Saharan Africa that ensure AI initiatives are more inclusive in their design and implementation of AI products. Finally, this paper reflects on future directions for improving on making AI initiatives more inclusive in sub-Saharan Africa.

Keywords: *Artificial Intelligence, Inclusive Innovation, Emerging Technologies, sub-Saharan Africa, low-resourced communities, development studies, ICT4D.*

TABLE OF CONTENTS

CHAPTER 1 - INTRODUCTION

In Africa, Artificial Intelligence (AI) is among the key enabling technologies that will drive the continent's digital economy. AI provides countless avenues for both the public and the private sectors to optimize solutions to the most crucial problems facing the continent today, especially for struggling industries/sectors such as healthcare and agriculture (Travaly and Muvunyi, 2020). Innovative forms of service delivery and support enabled by AI systems are paramount because of its crucial role in augmenting weak institutions and sectors for the benefit of the society and economy. For example, supporters claim that AI investment in sub-Saharan Africa will help improve human expertise, improve productivity, and enhance early disease detection and surveillance in the health sector (Smith et al. 2018). AI also has the power to transform the way governments deliver public services, as this could significantly improve citizens' experiences of government while reducing cost for people accessing these services from rural and peri-urban communities.

There are examples that AI is solving to local problems in Africa - from sexual and reproductive health monitoring chatbots in Kenya, to smart farming in Nigeria, and the tracking of illegal fishing in West Africa by AI-powered drones. However, it remains to be seen whether AI tools are used by marginalized groups - SMEs and individual developers, and incorporated into, for example, startup companies, locally developed open source tools, and educational uses. There is the risk that unequal design and implementation of AI applications and initiatives could widen inequalities (Miller and Stirling, 2019). In other words, while AI has the potential to solve some critical challenges in society, marginalized groups might not benefit from these innovations.

In this chapter, I will briefly explain the purpose of this research study and share the research question that informed this research. There will also be a preview of the key themes discussed in the literature reviews and inclusion of the research methodology used.

1.1 Purpose of the Study

This study examines the extent to which AI initiatives are or could become inclusive to help foster local capacity in leading AI development in sub-Saharan Africa. This research is an exploratory study to help establish a pre-understanding of how AI initiatives are inclusive, contribute to how best to proceed in a further intensive and broader study on the subject, and possible methodology would be useful to apply when gathering information in future research. It also provides a road map for the prospective study and indicates that this subject is feasible to conduct a research study on the future (Streb, 2009).

This study aims to provide a comprehensive and relevant framework to help organizations and policymakers to develop active, inclusive AI initiatives for sub-Saharan Africa to address issues of innovation exclusion of marginalized groups.

Objectives:

- To assess the state of inclusivity of AI initiatives in sub-Saharan Africa.
- To provide a comprehensive and relevant framework to help organizations develop effective inclusive AI initiatives for sub-Saharan Africa to address issues of innovation exclusion of marginalized groups, diversity, etc.
- To recommend or identify ways in which AI initiatives could be more inclusive in sub-Saharan Africa.

The results of this research study will contribute to a broader literature on the current state of inclusion innovation in sub-Saharan Africa, a region with little to no research about inclusive innovation. Also, this research study will provide a better understanding of the factors that widens the inclusion gaps in sub-Saharan Africa concerning innovation derived from emerging technologies such as AI.

The exploratory nature of this research study limits the ability to make a definitive conclusion that the findings of this study are an accurate picture of the inclusivity of AI initiatives in sub-Saharan Africa (Taylor, Catalano & Walker, 2002). It is because the number of participants engaged in this research study are very few and cannot be used to represent the entire ecosystem of AI initiatives in the region. However, the study provides a preliminary overview or a glimpse into what the current inclusivity state of AI initiatives in sub-Saharan Africa might be if there is a further extensive research study conducted in the future.

1.2 Preview of Literature

In sub-Saharan Africa, AI is another emerging technological innovation that is taking dominance in national development discourse. However, technology has been a significant factor in creating more social inequalities and widening the inclusion gaps. This study focuses on how AI initiatives are inclusive in sub-Saharan Africa. To explore this study, the research was viewed through the lens of inclusive innovation theory, using the “ladder of innovation” as a benchmark to analyze the state of inclusivity of AI initiatives in sub-Saharan Africa. However, two significant fields the literature delved into were technological innovations and inclusive innovations.

The literature reviewed covered the two fields mentioned by locating articles under these five particular areas: (1) AI development landscape in Africa, (2) Inclusive innovation and development, (3) Inclusive technological innovations and (4) Factors attracting multinationals to invest in the technology sector in SSA.

This research study's literature anchored on the works of several reports, academic research papers, and white papers. First, Smith et al. (2018) expand on the transformation AI will create across specific sectors - healthcare, agriculture, education, governance, and economic development - in developing countries, including sub-Saharan Africa. The authors also highlight the risks and challenges that will be created by AI, especially the creation and widening of social biases, loss of jobs, fake news, and inequalities. van der Merwe & Grobbelaar (2016) develops an analytical framework for measuring the inclusive innovation performance of a system. Finally, Harsh M. et al.'s (2018) argument that innovation could be more inclusive by just focusing more on technology transfer systems for disadvantaged communities and rural development. These research studies and reports guided my research to seek for better equity frameworks that provide specific policy pathways and a deeper understanding of inclusive innovation.

The literature indicates that technological innovations are associated with creating access and integration. However, it can also isolate people, creating unique forms of social exclusion (Foley and Ferri, 2012). According to UNCTAD's Post-2015 Development Agenda report, technological innovation is often an elite activity, serving a few people and industries. This study provides more insight into the extent to which AI initiatives are inclusive in the region, unknown factors that lead to AI inclusion gaps, and strategies to close the gap.

1.3 Preview of Methodology

The research design for this study is based on the inclusion innovation theory as its framework to find answers to the research question - *How inclusive are current AI initiatives in sub-Saharan Africa?* The research question was categorized into three sub-research questions:

- RQ1: To what extent are current AI initiatives in Sub-Saharan Africa inclusive?
- RQ2: How can current and future AI initiatives in sub-Saharan Africa become inclusive to help foster local capacity to lead AI development?
- RQ3: What indicators can help measure how inclusive AI initiative is in sub-Saharan Africa?

The research study is viewed through the lens of the qualitative description using a case study design. Data were collected using semi-structured interviews and applied to qualitative content analysis, using inductive thematic coding. Other possible research methods and strategies initially considered for this research study included ground theory and quantitative. Though this research exploratory in nature, its end goal is not to generate a theory, which suited a ground theory approach, instead describe a subject matter - the state of inclusivity of AI initiatives in SSA. This study is a small-scale study that needed to have a holistic view of the subject matter; thus, the choice of the qualitative method instead of quantitative methods.

1.4 Conclusion

There is minimal research on the state of inclusivity for AI initiatives operating in sub-Saharan Africa, and this research study aims to explore this and identify if there are any gaps, why these gaps exist, and how to close this inclusion gap. Chapter 2 reviews existing literature on the current state of AI development in Africa, the risks and opportunities of multinationals leading AI development in Africa, and the inclusivity of technological innovations on the

continent. Chapter 3 explains the research design and methodology, including insight into the underlying theoretical framework used, and chapter 4 presents the findings, analyses, and discussion of the study. Finally, chapter 5 concludes the report with a summary of key insights and recommendations for future research in this area.

CHAPTER 2 - LITERATURE REVIEW

Artificial Intelligence (AI) has been in existence since the middle of the last century. However, it did not survive the "winter" during the 1970s when the promising results and hype of artificial neural networks were pushed back by some researchers that neural networks were unreliable and limited in its use (Lee, 2018). The pushback resulted in total abandonment of AI throughout the 70s and 80s until its renaissance in the early 1990s. The recent AI renaissance was because of the availability of two key ingredients that neural networks feed on to function effectively and seamlessly – computing power and data (Lee, 2018). After several decades, the world's technological innovation sector has transformed, giving us high processing speed for the digital tools we use and the internet providing us with millions of data (text, images, videos, clicks, tweets, etc.) each minute. Our smartphones hold millions of times more processing power than the leading cutting-edge computers that NASA used to send Neil Armstrong to the moon in 1969 (Lee, 2018).

Researchers disagree when defining AI. Some argue that AI should have specific characteristics such as "operating autonomously, adapting to change, and creating and pursuing their own goals" (Guihot et al. 2017). Therefore, any computation that has none of these characteristics is not AI. For this paper and the geographical context of the research topic, I will define AI from the perspective of Access Partnership's paper on AI development in Africa:

> *AI is a constellation of technologies that enable machines to act with higher levels of intelligence and emulate human capabilities to sense, comprehend, and act. These human capabilities are augmented by the ability to learn from experience and adapt over time.*

> *In other words, AI enables machines to sense their environment, think, and in some cases learn, to act in response to the environment and the circumstances underpinning it. (p. 4)*

AI is the "new electricity" that will disrupt almost all aspects of human existence, and it could very well be the most important technological development revolution of our times. AI builds on the significant technological breakthroughs over the last century — electricity, railways, and information technology. Champions of AI promise it will boost productivity dramatically, maximizing output and growth in all industries - reducing poverty and improving education, to delivering healthcare and eradicating diseases, addressing sustainability challenges (Artificial Intelligence for Africa Report, 2018).

This literature review will begin with a description of the search methodology and criteria used in selecting the sources consulted. This section provides how the articles were selected, which keywords were used, the online databases accessed, etc. This literature review will focus on addressing the research question - *How inclusive are AI initiatives in sub-Saharan Africa?* The goal is to provide some foundational understanding of how to measure and ensure inclusivity when fostering local capacity in sub-Saharan Africa to drive and lead the development of AI innovation.

I will also provide a general overview of the AI ecosystem in Africa and throw more light on countries in sub-Saharan Africa in comparison to Canada. I will then delve into expounding on the identified themes from the literature research to explore the various critical elements of inclusive technological innovation. In conclusion, I will highlight the gaps in the literature and how it informed my research question.

2.1 Methodology: Search strategy and selection criteria

All researched articles were selected based on a certain specific year period of publication - 2000 to 2019. However, some literature was taken from the 1990s and 1977 due to their relevance. Initially, I downloaded 92 articles, papers, books, published reports, etc., and imported them to Paperpile. These articles were sources from database portals such as Google Scholar, Science Direct, University of Alberta Online Library, Research Gate, etc. Some of the keywords used for the search include, but are not limited to, Artificial Intelligence in Africa, Innovation in Developing Countries, Technology Transfer, Internet of Things in Africa, Inclusive Innovation, etc. Out of the ninety-two sources, fifty were considered for the literature review, of which thirty-nine sources were discussed.

The study inclusion criteria were as follows: (1) studies assessing the global landscape of AI development (2) studies assessing the general landscape of AI development in Africa (3) studies evaluating the impact of AI in Africa (4) studies assessing inclusion innovation from a technology perspective. Studies that involved the risks and opportunities of foreign technology companies leading technological innovation in developing countries were also included.

There were other exclusion criteria which were: (1) automated decision-making, (2) robotics, and (3) Trust in artificial intelligence. Also, the discarded sources did not provide a general understanding of the research question. Some of the discarded literature were outdated, and the information not relevant to current trends in AI. Articles were inputted into excel sheets for tabular synthesis and thematic organization.

2.2 Artificial Intelligence Landscape in Africa

Globally, AI promises to create a market worth over $35 billion by 2025 and double the annual economic growth rates (Schoeman W. et al., 2017). AI also promises a future of robots and humans working together to solve Africa's most challenging problems—reducing poverty and improving education, delivering healthcare and addressing sustainability challenges (Artificial Intelligence for Africa Report, 2018). Currently, AI-powered solutions are being used to solve some of the critical problems in agriculture, healthcare, public services, financial services, education, etc. For example (Artificial Intelligence for Africa Report, 2018 p.12-14):

- *FarmDrive:* A Kenyan startup, uses mobile phones, alternative data, and machine learning to close the critical data gap that prevents financial institutions from lending to creditworthy smallholder farmers.
- *Sophie Bot:* A user-friendly conversational free chatbot that provides information on sexual and reproductive health for people in Kenya.
- *Scan to Pay App:* A mobile banking app developed by Nigeria's Zenith bank, which is used by Zenith and non-Zenith customers to make online and in-store payments in seconds through quick response code scanning on any internet-enabled phone.

However, these benefits come with some challenges which might widen the existing precarious livelihoods, worsen inequality, and weak governing institutions in sub-Saharan Africa. Also, some gaps exist between urban and rural areas regarding gender and languages. Most of the AI products are made for non-African language speakers with less local content and African-produced open-source AI technology (Nwaodike, C. 2017).

Though Africa is seen as the rising star of the next technological boom after Asia, Africa has not yet unraveled the opportunities due to challenges such as regulated entry and competition, new economy skills access, and accountable institutions (Nwaobi, 2019). Therefore, Africa has welcomed some multinationals to facilitate the achievement of this potential economic growth (Dafoe A. et al. 2019). This is based on the logic that multinationals afford positive externalities in the form of technology transfer that may help to improve the productive capacity of local firms.

Africa must learn from its historical mistakes, industrialization crisis if it wants to benefit significantly from this technological revolution. The ongoing industrialization crisis in Africa has been attributed to the fact that the industrialization process has been dramatically shaped by external agents than nationalist state and/or a domestic indigenous bourgeoisie. Using Nigeria as a case study, one study used micro-level analysis to highlight how internal and external factors have resulted in inefficient production, limited domestic linkages, and the continuing weakness of technological capability. It attributed this problem to the lack of a systematic framework for technology transfer and the false sense of boom. However, Africa needs to position itself first in each theoretical concept, ideological, and technological evolution framework that can be launched once the fundamental concepts of AI have been well defined (Barro et al., 2018).

2.2.1 The Leading Stakeholders of AI Development in Africa: It is not surprising to see the dominance of global tech companies investing in AI in untapped markets because of the perception that global leadership in AI could confer clear, infrastructural and economic advantages to frontrunners (Cave et al., 2018). There is an ongoing fierce race between countries and multinational corporations that leads the AI superiority context (Managi et al., 2010). It is the reason why multinational corporations, particularly technology companies, are investing in

establishing AI research and innovation centers in emerging markets like Ghana, Kenya, South Africa, Nigeria, etc. (Artificial Intelligence for Africa Report, 2018).

These global tech companies are “tech worshippers” who hold the technological future of the continent in their hands. Therefore, it is essential to point out the cautions that need to be taken and the lessons that need to be learned from other parts of the world (Birhane,2019). Their accumulation of digital power, backed by their economic power, shapes the development and deployment of AI. In developing economies, these global tech companies can “control the infrastructures of public discourse and the digital environment decisive for elections” (Nemitz, 2018, P. 3). When multinationals lead AI development in emerging markets, it leads to rising monopoly power, profits, and wealth (Kurz, 2017).

As a result of their market power, they employ diverse strategies to choke off competing for local innovations, including the purchase of competitors (Kurz, 2017). For example, “Facebook was started in 2003 as a social website at Harvard and incorporated in 2004. As a corporation, it began with an initial investment of less than $50 Million but raised $16 Billion in its initial public offering in 2012. During 2012-2014 it acquired Instagram, WhatsApp, Pryte, and LiveRail- with negligible capital on their balance sheet- for about $20 Billion, accounting for most of its $21 Billion (Kurz, 2017. p. 10).” These multinationals may not also prefer a joint venture as a mode of entry, given the weak competitive base of local firms and the difference in capabilities between foreign affiliates and domestic firms (Elmawazini et al. 2012).

Some sub-Saharan African governments are taking the initiative to start the discussion of developing policies and strategies to promote AI. For example, The Ministry of Science and Technology in Nigeria has formed the National Agency for Research in Robotics and Artificial

Intelligence (NARRAI) to collaborate with international research bodies, enhance instruction on AI topics for thousands of students, and promote Nigeria's ability to leverage these technologies for economic growth. South Africa has also formed a Chief Directorate for Future Industrial Production and Technologies (FIP&T) to find solutions to the challenges from the impacts of emerging digital technologies, including the Internet of Things, big data, AI, robotics, and new materials (Artificial Intelligence for Africa Report, 2018 p.15-17).

In academia, there are few local AI research centers and hubs in universities across the sub-Saharan African region. The University of Lagos has established the first AI hub in Nigeria to serve as an avenue for developing the AI cycle in the country by focusing on deep learning and encouraging young talent discovery within the innovation and data analytics space. Strathmore University (Strathmore) in Kenya has established the iLabAfrica Research Centre, to promote cutting-edge research on emerging technologies such as Big Data, Artificial Intelligence (AI), Blockchain Technology, Cyber Security, Internet of Things (IoT) and Cloud Services for Kenya (Artificial Intelligence for Africa Report, 2018 p.17-18).

The Big Tech companies have established AI research centers across the region - IBM Research Africa (IBM-RA) in Kenya and South Africa is the first commercial technology research facility in Africa conducting both applied and far-reaching exploratory research and Google AI Research Centre in Africa, located in Ghana, focuses on AI research and its applications, looking to push the boundaries of AI while solving challenges in areas such as healthcare, agriculture, and education (Artificial Intelligence for Africa Report, 2018 p.19-20). However, many such initiatives by corporate entities have been heavily criticized for contributing little to inclusive growth since they are corporate-centric and use top-down strategies that emphasize corporate profit generation (Peerally, J. A., et al., 2019).

2.3 Inclusive Innovation and Development

Inclusive development is defined by Cozzens and Sutz (2014) as *the process of increasing livelihoods and capacities among people who are currently marginalized.* On the other hand, inclusive innovation is defined as *the means by which new goods and services are developed for and/or by those who have been excluded from the development mainstream* (Odame, H. S, et al. 2020). Using the "ladder of inclusive innovation" by Heeks et al. (2014), Kalkanci, B. et al. (2019 p.5) define inclusive innovation by conceptualizing the term from an operations management perspective along with three domains: (1) inclusive product and service innovation (2) inclusive process and business model innovation and (3) inclusive supply chain innovation. Inclusive innovation could also be providing an avenue to address challenges related to poverty, inequality, and exclusion by bringing people and organizations who were out of the spotlight, to the mainstream development activity (George et al., 2012).

In their research paper, Kalkanci, B., Rahmani, M., and Toktay, L. B. (2019) argue that innovation in any form (in product/service, process/business model, and supply chain) play a crucial role in social sustainability in developing economies such as SSA. Also, the uniqueness of inclusive innovation is based on adopting social objectives more explicitly in problem definition and scoping. Secondly, it is people-centric and built on interactions with underserved populations of diverse cultural, geographical, and economic characteristics. However, the researchers caution that:

> *Innovation is a double-edged sword that can have unintended consequences unless there is a deliberate attempt to incorporate justice, equity, and inclusion considerations (e.g., expensive micro-irrigation technologies can push small local producers out of business;*

> *grid interconnection can focus only on urban areas at the exclusion of rural populations; affordable housing can omit to account for long-term energy efficiency, etc.). To ensure these considerations are integrated, we need closer alignment and collaboration between the for-profit sector, civil society organizations, and government. (p.5)*

The emergence of inclusive innovation has led to significant arguments and advocacy of reorienting business strategies and the way businesses understand innovation systems. However, van der Merwe, E. et al. (2016) indicate that practical implementation of inclusive innovation projects and programs and transforming innovation systems to develop inclusive innovations is a very strenuous and complicated task to execute.

2.31. Innovating for the marginalized: Govindarajan and Ramamurti (2015, p.3) posit that businesses play an essential role in innovating for under-represented population by applying "can apply its innovative genius in three ways to create shared prosperity: by supplying quality products at ultra-affordable prices, which will allow the masses to stretch their purchasing power and improve living standards; by creating new opportunities for gainful employment, which will increase their incomes; and by providing access to services that will increase their future earning potential." To contextualize and replicate the existing inclusive innovation systems from developed countries, innovators must understand the different needs of poor consumers in developing countries, acknowledge the uncertainties and resources scarcities within such markets, the unique local institutional forces at play and the heterogeneity between local markets (Foster, C., & Heeks, R. 2013).

Innovators have identified that marginalized groups are exempted from the consumption process of inclusivity due to their low purchasing power and poor living standards. However,

Prahalad and Mashelkar (2010) suggest that private firms and multinational companies could potentially generate profit by developing cheap, affordable products and services for marginalized groups even within a resource-constrained environment. In a qualitative study by Patnaik, J., & Bhowmick, B. (2020)., the researchers found that to innovate *for* and *with* the underrepresented population, there is a need to (1) create a new market, (2) develop appropriate technologies, (3) ensure local utilization of resources and (4) improve production that goes on to serve the needs of communities.

2.3.2 Policies of Inclusive Innovation: Policies are often introduced when there is a need to fix a failure within the innovation system, in this case, inclusion gaps, which usually occurs between excluded groups seeking for their needs to be met, but multinationals focusing on wealthier groups (Bergek, A., 2008).

Drawing findings from Kenya's thriving and highly inclusive mobile money market, Foster and Heeks (2013 p.115-117) provide the following three key considerations as a response to the question, "what policy is needed for inclusive innovation?":

1. Identify the core purpose of the policy. That is, inclusive innovation systems must be built around a potential virtuous circle of pro-poor adaptive innovations, dynamic competition in markets, and innofusion[1] intermediaries within poor communities, underpinned by initial policies that simultaneously regulate and deregulate.
2. Develop specific policies that support components of inclusive innovation. That is, sector-specific policies (e.g., removal of VAT on products, rules on approved products, product regulations), sector-significant policies (e.g., the Anti-Counterfeit Act, and

[1] Innofusion is the concept used to explore this process of introducing information and communications technology.

universal service initiatives), sector-foundational (e.g., business/enterprise laws, and trade policy) to generic policies (education and taxation, etc.).

3. The implementation of the policies. That is focusing on enforcing these policies by providing the necessary resources needed and establishing formal institutional forces to reduce the presence of informal institutional forces: norms and values that cause bureaucracies to deviate from their legal remit.

2.4 Technological Innovations

Although technological innovations have improved living standards, it has also caused rising inequality with other adverse economic effects (Kurz 2017). The structural relation between waves of innovations and inequality depends upon other factors such as the power of organized labor, income taxes, and the nature of the innovation wave itself. Kurz (2017) argues that the wealth creation from technological advancement does not create wealth for everyone but is transferred from one group of monopoly wealth owners to the next set of innovators, who may be young but not members of the same family. There is a growing hypothesis that the benefits of investments from multinationals into emerging markets, like sub-Saharan Africa, are not mutual and shared unequally. There are two possible explanations for this: institutional/structural weaknesses and low levels of innovation and imitation activities, which create no incentives for foreign affiliates to transfer technology to sub-Saharan Africa (Elmawazini et al., 2012).

In a study to develop a set of indicators to inform the development of policies and practices to ensure the participation of low-income groups in economic activities in Nigeria, Adejuwon, O. O, et al. (2016) found that technology adoption in commercial ventures among low-income groups may be a remedy to the increasing income disparity in developing countries.

Technological innovations help increase the participation of excluded groups in development. However, lack of access to or non-adoption of technological innovations by the poor may hinder their participation and contribution to the economy resulting in a negative impact on their income and other socio-economic indices (Adejuwon, O. O, et al. 2016). Excluded people such as people with disabilities are less likely to own a computer, smartphone, or digital device, which often AI technologies are built on. Due to the lack of these digital resources, the marginalized groups experience technological disparity and are not part of the AI development conversations (Noel, K. et al. 2020).

2.4.1. Inclusive Gaps in Technological Innovations: Foster and Heeks (2013, p.335) define inclusive innovation as "*the means by which new goods and services are developed for and/or by vulnerable populations living on lowest incomes. Contrasting conventional views of innovation, inclusive innovation explicitly conceives development in terms of active inclusion of those who are excluded from the mainstream of development and refers to the inclusion within some aspect of innovation of groups who are currently marginalized*". Some scholars argue that even though business models need the technological innovation element to succeed, they often neglect the processes by which operational capabilities and innovative capabilities. Hence, creating an inclusive innovation gap (Cozzens, S. and Sutz, J. 2014; Peerally, J. A., et al., 2019;).

Technology has been identified as a critical factor to inclusive innovation. Still, Odame, H. S, et al. (2020)'s research indicates that little attention has been paid to the role it plays in inclusive innovation, especially in transforming key sectors such as agriculture, health, and education. However, technology through multinationals has varying impacts in developing countries - not always leading to the alleviation of poverty, widening inequality, and the creation of value for vulnerable or marginalized communities (Peerally, J. A., et al., 2019).

2.4 Factors Attracting Multinational to Invest in the Technology Sector in SSA Region

Multinationals such as Google, Facebook, Microsoft, etc. assess several factors before investing in a country's technology sector. The AI industry is no different from this, and such factors differ from country to country and vary based on how "developed" or "developing" the country is. In this section, I explore these factors from the SSA region. I will also explore how developing countries can improve on these identified factors to benefit significantly from the investment of multinationals into their AI ecosystem by taking some examples from Canada's ongoing robust AI sector.

2.4.1. Technology Diffusion/Adoption: The economic effect of multinationals' investment into SSA's AI ecosystem is dependent on two key factors - technological conditions and its diffusion (Elmawazini et al. 2012). There is little or no incentive for multinationals to transfer technology to SSA countries due to significant differences in individual skills and technological capabilities between local firms and foreign affiliates. Some previous studies show that better technologies are transferred faster when the host country has made more substantial investments in learning, which has not been the case with SSA (Elmawazini et al. 2012). In another study, researchers used three technology spillover[2] variables – "horizontal (intra-industry) productivity spillovers, vertical (inter-industry) technology spillovers from foreign firms to local firms and regional technology spillovers" (Managi & Bwalya 2010 p.605) - to determine that there are rapid technology spillovers from foreign firms to domestic firms when there is a high concentration of international firms within a region (Managi & Bwalya 2010).

[2] Technology spillover refers to the unintentional technological benefits to firms that come from the research and development efforts of other firms without the costs being shared.

Due to the low innovation expenditure of developing countries, its technological endowment depends on technology diffusion from foreign firms (Berthoumieu, 2017). Africa's technological dependence is of the asymmetric type where it imports technology but without any local adaptation, modification, and ability to assimilate it into an already developed domestic technological system (Fabayo, 1996). Using a quantitative method, Jafarieh's (2001) findings indicate that the rate of technology integration varies significantly with the level of socio-economic development. The article considers the role of multinational corporations as facilitators of technology transfer. It emphasizes that the profit agenda of these multinational corporations are likely to make the developing countries more dependent. However, technology dependence on foreign firms undermines the attempts that might be made by the African countries to strengthen their capacity for scientific research and technological development to solve local problems. (Fabayo, 1996).

2.4.2. Government Policies/Strategies: There is an urgent need for government policies to be directed towards moving from the factor-driven stage to efficiency- and innovation-driven stages of development. Policies based on factor-driven competes based on factor endowments, such as unskilled labor, and natural resources. In contrast, innovation-driven competes based on the new and unique products and using sophisticated production processes. Moving beyond the factor-driven stage of development will result in a more positive effect of FDI in host countries through both capital accumulation and total factor productivity. To benefit from the global technological advancement and the rising interest of multinationals in its technology sector, SSA countries like Ghana has instituted a new Presidential Advisory Council on Science, Technology, and Innovation (PACSTI) which will advise the President on matters relating to Science, Technology and Information (STI), current advances in STI, and their relevant applications

towards national development. The PACSTI is also intended to increase more significant funding for Research and Development (R&D), higher STEM education, meaningful legislation, and making sure that agriculture, food processing, and environmental problems are being solved with Science and Technology solutions.

Also, Ghana aims to establish the Ghana Innovation and Research Commercialization Centre (GIRC-Centre), which will focus on technology transfer and the commercialization of the work produced by academia and industry. The Centre will also work to "promote partnership between government, public research institutions, industries, academia, and the private sector to ensure that the collaborations [leads] to enhanced productivity (Global Trade and Innovation Policy Alliance Report, 2019. p. 38)." These projects are yet to take off while there is an ongoing R&D investment by Google and other multinationals in the country. It is good to have the intention of good initiatives, but the government must implement these initiatives (Global Trade and Innovation Policy Alliance Report, 2019).

Using Ghana as a case study, Osabutey, & Debrah (2012) reveal that there are gaps in the existing foreign direct investment policy that does not address issues of technology transfer policies, technological development policies and private sector policies. Instead, policies should encourage foreign companies to spend on research and development and university-industry research collaboration (Osabutey, & Debrah 2012). The report also surveyed members of the academic community, privately funded research institutes, financial institutions that fund innovation, and high-level officials in government institutions that deal with innovation policy in Ghana. The recommendation was that Ghana needs to focus mainly on investment and infrastructure for ICT and address "fiscal and monetary deficiencies" in the national systems of innovation (Global Trade and Innovation Policy Alliance Report, 2019. p. 38).

For SSA to have a positive impact of Artificial Intelligence (AI) on the economy concerning productivity, growth, inequality, market power, innovation, and employment, it must prioritize these two forms of policies - policies that are likely to influence the speed of diffusion of AI and the way that the technology takes. Also, there is a need for industry regulation and policies related to addressing the potential consequences of the diffusion of AI concerning productivity and labor market changes (Agrawal et al. 2019). Agrawal et al. (2019) article categorize the diffusion of AI into three key policy drivers that are currently shaping AI development - privacy, trade, and liability, and how to balance that with societal values, which are essential for AI development in the SSA region.

2.4.3. National AI Strategy: Currently, no country in SSA has a comprehensive and fully completed national AI strategy/policy that guides the activities of AI initiatives in the region. However, Canada, one of the leading pioneers in AI development, is the first country to develop a $125million national AI strategy that outlines the country's priorities with regards to AI development and inclusivity. Also, Canada is globally recognized as the "second-largest tech sector outside Silicon Valley" and is considered a global leader in the field of AI (Carole J. Piovesan et al. 2018). It is estimated that funding raised by Canadian AI companies would "exceed US$250 million, representing an almost two-fold increase from the previous record historical high of US$143 million in 2015."

This strategy informs every local and foreign investment into their Canadian AI industry. Canada's National AI Strategy leans heavily towards promoting research as opposed to regulations and governance structures. These are outlined in the national AI strategy objectives:

- To increase the number of outstanding artificial intelligence researchers and skilled graduates in Canada.
- To establish interconnected nodes of scientific excellence in Canada's three major centers for artificial intelligence in Edmonton, Montréal, and Toronto.
- To develop global thought leadership on the economic, ethical, policy and legal implications of advances in artificial intelligence; and,
- To support a national research community on artificial intelligence.

Canada (and its provinces and territories) could focus more on both building and fostering the organic growth of a blended governance model that places AI oversight and accountability at the fore of its efforts (Gaon et al. 2019). Reports by the White House, the European Parliament, and the UK House of Commons on their plans for AI postulate the need for countries to provide a political vision and long-term strategy for the development of AI for social good (Cath et al., 2018). In a comparative assessment, Cath et al. (2018) identified some significant weaknesses in the various reports – "developing an understanding of how responsibility, cooperation, and values fit together to design and steer the development of AI for social good" (Cath et al., 2018. p. 524). SSA countries need to develop a policy that focuses on making AI respond to social needs. However, Cath et al. (2018) fail to outline what "social good" means in the context of an ethical society.

2.4.4. Privacy and Data: Canada is working on updating its *Personal Information Protection and Electronic Documents Act (PIPEDA)* to reflect the European Union General Data Protection Regulation. This is to reduce the risk of AI algorithms using personal information data to make discriminatory decisions. The current privacy law applies to the private sector, and it states that:

> *[c]onsent has always been considered a foundational element of PIPEDA. Legally, organizations must obtain consent to collect, use, and disclose an individual's personal information, subject to a list of specific exceptions. But obtaining meaningful consent has become increasingly challenging in the age of big data, the Internet of Things, artificial intelligence, and robotics.*

Generally, SSA countries have porous data protection policies that create more inequality due to the non-representation of marginalized groups within the datasets. Tasking the government to address the issues of datasets inequality is not the best option because it is the activities of the private corporations that have often widened the inclusion gap. Therefore, it is imperative to task private corporations to address the issues of data representation using proposed tools such as codes of conduct, impact statements, and whistle-blower protection (Katyal,2019). Dafoe A. et al. (2019) also makes a similar argument in their article, pointing out that multinationals are the main actors in the AI development game. Therefore, they should be given the mandate to address the problems that result from AI development. The race for technological superiority among nations results in potential risks such as incentivizing corner-cutting on safety, increasing inequality, and increasing the risk of conflict (Cave et al. 2018). This makes it easy to "manipulate behavior" or "nudge" people, often toward profitable outcomes for the companies and not the individuals (Birhane, 2019). Instead of pursuing AI development as a "winner takes it all" approach, it should instead be approached with the mindset of "shared priority for global good" (Cave et al., 2018).

2.4.5. Intellectual Property Laws: Another licensing that has not received lots of attention is the exclusive rights transaction among inter-firms as a strategy used by some firms considering entering a foreign market. The findings from Aulakh et al. (2010) study indicate a positive

relationship between the size of the foreign market and the option of non-exclusive/multiple licensing. This provides an excellent understanding of how international technology companies operate in foreign markets, giving developing countries guidelines to understand the licensing approach of these firms before granting them business right into their markets for economic growth and not to be used as a tool by these firms to gain global competitive advantage (Aulakh et al. 2010). Policies implemented by the government can slow down technology diffusion in developing countries. If policies prolong patents of new technology within developing countries, it slows down technology diffusion to domestic firms, thus increasing monopoly power for foreign firms. However, policies can accelerate technology diffusion by reducing the monopoly period with the new technology and improve local national welfare (Berthoumieu 2017). However, Berthoumieu (2017) puts so much emphasis on the policy as a significant factor for slowing down technology diffusion without considering factors like weak "absorptive capacity" systems in developing countries.

The cause of the rise in the intense competition of AI might be that some firms benefit significantly from new technologies, which results in higher profit, more significant market share leading to higher concentration (Bessen, 2017). This is important to my research because Bessen's (2017) findings conclude that technological systems contribute to a widening productivity gap between the top firms and the rest, driving an increase in industry concentration.

This is a crucial risk factor for developing countries to consider as global firms, with IT system advantage, invest in their artificial intelligence sector. It is not appropriate to solely base the unsuccessful transfer of technology to developing countries on weak intellectual property rights because other factors also influence the success of the transfer such as, the size and level of development of the economy (captured by per capita income and population), the capacity to

absorb foreign technology (represented by the stock of human capital), trade openness of the economy, and economic freedom (Langdon, 1977). The differences in institutional regulatory frameworks between two countries impact the foreign direct investment and the decision of multinational enterprises to enter developing markets concerning intellectual property rights protection.

The findings of the study by (Mo 2017), based on the qualitative research method, indicates that there is less interest by multinationals to enter a market when there is a broader dissimilarity of intellectual property. It provides an excellent background as to why multinationals are interested in investing in the AI ecosystem in sub-Saharan countries due to similarities in intellectual property rights laws, which favors their business activities.

2.5. Conclusion

The SSA region needs to identify areas for which AI technology is relevant to, without trying to reinvent the wheel, but, at the same time, using proven ideas that are relevant (Chandrasekar et al. 1989). I found the literature useful because it suggests that developing countries need to identify what problems AI can help solve before investing in this new technology, address issues of policies, and develop a more comprehensive AI strategy that benefits the marginalized groups. However, the majority of the literature does not discuss the steps currently being taken by countries within developing countries to ensure AI does not create more inequalities or only serve those who can afford or have the resources to use the AI products. There is little literature on the state of inclusivity of AI initiatives in the region and how their AI solutions meet the needs of low-income communities, which my research seeks to fill the gap.

CHAPTER 3 - RESEARCH DESIGN AND METHOD

Generally, technological innovations have been associated with creating access and integration. However, it can also isolate people, creating unique forms of social exclusion (Foley and Ferri, 2012). According to UNCTAD's Post-2015 Development Agenda report, technological innovation is often an elite activity, serving a few people and industries. Still, inclusive and sustainable development involves three related approaches: addressing basic needs, grassroots entrepreneurship, and promoting inclusive growth by building capabilities among excluded and marginalized groups.

In sub-Saharan Africa, AI is another emerging technological innovation that is taking dominance in national development discourse. This study focused on how inclusive AI initiatives in sub-Saharan Africa are. It further explores the following research questions:

RQ1: To what extent are current AI initiatives in *sub-Saharan Africa* inclusive?

RQ2: How can current and future AI initiatives in sub-Saharan Africa become *inclusive* to help foster local capacity to lead AI development?

RQ3: What indicators can help measure how inclusive AI initiative is in sub-Saharan Africa?

This chapter discusses in greater detail the case study strategy used for this study. It also explains the research methods which involved key informant interviews (electronic) and document review. This chapter further explains the research design, participant recruitment; selection criteria; setting, research instruments; procedures; data analysis, and concludes with a summary of the chapter.

3.1 Theoretical Framework

In search of a theoretical framework, several other theories were explored including the theory of 'diffusion of innovation,' 'Technological Determinism,' "Social Shaping" and "Social Construction of Technology." However, 'inclusive innovation' theory is the most appropriate to use because my research focuses on how new technological innovations like Artificial Intelligence can be made more inclusive to reduce or possibly eliminate inequality when employed as a technological tool for development in sub-Saharan Africa. Its core focus is the structures and processes required to develop and deliver innovative technologies (goods and services) incorporating the needs and interests of the poor.

The term 'inclusive innovation' has been given many tags including, but not limited to, 'pro-poor innovation,' 'below-the-radar innovation,' 'inclusive growth,' 'grassroots innovation' and 'BoP (base-of-the pyramid) innovation' (Kaplinsky 2011; Cozzens and Sutz 2012; Ramani, SadreGhazi, and Duysters 2012). Even though recent literature suggests that inclusive innovation is a new phenomenon, seeking and ensuring equity outcomes of innovation goes back at least to the 1950s (Chataway, J et al. 2014). George et al. (2012: 661) uses the term 'inclusive growth' to define inclusive innovation: "Inclusive growth can be viewed as a *desired outcome* of innovative initiatives that target individuals in disenfranchised sectors of society as well as, at the same time, a characteristic of the *processes* by which such innovative initiatives occur." Cozzens and Sutz (2012:12) define inclusive innovation based on two metrics: "innovation needs to be 'inclusive' in at least two ways: inclusive in terms of the process by which it is achieved and inclusive in terms of the problems and the solutions it is related to." These definitions focus on ensuring that the process and the direct outcomes of innovations are inclusive. The gap in these definitions is that it excludes the vulnerable and marginalized being actively part of the

innovation process. That is why I gravitate towards the definition provided by Foster and Heeks (2013, p.335), which is, inclusive innovation is "the means by which new goods and services are developed for and/or by vulnerable populations living on lowest incomes. Contrasting conventional views of innovation, inclusive innovation explicitly conceives development in terms of active inclusion of those who are excluded from the mainstream of development and refers to the inclusion within some aspect of innovation of groups who are currently marginalized".

The "ladder of inclusive innovation," which is a slightly modified version of Amalia et al. (2013)'s "levels of inclusive innovation," helps measure to which extent of inclusion of the excluded group concerning innovation (Heeks et al. 2014).

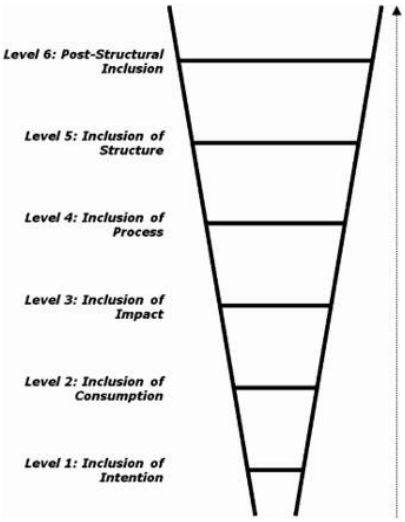

Figure 1: Ladder of inclusive innovation

Heeks et all. (2014. p177-178) explain the ladder of innovation below based on each level:

- Level 1/Intention: an innovation is inclusive if the intention of that innovation is to address the needs or wants or problems of an excluded group.

- Level 2/Consumption: an innovation is inclusive if it is adopted and used by the excluded group.
- Level 3/Impact: an innovation is inclusive if it has a positive impact on the livelihoods of the excluded group.
- Level 4/Process: an innovation is inclusive if the excluded group is involved in the development of the innovation.
- Level 5/Structure: an innovation is inclusive if it is created within a structure that is itself inclusive.
- Level 6/Post-Structure: an innovation is inclusive if it is created within a frame of knowledge and discourse that is itself inclusive.

However, identifying which level or type of innovation is needed depends on the model used in creating that innovation, and there is no right or wrong level of inclusive innovation. The model makes it "easier to understand innovation, to communicate and discuss innovation, and to prioritize innovation interventions (Heeks et al. 2014 p179)." Such models of inclusive innovation include innovation platforms, cluster innovation, user-producer interaction, grassroots innovation, and frugal innovation. (Heeks et al. 2014 p. 179): For example, this study will consider the extent to which AI initiatives in *sub-Saharan Africa* are or could become *inclusive* to help foster local capacity to lead AI development. Therefore, it is essential to reduce the inequality that will arise from AI innovations and ensure that local technologists, entrepreneurs, technology firms, and initiatives and other marginal groups within this context are not only included but are the innovators in designing and developing AI applications for their local needs. The ladder of inclusive innovation was integrated in the research methodology especially in helping develop the right interview questions. This is depicted in figure 2 below:

Level of Inclusive Innovation **(Theoretical Framework)**	**Definition of Excluded Group**	**Key Indicators**	**Sources of Data**	**Key Informants to Interview**	**Questions to Key Informants**
Level 1 - Intention	Low-income households Youth, especially poor youth. Poor ethnic minorities Women and children Local innovators and entrepreneurs especially women Local AI startups Local tech hubs and Incubators Local AI research network Persons with disabilities	Written aims should focus on supporting inclusive AI innovation One of its aims should focus on innovating *with* and *for* identified excluded groups.	Website Review Published Reports (Gray and Academic) Interviewing key organizational leads	Project Director Research Lead Innovation Lead Policy Lead	Tell me who you think will benefit from this AI initiative? How might lower-income groups benefit? Are there any groups that won't benefit?
Level 2 - Consumption		Products and services from AI innovations can also be *adopted* and *used* by excluded groups or the BoP market, especially female consumers.			
Level 3 - Impact		AI innovations should aim at improving the lives of not only the affluent but low-income households AI innovations should improve the attainment of basic needs, such as good health, food, education, etc.			
Level 4 - Process		Core business/organizational strategy should include plans to *engage* and *work* with local tech innovators/entrepreneurs/policy analysts, etc. Organizational/Business support systems that provide mentoring, network, and financial support to local innovators Locals hired as part of the organization's AI innovations decision- making the team.			
Level 5 - Structure		Inclusivity should be the foundation of the business/organization's model for AI innovations			
Level 6 - Post-Structure		AI innovations are fundamentally premised on the principles and values of inclusivity.			

Figure 2 Theoretical Framework Chart

3.2. Design

Due to the qualitative nature of my research, it was appropriate to use the case study as a strategy to examine the research questions. It was necessary to identify a research strategy that can provide access to the kind of data sources, people, contexts, events, and documents that will be crucial for the success of this research (Denscombe, 2010). Case study refers to the study of a "social phenomenon carried out within the boundaries of one social system (the case), or within the boundaries of a few social systems (the cases), such as people, organizations, groups, individuals, local communities or nation-states, in which the phenomenon to be studied enrolls" (Swanborn, 2010. p.12). This research strategy is useful for my research because it helps explore a social phenomenon such as inequalities that exist due to AI in SSA.

Qualitative description, using a case study approach, was chosen as the research study because it has the potential of being able to examine issues in greater detail to identify and unweave the processes and complexities of the social phenomenon and not the outcome (Denscombe, 2010). For instance, a case study was selected because this study focused on exploring the factors or indicators (processes) that determine how AI initiatives are inclusive in sub-Saharan Africa. It also provided this study the flexibility to use both document review and essential informant interview methods for data gathering. A case study afforded the flexibility to use a variety of data collection techniques as part of the study (Guthrie, 2010). In contrast, the case study faces some criticisms due to critical questions raised against the credibility of generalizations made from its findings. Due to access to small data, a researcher using a case study must indicate the extent to which the case is similar to or contrasts with others of its type to avoid unrealistic generalization (Denscombe, 2010).

Two essential data collection methods were used for this study - key informant interviews and document review, to examine the research questions. While the interview focuses on conducting conversations with carefully selected vital informants, document review focuses on analyzing publications, websites, reports, etc. about cases being studied (Denscombe, 2010; Guthrie, 2010). Critical informants interview involves the deliberate selection of individuals because they have some information to share, they have some unique insight, or because of the position, they hold (Denscombe, 2010; Guthrie, 2010).

The interview was more appropriate to use than using observation or questionnaires because this study needed to gain insights into experts' views and experiences, which other data collection tools cannot provide (Denscombe, 2010). Due to the recent coronavirus pandemic, an online video interview format was used in gathering data from key informants instead of in-person or face-to-face interviews. Although online video interviews take somewhat more time to arrange than a simple telephone conversation, and they are more prone to technical quirks, they are almost as good as a face-to-face and telephone experience, and of course, save traveling (Walliman,2018). It has become a more convenient option that provides a richer experience than contact by telephone.

3.3 Participants

Before the recruitment of participants, approval was sought from the University of Alberta's ethics board. These key informants residing both in sub-Saharan Africa or Canada were either leading authors of white papers/academic papers or working on AI initiatives in the region. This study used purposeful sampling in recruiting 4 participants from across civil society and industry players working on AI development initiatives in sub-Saharan Africa. Purposeful

sampling is a sampling technique used in the deliberate selection of research participants based on the reason that the researcher knows something about the specific participants or events because they are seen as instances that are likely to produce the most valuable data (Denscombe, 2010). Purposeful sampling was necessary because there was a need to identify and interact with AI experts working in sub-Saharan Africa to gather informed and educated views on the research topic, not general opinions. However, a significant setback to using purposeful sampling is that the researcher may be subjective and biased in choosing the participants of the study (Etikan, 2016).

To identify the key informants, first, two main AI initiatives in sub-Saharan Africa were used for the case study. Then individuals involved in these AI initiatives were identified as key informants. The inclusion criteria were categorized into groups. The inclusion criteria for each group are described below:

Group 1 - Industry key informants: The criteria included country directors of AI projects, AI research directors, AI policy directors/analysts, etc. who are working on commercial AI projects or initiatives in sub-Saharan Africa.

Group 2 - Non-industry key informants: The criteria included AI researchers, technology advocates, etc. who are involved in non-commercial AI activities.

Other inclusion considerations: Researchers who have authored white/academic papers/reports on AI development in Africa or are part of the leadership team working on AI initiatives in sub-Saharan Africa. All participants that met these essential selection criteria were considered regardless of gender, age, race, ethnicity, or background, whether cultural, economic, political, or religious.

Exclusion criteria: This study's exclusion criteria consisted of three variables: (a) AI initiatives based outside of sub-Saharan Africa or not focused on the region (b) non-AI, but other technology initiatives (c) job positions outside of AI lead, AI researcher, AI policy lead, etc.

In identifying the key informants that fit the criteria for the study, an internet search was conducted to determine commercial and non-commercial AI initiatives working in sub-Saharan Africa or focused on the region. These key informants included leading researchers who are currently working on the research topic and have made some significant progress by publishing white papers that support the development of AI in the selected region and other industry players such as innovation leads for AI initiatives - Google Africa AI Research Centre and IBM Africa Research. Also, the International Development Research Centre (IDRC) was contacted to recommend some key informants that fit the selection criteria.

Interactions were done via Zoom and Google Meet video conferencing platforms. All conversations were recorded with the participants' permission, and policy and processes for discarding the recorded conversation were disclosed. The participants included a representative from MinoHealth AI Lab, World Wide Web Foundation, IDRC, and a representative from IBM Research Africa.

3.4. Ethics

Before conducting the interview, approval was sought from the University of Alberta's ethics board. This involved the submission of a comprehensive human research ethics application to the university's Research Ethics Board (REB). The ethics board reviewed and approved all aspects of the research, including the research topic, the research design, letter of consent (Appendix A), letter of initial contact (Appendix B), the level of risk, how participants' data will be protected, etc. The ethics application was submitted with the help of the research supervisor, who reviewed all sections of the application before the final submission to the ethics board.

3.5. Setting

Out of four key informants, two lived and worked in sub-Saharan Africa - South Africa and Ghana, while the other two lived in Canada and the USA. However, due to the coronavirus pandemic, researcher's location (Canada), and lack of travel funds, it was not appropriate to facilitate in-person interviews. Thus, it was necessary to employ the use of Google Meet and Zoom to conduct the interviews. Three of the interviews were done via Google Meet as it is one of the secured virtual conferencing platforms to use during official tasks. It also enables the researcher to be able to record the interview in both video and audio format for smooth playback. However, one of the participants used the company's internally built virtual conferencing platform for the interview.

It is important to note that the use of virtual face-to-face platforms can create fears for both the researcher and the participants, especially when they are unfamiliar with the technology (Bertrand & Bourdeau 2010). The fear can lead to mistrust due to the absence of physical

presence. To mitigate this, the researcher needs first to build a relationship of trust with the participant within the virtual interaction. To avoid repeating such mistakes, this research complied with the following best practices proposed by (Bertrand & Bourdeau 2010. P. 5-8) in their research work titled “Research interviews by Skype: A new data collection method”:

- Assess the virtual experience and technology familiarity and comfortability of the participant and the researcher: During this study, both the researcher and the participants' level of knowledge of using virtual platforms were assessed. All the participants used virtual platforms to communicate as part of their work and found it very comfortable to navigate their way through.

- Ensure virtual trust: Building virtual trust can be difficult, but participants of this study were assured that the interview conducted was in a secure room with only the researcher present. The researcher provided a view of his environment as proof that he was alone, and the setting was very secure for the interview. The researcher ensured that the participants were very comfortable to grant the interview from their current location without any unanticipated invasion of privacy, such as family members or work colleagues entering the room. In contrast, the interview was ongoing, etc.

- Confidentiality: Participants were informed that the interview would be recorded, and the virtual platform required that they confirm the researcher clicks on the recording feature. Some participants were still concerned about the recorded interview and enquire more about the purpose of recording. As a result, participants were also assured that they would receive unedited copies of the recorded interview.

All four of the interviews were done from key informants' own corporate offices and home-based offices, which were securely closed before and during the interviews. In each of the four interviews conducted, no other persons were present in the interview space, except for one, thus providing the environments appropriate for privacy and confidentiality.

3.6. Instruments

3.6.1. Interviews: Semi-structured and open-ended interview questions (See Appendix A) were developed, about 16-18 questions. This data gathering strategy was necessary because the semi-structured nature of the interview allowed me to ask follow-up questions during the interview and get a real-time response. The interviews were done via Google Meet with selected key informants, asking carefully developed and structured interview questions that helped provide answers to the research questions. The questions formulated for the interviews were designed based on the theory of *inclusive innovation*, and the responses pointed towards themes of creating inclusive AI initiatives in sub-Saharan Africa.

Furthermore, I asked open-ended questions, which allowed participants the opportunity to provide broader responses. Open-ended questions allowed the researcher to explore specific themes as well as participant responses (Galletta, 2012). Therefore, semi-structured interviews increased the substance and validity of findings by allowing participants to elaborate on their experiences and opinions. Nevertheless, an inexperienced interviewer can be a drawback of semi-structured interviews since he/she may not be able to probe into situations, ask for explanations, or query reasons behind responses (Kajornboon, 2005). The interviews were conducted through Google Meet and Zoom, depending on the preference of the key informant to

avoid in-person interviews. As indicated, the conversations were audio-recorded and transcribed for clarity and to prevent misinterpretation.

3.6.2. Document Review/Analysis: I also reviewed and analyzed documents on inclusive AI applications in developing countries as part of my data collection strategies. Document analysis is often defined as a systematic procedure for reviewing or evaluating documents—both printed and electronic (computer-based and Internet-transmitted) material (Bowen 2009). For this research project, the focus of the papers was limited to official statements published on the websites of the selected organizations or projects or themes, organizational or institutional reports, organizational and participants' blog posts, press releases, mainstream articles from credible news media houses, academic/white papers published by the initiatives or participants, mission statements and strategic plans published on the websites of the selected AI initiatives. Researchers highly recommend that the success of document review is heavily dependent on the effort put into the planning process. Therefore, this research employed O'Leary's (2017 P. 221-222) 8-step planning process, as described below:

1. Create a list of texts to explore (e.g., population, samples, respondents, participants).
2. Consider how texts will be accessed with attention to linguistic or cultural barriers.
3. Acknowledge and address biases.
4. Develop appropriate skills for research.
5. Consider strategies for ensuring credibility.
6. Know the data one is searching for.
7. Consider ethical issues (e.g., confidential documents).

8. Have a backup plan.

Other documents included credible online news media articles, academic articles, and published books. The search for documents was limited to those that provide answers to the research and interview questions.

In evaluating the documents to ensure how credible and authentic these documents are, I employed O'Leary's (2017) eight-step process:

1. Gather relevant texts.
2. Develop an organization and management scheme.
3. Make copies of the originals for annotation.
4. Assess the authenticity of documents.
5. Explore the document's agenda, biases.
6. Explore background information (e.g., tone, style, purpose).
7. Ask questions about the document (e.g., Who produced it? Why? When? Type of data?).
8. Explore content.

These documents provided more context to understanding how SSA can learn from other successful inclusive AI initiatives. This research took a closer review of existing inclusive technology projects. I used the interview technique during the reviewing of the documents - asked questions and highlighted the answers and themes in the documents.

It is important to note that the documents did not provide all the necessary information required to answer the research and interview questions. Some documents provided a small amount of useful data or sometimes none. Other documents were incomplete, or their data were inaccurate or inconsistent. Sometimes there were gaps or sparseness of documents, leading to more searching or reliance on additional documents than initially planned.

3.7. Procedures

An internet search was conducted to list all AI initiatives whose work is focused on AI innovations in sub-Saharan Africa. Out of the list of about six, four initiatives were selected to be examined. Key informants who could speak on the research questions were identified from the selected AI initiatives. The key informants were then evaluated based on the developed inclusion criteria. Key informants who met the requirements were contacted via email or a phone call in the first week of May 2020, and the researcher briefly explained the purpose of the study and requested their permission to be interviewed.

The email indicated the purpose of the research and the reason for selecting such a key informant (See Appendix B). Those who agreed to participate were followed up with a longer version of the email (See Appendix C), providing details about the interview, included a copy of the consent form (See Appendix D), and explained how the person's privacy would be secured. Further discussions were made about the interview process, exchanged contact information with the participants, and officially invited them to participate in the research.

It took about 4-5 weeks to receive responses from all the key informants confirming their participation in the study. The delay in response was because of the ongoing coronavirus pandemic, which was at its peak during the time of the email circulation. This risk was difficult

to account for since it was often unclear when the rising cases concerning coronavirus pandemic would drop to enable organizations to return to their normal working operations.

The signed and dated Consent Form was digitally scanned and emailed back for the researcher's record-keeping, which was securely saved in an encrypted cloud storage device facilitated by his password-protected laptop. Participants were also asked if they wished to receive digital copies of the signed documents, which all agreed. The research participants were asked to carefully read the Consent Form to ensure that they fully understood the interview process, their rights throughout, and the nature of the research to be explored. Participants were all reminded that at any time during the interview, they could stop the interview if they felt uncomfortable or wished to halt the entire process altogether. There was a follow-up with participants two days and a day before each interview was scheduled. Each interview session varied between 45 to 90 minutes, depending on the discussion and the quality of internet connectivity.

3.8. Analysis

As Denscombe (2010) indicates, the purpose of analyzing something is benchmarked on these three pillars:

1. To describe its constituent elements
2. To explain how it works
3. To interpret what it means.

A description analysis provides the basis for research, and it is used in types of social research such as ethnography and phenomenology where the researcher aims to portray

particular cultures or experiences in-depth and in detail, allowing the texture and subtlety of the situation to become visible to the reader (Denscombe 2010 p. 250). A researcher using the explanatory analysis aims to find out how things work by looking for evidence of cause-effect relationships in the data. When the researcher has discovered the causes of specific behavior, events or interactions, there is the possibility of predicting how and when things might happen in the future (Denscombe 2010 p. 251). On the other hand, the interpretive analysis focuses on providing an understanding rather than providing something that is an objective, universal truth. There is a greater interest in gaining knowledge about how and why things happen, but skeptical because theories must inevitably be 'value-laden,' rather than objective (Denscombe 2010 p. 251).

3.8.1. Content Analysis: Content analysis was used to analyze the data of this research. Qualitative content analysis is a dynamic form of analysis of verbal and visual data that is oriented toward summarizing the informational contents of that data (Sandelowski, 2000). Hsieh and Shannon (2005) also define content qualitative analysis as a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns (p. 1278). In examining and identifying which content analysis approach to use, this study explored the three approaches proposed by Hsieh and Shannon (2005): conventional, directed, and summative.

The conventional approach, also known as inductive content analysis by Elo and Kyngäs (2008), was employed for this study because this approach is generally used with a study design whose aim is to describe a phenomenon. The approach also uses interviews, with open-ended questions, as a data collection method. For further understanding, this approach tends to use open-ended or specific questions relating to the participant's comments rather than to a

preexisting theory. This research borrowed the four iterative steps provided by Erlingsson & Brysiewicz (2017 p.96-99) for conducting content analysis:

1. Familiarizing oneself with the data
2. Dividing up the text into meaning units and condensing meaning units
3. Formulating codes
4. Developing categories and themes

It is often a challenge for qualitative research to prove data accuracy or to prove that the findings indeed reflect what the data indicates. Ensure the validity of the data, participants were contacted to confirm the results, and data reflect the data they provided, and they have not been misinterpreted (Denscombe, 2010). To ensure that this study is reliable enough to be replicated and get the same findings, all the methods, procedures, and research strategies used to conduct this research have been explicitly outlined in this study.

In summarizing my data, I compared my research findings to the research topic to confirm if it did answer the research questions. I presented my findings as a descriptive summary of the information gathered without changing its meaning. The above steps used in analyzing the data were fixed but flexible and iterative. This was based on Erlingsson and Brysiewicz (2017 p. 95) suggestion that “content analysis, as in all qualitative analysis, is a reflective process. There is no “step 1, 2, 3, done!” linear progression in the analysis. This means that identifying and condensing meaning units, coding, and categorizing are not one-time events. It is a continuous process of coding and categorizing then returning to the raw data to reflect on your initial analysis.”

3.9. Summary

This study used the case study approach as its research methodology for data collection, including conducting four semi-structured interviews with four participants via Google Meet and Zoom. Interviews were conducted with AI researchers, AI policy advocates, and AI initiative founders who are working in or for countries within the sub-Saharan African region. Qualitative content analysis, from an inductive content analysis approach, was used to analyze the data from the interviews to ascertain the meaning units, codes, categories, and themes.

In the next chapter, I discuss the research findings, including commentary from the participants, and provide a summary of initial insights as they relate to the research questions.

CHAPTER 4: FINDINGS AND DISCUSSION

The analytical review of the literature - academic papers, white papers, blogs from websites of reputable educational institutions and think tanks, etc. indicate that, though AI will significantly transform the future of our societies - transportation, manufacturing, and social justice, the uneven access, participation in the design process and the impact of AI-based technologies on marginalized populations do not provide equal benefits to all. The lack of inclusion of marginalized and underrepresented groups create "AI divide" – that is, a gap between those who can design and deploy AI applications, and those who do not, in low- and middle-income regions such as SSA (Smith et al., 2018; Yu, 2020). However, there is minimal knowledge of the level of inclusivity of AI initiatives in sub-Saharan Africa.

Using the "ladder of inclusive innovation," derived from inclusive innovation theory, as a framework coupled with document review and interviews helped in providing answers to the following research questions (RQs):

RQ1: To what extent are current AI initiatives in SSA inclusive?

RQ2: How can current and future AI initiatives in sub-Saharan Africa become inclusive to help foster local capacity to lead AI development?

RQ3: What indicators can help measure how inclusive AI initiative is in sub-Saharan Africa?

The data used for the findings of this research were derived from semi-structured interviews with four participants, two of which work and reside in sub-Saharan Africa. Among the participants were a leading AI expert working with one of the big technology companies in

sub-Saharan Africa, a lead and founder of a local AI company in sub-Saharan Africa, and two reputable researchers with expertise in digital rights and technology inclusion advocacy for developing economies.

As indicated in Chapter 3, all interviews were conducted virtually, instead of the preferred face-to-face due to the coronavirus pandemic. The interviews were all conducted over Google's secured virtual conferencing platform, Google Meet, and Zoom, except for one which was done over a video conferencing platform owned by the participant's institution.

All the virtual interviews took place between May-June 2020, lasted between 45 minutes to one hour. All the interviews were recorded (with permission from participants), downloaded, and specially coded names to protect the identities of the participants. Once the interviews were completed, the data were transcribed and coded following the inductive content analysis process.

Four main themes emerged from coding and are discussed in this paper include:

1. Current state of inclusivity in AI initiatives
2. Building capacity of local AI initiatives
3. Strategies for improving inclusion in AI initiatives
4. Impact indicators of inclusive AI Initiatives

This chapter details in order: (1) data presentation and findings (2) data analysis, (3) reliability and validity (4) discussion of the results concerning the RQs, and the theoretical framework, including limitations and (5) a summary.

4.1. Data Presentation (Findings)

As previously highlighted, four major themes emerged from analyzing the data:

- Current state of inclusivity in AI initiatives
- Building capacity of local AI initiatives
- Strategies for improving inclusion in AI initiatives
- Impact indicators of inclusive AI Initiatives

The themes were derived from the analysis of the data concerning how well they answer the main research question and the three sub-research questions:

- **RQ1:** To what extent are current AI initiatives in Sub-Saharan Africa inclusive?
- **RQ2:** How can current and future AI initiatives in sub-Saharan Africa become inclusive to help foster local capacity to lead AI development?
- **RQ3:** What indicators can help measure how inclusive AI initiative is in sub-Saharan Africa?

The themes were arranged in this order based on how the interview guide approach, which helps a reader first to understand what the current background to the state of inclusivity in AI initiatives is in the context of sub-Saharan Africa. This provides answers to the main research question because it details responses from participants regarding the level of inclusivity in their AI initiatives and the challenges of ensuring inclusivity. The second theme provides a brief understanding of how foreign AI initiatives are supporting local AI initiatives and the gap that exists. The third and fourth themes discuss how inclusivity can be improved and how they are currently being measured, if any, in the AI initiatives.

Below are some of the key findings from this research which will be expanded in the key findings section:

1. All participants agreed that there exists an inclusion gap in the sub-Saharan region and it cuts across national policies as well, but they (especially participants working or managing AI initiatives in the area) also argued that they have the intention to include marginalized groups, but there are existing bottlenecks to overcome. One of the participants explained that when the focus is on marginalized groups, it helps AI initiatives to innovate creatively and differently.

2. There is a collective agreement that there exist partnerships between big technology companies and local AI companies. However, the problem is that the partnerships often focus on big technology companies building their capacity to innovate for a global market instead of designing and producing local products for the local market.

3. Although all participants agreed that it is crucial to include marginalized groups in the design process, they argued that this is highly dependent on the type of AI solution being produced. The kind of AI solution will determine the level at which it will be beneficial to get marginalized groups to be involved in the process.

4. Most of the participants viewed the inclusion of marginalized groups as a high cost to their work.

5. Two of the participants, one is a researcher with the big technology company's AI research lab in the region and the other manages a local AI initiative, emphasized that Africa as a continent is marginalized when compared to the global world, concerning AI. Therefore, their AI innovations are often to help Africa bridge that gap and not

necessarily the marginalized within Africa, which creates the inclusion gap within the region.

4.2. Current state of inclusivity in AI initiatives

Sharing their expert views on whether AI initiatives in sub-Saharan Africa are focused on using AI to serve the needs of the most marginalized groups in society, the participants pointed out significant factors that made it impossible to do so even with their best intentions. All participants agreed that inclusion gap exists because it is effortless to include and design for well-resourced groups such as people living in more affluent communities with access to electricity, smartphones, etc., due to their ability to afford the high cost of building AI solutions, and inclusion of marginalized groups at any level of the AI development and design processes are highly dependent on the type of AI solution/initiative. The comments below reflect these observations:

- "It can be very costly to train a machine learning model, and who's got the infrastructure or the funds to pay for?" (Participant #4)
- "...for example, with the software we use for piloting with these facilities, we can pilot with thousands of facilities, and there's some cost involved in a server, but that is not even close to being compared to the cost of actually having trained experts in each of these thousands of facilities." (Participant #2)

4.2.1 Inclusion gap and policies: All four participants unanimously agreed that there is a big gap with regards to the inclusion of marginalized groups at all levels of AI development in sub-Saharan Africa. As some might assume that sub-Saharan Africa has AI, participant #3

indicated that, just like other emerging technologies, “it's tempting to feel like we have AI in Africa while AI is mostly servicing the well-resourced." One of the participants pointed out that there is a continuous existence of an inclusion gap because there are no AI national policies addressing this problem. Participant #1 acknowledged with the following comments:

- “...we did some more work on some countries in sub-Saharan Africa, specifically Nigeria, Kenya, and South Africa. We did some research in these three countries and talked to a range of people. It was interview-based, but talking to academics, AI developers, industry people, journalists, to get a sense of who is involved and figure out what the issues are. The gap that we saw was around the policy. Policymakers and governments are not trying to address issues concerning policy issues around AI… which could be equity issues, gender issues, issues in intellectual property, etc."
- “...if you want to compare it to Europe, there are lots of policy briefs and papers that governments have put out - AI strategy, nationally AI strategy. That conversation was not happening in the three countries that we looked at. That is the concern.”

This gap means that there is no representation, for example, civil society groups of marginalized groups at the table during the AI discussions. Participant #1 who often works with governments to develop inclusive digital policies and often see high representation from the big technology companies including Google and Facebook indicated again that, "there's usually no civil society groups in these meetings or multiple groups that represent rural communities or disabled communities, women, children and various kinds of groups."

4.2.2. Inclusion and Resources: Two of the participants indicated that there is a high cost in developing AI models, building the infrastructure, and training machines to be able to analyze

data for the development of AI solutions that serve the needs of people. About the reduced difficulty in building AI solutions for the well-resourced, participant #3 mentioned that:

- "...the truth is, it's easy to innovate for the well-resourced. So, it's effortless to innovate for people that have access to electricity and smartphones that are fast and have a high processing speed."

- "...the difficult part is making it work in low-income urban settlements, making it work, where schools have no computers, and we took some time. One thing I wanted to highlight was, a lot of people think building the AI solution is the end, whereas the end is taking it to the context and making it work with the people that are working and living in that context and still meeting their needs."

In agreement, participant #4 also stated that "collecting the data that's relevant for different places can be quite costly, depending upon what it is and who has the infrastructure to do it" which indicates that AI initiatives ability to include marginalized groups is highly dependent on the availability of resources to support inclusion at any level of the development and design process.

4.2.3. Inclusion Dependency: Interestingly, one out of the four participants pointed out a rare factor that contributes to the decision of "what extent can we involve the marginalized groups in AI solutions?" Participant #2 revealed that:

- "It depends on the solution. For example, if we are dealing with diagnostics, you can't engage marginalized groups in developing radiological systems. The people we should be engaging are the doctors I work with because the system will be used by doctors for marginalized groups, not by marginalized groups themselves."

- "...so, if our target is vaccines, it will be difficult to include marginalized groups in this process. In the process of collecting data, by logic, we must explain to them what the data is going to be used for. This is a major issue where people say they come for our data, and they do not explain. We are very serious about this. So, we tell them what the data is going to be used for."

4.2.4. *Local Innovation and Public Good:* Two of the participants argued that, even though the foreign and big tech companies operating in the region are less focused on inclusion in their AI-related initiatives, local AI innovators are more focused on developing and deploying AI for the public good and marginalized groups. Participant #4 narrated how the young men and women in the region are driven and passionate about using AI for the public good, "there's quite an amazing community that's developing. I'm sure you've heard of the Indaba community... a lot of people were inspired to do something for the public good and in the public interest." Participant #1 also pointed out some of the locally produced innovations that are addressing the needs of marginalized groups in the region. For instance, "there are lots of apps that we have seen that have been locally developed, which are good, around agriculture, public transport, like chatbots about public transport and chatbots to help with health information." (Participant #1)

4.3. Building Capacity of Local AI Initiatives

In understanding how foreign AI initiatives support the building of existing local AI initiatives, most of the participants expressed that there is significant support from big tech companies, primarily through local partnerships, training programs, funding opportunities, etc. However, the capacity building is often focused on developing and implementing ideas of the big tech instead of producing their own local AI products for the local markets.

4.3.1. Curriculum Development and Ethics Training: Participant #4, who is a researcher and authored a paper on how AI will impact sub-Saharan Africa, posited that AI is data-driven and lots of inclusion gaps result from lack of ethics training to understand that the data being used to develop the AI solutions or products need to be representative of all people and not just those who can afford. Participant #4 shared some of the support they offer to locals:

> "support for PhD and master's students and support for academics who want to build a research plan and curriculum around AI for development... When young people come through, and they get trained, they have just gone through computer science, and they do not have that perspective as much. One of the big things that we are focused on within the AI program is incorporating all of that. When I talk about a curriculum, for example, when you study AI, you should be studying ethics... and participatory design."

4.3.2. Local Partnerships: The majority of the participants, three out of four, agreed that their initiatives are partnering with local AI institutions, or they are partnering with foreign companies to drive their AI agenda. They also decided that domestic partnership is essential to reduce the inclusion gap, and most companies are doing well. In contrast, participant #1 was somewhat not in full agreement, "Facebook is doing similar work. So, I think that those approaches are good, and it can help develop local partnerships with these various groups. At the same time, I think it's also important for these local companies to be able to develop their ideas and their own AI products for the local markets." Participant #1 hinted that most of the local partnerships are often focused on building products that do not meet the local needs or do not fit the local context. These comments from participant #1 reflect this observation:

- ...so, at one point, you want to support these foreign companies, these big global tech companies, to partner with local AI firms, but you also want to build robust local industry and local groups to come up with their solutions.

- Many different solutions are coming up all the time. For example, in South Africa, natural language processing is a good focus for machine learning in a country with over 20 different languages. Natural Language Processing could help translation services, which can be very useful, and Nigeria has so many languages too. There are lots of apps that we have seen that have been locally developed, which are good, around agriculture, public transport, especially chatbots about public transport and chatbots to help with health information and things like that.

4.3.3. Funding Opportunities and Local Research: Other participants pointed out that their AI initiatives support local capacity building through funding, local research, and local innovation and, to some extent, policy-driven research. Participant #4 said that their support for locals is often centered around "research, innovations, and research on the policy environment." Participant #1 also indicated some of the big tech companies are already providing this support in sub-Saharan Africa, "I think then it comes down to partnerships with local companies, local academia, so both Facebook and Google are already doing this. So, for example, they are already engaged in partnerships, so they provide funding for our local research. Google has set up an AI research center in Accra."

4.4. Strategies for Improving Inclusion in AI Initiatives

Responding to how AI initiatives in the region could be more inclusive, some of the participants shared their work as an example of how other initiatives could learn from to be more inclusive. Other participants also pointed out that inclusivity should be addressed comprehensively and not just a small part of the problem to be fixed.

4.4.1. Participatory Design and Diversity: All participants agreed to the importance of using a participatory approach to ensure inclusion in AI innovations. Participant #3 indicated other experts used the term "co-design" instead of "participatory," but the process is the same. Participants #1 and #3 stated that no AI initiative could build an AI solution without involving the core users or those who will be heavily impacted by AI products. For example,

> ...if you're going to develop some AI solution, let's say to provide geospatial mapping for farmers, like using drones, which is something that you see everyday. It might be useful to start with the farmers first and understand what the problems are? What kind of data do you have available? Then you can bring in the government and the land records office to understand what kind of land data is available? (Participant 1)

Participant #3, who works with one of the big tech companies' AI research labs acknowledged the personal firm believe in participatory design and how that is important for their AI research team:

> I am a firm believer in participatory design, that for any solution that is going to be developed either for business or individuals or communities, etc. It's essential to bring in users from those user groups to design with. People call it co-design in other contexts, depending on the approaches you take, etc.

Responding to how their initiative value diversity, which was indicated on their organization's website, Participant #3 showed that their AI research team in the region is very diverse and it dramatically influences the recruitment of new team members:

> We believe in the diversity of the type of people that we hire. If you have a team that comes from one kind of culture, then you will have one type of thinking. That is problematic because then we have one type of innovation... We have a variety of people that work here, and you can see them in the way that we think... We believe that there's incredible wisdom in diversity.

Participant #1 again pointed out the need for diversity at the higher level especially during AI policy discussions and consultations to influence foreign AI initiatives to value inclusion when designing their AI products to implementing their AI initiatives:

> At a higher level for us, we need to have these rights policies in place and recommendations on government. So governments could be saying, for example, you need to have more diverse design teams, you need to have more varied processes in terms of how you design these AI systems, training data needs to be provided an open database so everyone can look at it and then contribute or criticize that kind of data.

4.4.2. Comprehensive and Holistic Solution: The inclusion problem should be addressed using a complete system because inequalities are more than just a technology problem; it cuts across all levels and beyond technology, suggested participant #4:

> …I think when it becomes a little bit more powerful is when you have got a consolidated national strategy that is inclusive. I think India has a very inclusive national strategy that

> focuses on inclusion...inequalities are more than just "it's a technology thing." It is across the board. So, you need a comprehensive systemic look at it or approach it.

4.4.3. Organizational Vision and Objectives: To ensure how big tech companies can value inclusion and ensure marginalized groups are included in design and implementation process, participant #4 suggested that the most effective way to do so is for inclusion to be embedded in the vision of the organization and what they strive to achieve as this helps every team member to be on the same page:

> ...for me, it is all about the vision of the organization and what they're striving to do. That is the only way you can get everyone on the same page…but the question is, how do you manifest that? How do you implement that along those lines on a day to day basis? How do they think strategically? What are the choices for projects? It is super exciting and super exciting to find out how that is playing out.

4.4.4. Explainability, Transparency, and Awareness: Providing clarity and understanding to users, especially users from low-income communities about how an AI all participants highly recommended solution works, but it was much emphasized by participant #3,

> making sure the AI solutions we create are explainable. So that when someone sees a decision or an outcome, or a recommendation made by an AI model with an AI system, they know how and why the model is recommending, deciding, inferring, or using whatever, for sharing whatever type of insight... If there are components of true explainability and transparency, then we give people the voice in the technology that affects their lives.

4.5. Impact Indicators of Inclusive AI Initiatives

To understand participants' value for inclusion, most participants provided some indicators that were indirectly linked to the inclusion as a key measurement. Some of the key indicators for measuring the impact of their AI initiatives include having equitable AI Policies. Participant #1 emphasized that when national AI policies reflect the need for inclusion or policy consultations, have a civil society present at the table, that gives the organization great satisfaction.

- Because we are policy-focused, our impacts are at a different level. We are not engaged in training programs for AI, investment funds for startups, or things like that. It's more policy, and it's more on what governments should do, what public policy should be in place to help govern AI so that it has a beneficial effect for everyone in society. So that is the angle that we come with it. (Participant #1)
- For example, two years ago, at the G20 Summit, we put forward some recommendations of what the G20 group of countries could do to ensure that AI has a gender equality impact. (Participant #1)
- We would want to see these principles and values around inclusion and equity reflected in any final policy outcomes, which could include a national AI policy or strategy... Making sure to consider gender income inequality, rural populations, children, and so on. (Participant #1)

Participant #2, who is a local AI innovator, designs and produces AI products, viewed measuring impact from a continental level, but emphasized that their priority is on marginalized regions,

> Our long-term metric is how much we are preventing deaths from infectious as well as non-communicable diseases across Africa. That is the key metric that matters… but the bigger picture will be how much we have impacted food insecurity across these marginalized regions.

4.6. Data Analysis and Discussion

As aforementioned in the Design and Methodology chapter, inductive content analysis was a good fit for this research used to analyze the data because it is suitable for a phenomenon such as the inclusivity of AI initiatives in sub-Saharan Africa which has no extensive academic research, but there is fragmented knowledge about the subject. Due to the qualitative nature of this research, without any expectation to present numerical results, inductive content analysis was used to analyze the themes identified during the analytical process to answer the research questions (Kyngäs et al., 2020 p.14&21).

Inductive analysis is a form of qualitative content analysis - systematically transforming a large amount of text into a highly organized and concise summary of key results. Even though some researchers admit that there are no systematic approaches to analyzing data using inductive content analysis, these phases are often recommended to follow - data reduction, data grouping and the formation of concepts that can be used to answer research questions (Erlingsson & Brysiewicz 2017; Kyngäs et al., 2020).

Unlike deductive analysis, which requires a theoretical structure from which research builds an analysis matrix and does not make room for findings, the inductive content analysis does not require any analysis matrix. Still, it uses the collected data as a guide to analyzing (Kyngäs et al., 2020). This informed how the interview questions were developed and the goal of the interviews

with participants. The interviews were geared towards finding out the level of inclusivity in AI initiatives operating in sub-Saharan Africa.

4.6.1 Procedure

All four interview participants were asked between 15-18 main questions, with some follow-ups depending on the flow of the interview. These interviews produced four transcripts that were transcribed using Otter.ai, a free web-based service that allows users to record and transcribe. The transcription from audio to text took a significant amount of time due to some clarity issues with recorded data as well as tidying up the data to ensure sentences make sense to the researcher and any reader. Additional data were also gathered from the websites of organizations where participants worked, including publicly available white papers and annual reports, which provided further insight to some of the research questions. This research borrowed the four iterative steps, even though these researchers avoid using the term steps, provided by Erlingsson & Brysiewicz (2017 p.96-99) for conducting content analysis:

5. Familiarizing oneself with the data
6. Dividing up the text into meaning units and condensing meaning units
7. Formulating codes
8. Developing categories and themes

The transcripts and documents were initially read several times and further reviewed thoroughly more than three times and manually coded during analysis using Microsoft Word and Google Sheets. During the first and second reviews, first impressions and thoughts were noted, but texts of interest were not highlighted. The first and second reviews were to help refresh the

memory of the interview conducted and read with the research questions in tandem. The third and subsequent reviews were done with careful attention being paid to texts and quotes of interest. Texts of interest were highlighted, and comments were provided in the comment box in Microsoft Word.

Preliminary codes were then derived from the text during the third to fourth reviews. Codes included key phrases taken from the transcript and terms that summarized key ideas. As defined by Erlingsson & Brysiewicz (2017), a code "can be thought of as a label, a name that most exactly describes what this particular condensed meaning unit is. Usually, one or two words long." (p. 94). For example, "Inclusion and Resources" was coined directly from some of the transcripts. Coding for patterns also started to occur during the third and the subsequent reviews as codes were derived. As repeated ideas were observed across all transcripts, these patterns were further considered when refining codes.

The fourth review was used to refine codes, and a table of the codes was created to help organize them under each transcript. Reviewing transcripts requires a firm restraint from adding personal opinions in the comment box. As pointed out by Erlingsson & Brysiewicz (2017), "this is the difficult balancing task of keeping a firm grip on one's assumptions, opinions, and personal beliefs, and not letting them unconsciously steer your analysis process while simultaneously, and knowingly, utilizing one's pre-understanding to facilitate a deeper understanding of the data."

Once coding was complete, all codes were reviewed among all transcripts to determine if there were outlier codes that did not help to identify patterns or fit with the research question. Some codes were dropped from the final list of categories because they did not relate to the

broad themes or the research question, but codes that shared a common theme or idea were grouped in categories to create common themes. For example, codes such as “inclusion and resources,” “inclusion dependency,” “local innovation and public good” and “inclusion gap and AI policies” were put under the same category to create the broad theme “Current State of Inclusivity in AI Initiatives” As a result of sorting, the main overarching themes that guide the discussion of the findings and analysis are:

1. Current State of Inclusivity in AI initiatives
2. Building Capacity of Local AI Initiatives
3. Strategies for Improving Inclusion in AI Initiatives
4. Impact Indicators of Inclusive AI Initiatives

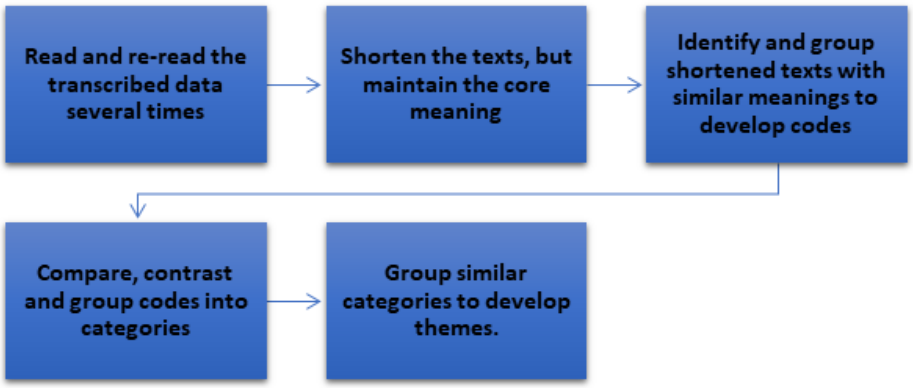

Figure 3 Steps taken to analyze data - Adapted from Erlingsson & Brysiewicz (2017)

4.6.2 Reliability and Validity

To ensure the credibility of this research, validity, and reliability were considered. I ensured that the results from this research study were consistent over time and maintained an accurate representation of the region and AI initiatives understudy so that the results of the study can be reproduced under a similar methodology (Joppe (2000).

In other words, does the research instrument allow the researcher to hit "the bull's eye" of your research object? Researchers generally determine validity by asking a series of questions and will often look for the answers in the research of others." (Joppe 2000 p. 1). Golafshani (2003) points out that in qualitative research, validity and reliability should exhibit two key components; first, for research to be reliable, it should be replicable, and for validity, measurement should be accurate and have the ability to generalize findings.

Several steps were taken to ascertain the validity and reliability of this research to ensure avoidance of bias, transparency, and accuracy of the procedures and findings. To test accuracy and transparency, some participants were asked to clarify the information provided during the interview. These participants were asked to confirm what was communicated and if the researcher either misunderstood or misinterpreted what was said. Also, participant #2 was contacted post-interview to provide more clarity and confirm some incoherent information recorded.

Even though researchers argue that it is difficult to eliminate personal bias, the researcher took intentional steps to avoid it from influencing the findings of this research (Vonk, Tripodi & Epstein 2007). The researcher ensured that interview questions developed were fair and did not mention any preconceived ideas. Views from participants that were contrary to the researcher's

views were genuinely accepted and probed further to gather more diverse information. This can be confirmed in the themes that were selected for the analysis as it comprised diverse views.

There was no personal relationship between the researcher and any of the participants which needed to be disclosed or could have affected the interview results (Vonk, Tripodi & Epstein 2007). Therefore, it is worth noting that this study can be taken in five or ten years using this design and would be replicable in that it would give a similar insight into how inclusive AI initiatives are in sub-Saharan Africa.

4.6.3. Discussion

This section discusses the key findings to the research question and within the context of inclusive innovation theory. To briefly reiterate, the study aimed to explore the level of inclusivity of AI initiatives in sub-Saharan Africa, to understand the current state of inclusion better and to find better ways to close the inclusion gap.

4.6.3.1. Innovating for marginalized groups is costly. Even though all participants agreed that AI is playing a critical role in the impact of the socio-economic development of sub-Saharan Africa, the findings revealed that the effectiveness of the impact is not equitable. This is because there is a vast inclusion gap even though there is an intention to be inclusive, which does not translate into reality due to certain critical factors. In a paraphrased comment, participant #3 indicated one of the factors which are, “it is *easier* for AI initiatives based in sub-Saharan Africa to innovate for target audiences who have enough resources to support the design, development, and consumption of the AI solutions.” This *easiness* means that people living in well-resourced communities have either the primary resources needed to use the AI solutions or have the

financial capacity to provide the resources to develop these AI solutions, unlike the marginalized groups.

4.6.3.2. Local partnerships focus on innovating for the global market. One of the factors that contribute to the unequal gains of AI, which was highlighted by participant #1 is that in reality, the AI technology is not locally owned, but owned by external entities, such as Facebook, Google, IBM, Microsoft, etc., which often develop solutions that are not responsive to the local needs.

> The problem historically, with a lot of technologies that are applied to socio-economic development, is that a lot of the technology has come from external sources. So that has indications for how effective they can be. The issues often revolve around how to get more participation by the target audiences in the development of these solutions. So that has always been a challenge for that community because most people in that community are often not based in say Africa, so that's the challenge. (Participant #1)

Based on the findings, the inclusivity problem in sub-Saharan Africa was viewed from many angles by some participants. Others saw the region as marginalized compared to the global AI race. Therefore, they develop AI products for those who can afford to enable the region to compete with the global world. This position was insinuated by participant #3, who works with a subsidiary of one of the big technology companies based in the region. However, that often widens the inequality gap within the region, even though it closes the inequality gap when measured on a global scale. The findings also revealed that local AI initiatives that are not affiliated with any of the big technology companies are intentional about developing AI solutions that meet local needs, especially marginalized groups.

> We see AI as an amplifier of existing efforts, and we do not expect people from other parts of the world to come in and say, this is a uniquely African problem, let us bring in AI to solve it. We think we have an opportunity as Africans, who are also working with Africans, to identify unique problems on the continent and apply AI to them. We are not against building upon what has been established in the world. We use a lot of existing solutions and frameworks, etc. that are being generated, designed, and researched by the global community. Still, we are very focused on solving challenges that are specific to the continent. (Participant #3)

4.6.4. Interpreting findings using the Inclusive innovation theory framework

This research was viewed through the lens of inclusive innovation using the ladder of inclusive innovation model to assess the extent to which AI initiatives in sub-Saharan are inclusive. It is important to determine the collective findings through the ladder of inclusive innovation to understand the inclusivity of AI initiatives in sub-Saharan Africa at each innovation level:

1. *Level 1/Intention:* Based on the findings, there is an intention by foreign AI initiatives to innovate for marginalized groups, but the implementation of such intention is often not executed. The challenge revealed by the findings is that developing AI solutions is costly, and most AI initiatives find it more convenient to innovate for the well-resourced. This is because most of the AI initiatives in sub-Saharan Africa are subsidiaries of profit-oriented global technology companies. However, local AI initiatives were more driven by the intention of using their AI innovation to solve the specific needs of the most marginalized in the region.

2. *Level 2/Consumption:* AI products developed are often targeted at the well-resourced communities based on the findings. Due to the high cost of innovating for the marginalized groups, foreign AI initiatives in sub-Saharan develop more AI solutions for the richer communities and less for lower-resourced communities. There are some attempts by some of the big technology companies to design AI products for the marginalized after developing for the rich societies, which includes... Participant #3 confirms this by revealing the danger of only well-resourced consuming AI products - "If we only limit the use of AI in high resourced areas, even if that is fair to the low-income groups, it will still not be useful and could even be harmful to the low resourced groups." (Participant #3) However, the challenge observed from the findings at this level of inclusiveness is that "the difficult part is making the solution work in low-income urban settlements, making it work, where schools have no computers, and it takes some time." (Participant #3)

3. *Level 3/Impact:* Based on the findings, current AI solutions in sub-Saharan Africa have less impact on marginalized groups because AI solutions are targeted towards groups that have the resources to develop and use the products. The challenge revealed by the findings is that "AI is not democratized in the region, especially AI that will be used by people or for people that have been impacted. They need to understand how it works, and there are simple ways of explaining AI." (Participant #3) None of the participants had excluded groups as indicators for measuring the impact of their AI solutions.

4. *Level 4/Process:* Findings indicated that the involvement of marginalized groups in the development of AI products was not a cemented consideration, but highly dependent on several factors including the relevance of their inclusion, their expertise, availability of

resources to include, etc. The findings revealed that even though marginalized groups are sometimes included in the designing process, there is a knowledge gap of "why are we designing this?". Participant #3 explains this saying, "...when you tell people, come and let's co-design something and they don't quite understand what that thing is, there is no way that they will give you or they will contribute any valuable input." In addition to the previous, participant #3 indicated that,

> *It is making people understand at their level how it works so that they can contribute to its utility, and that they're able to define the direction of its use. Even when we go on to build the solutions, it does not only end at the design phase of determining how this thing will work. I think it must extend to questions of once this thing is in use, do the users understand what it is doing?* (Participant 3)

5. *Level 5/Structure:* According to the findings, most of the AI initiatives had well-structured inclusion plans, but it was often at a global level. That is, most of the AI initiatives in sub-Saharan Africa are focused on helping marginalized continents and not marginalized groups within the country they operate. There was no specific system in place that ensures the inclusion of marginalized groups within the local context.

> In the last three years here in South Africa, we have been working with education specialists or providers of education to support the learning of English as a second language in South Africa. I mean, we all understand as an example the fact that you know English and some of these other international languages are more like

> the door to the world or like a gateway to opportunities, and that's something we can't deny. (Participant #3)

6. *Level 6/Post-Structure:* Among the findings, only one of the participants confirmed that their AI initiatives are within an inclusion framework, but often at a policy level discussion. That is, influencing policies to meet the needs of the marginalized groups. Due to the profit-oriented motives of the big technology companies, AI inclusion projects in sub-Saharan Africa are often executed for a "social good" purpose and not part of the core mission of the initiative. For example, a lot of South Africans or a lot of African students end up sometimes being disadvantaged in specific opportunities simply because they aren't fluent or proficient in a language like French or English. This is something AI is used to augment the efforts of the teaching systems and the different activities among learners in school and out of school by building AI solutions that accelerate learning in the classroom, says Participant #3.

4.7. Summary of Findings, Recommendations, & Research Limitations

Ideally, this work could have included more participants from the big tech companies to better give clarity to how inclusive their work is. However, due to the coronavirus pandemic, it was difficult getting their representatives to respond to email invitations. There was only one representative from such groups, and that participant's response might have been overgeneralized to reflect the views of the other big tech companies without representation. Due to the inability to meet physically, virtual conversations without video did not help see the facial expressions and gestures of the participants during the interview to give more insight into their comments on specific questions being asked (Denscombe, 2010).

In summary, the results of this study suggest that in providing answers to RQ1, participants generally agree that there exists an inclusion gap regarding working with and developing AI solutions for the marginalized groups in the region, which confirms the findings in the literature review. What the literature could not provide answers to was what novel factors contribute to the existence of the inclusion gap, which this research offers solutions. The research question had a fundamental assumption that big tech companies intentionally ignored marginalized groups. Still, the findings revealed that it is incredibly costly to innovate for the low-resource communities.

However, local AI initiatives are investing more in using AI to solve problems of the marginalized groups. Regarding RQ2, the findings pointed out that there is a need to focus more on engaging marginalized groups through approaches such as participatory design or co-design, making funds available to innovate for marginalized groups, and support local AI initiatives to use AI to solve local problems. The answer to RQ3 was quite surprising because only a few of the AI initiatives had considered marginalized groups as an indicator for measuring their impact.

CHAPTER 5: CONCLUSION

AI is predicted to be instrumental in the economic transformation of many developing countries, including countries residing in SSA. However, for AI to benefit all, there is a need to close the existing inclusion gaps to ensure marginalized groups are not exempted from the positive economic and social impact of AI. Using AI to address the specific needs of marginalized groups, involving them in the design and implementation of the AI solutions is paramount to closing the inclusion gaps.

As previously mentioned, even though there exists considerable literature that throws more light on how AI, if not checked, will widen the existing inequalities in societies or might benefit only those who can afford, there is little to no literature on the specific factors that contribute to the widening of the inclusion gaps, especially in the context of sub-Saharan Africa. This is the gap my research has aimed to fill. That is, to explore the current state of inclusivity of AI initiatives operating the region and discover factors contributing to the widening of the inclusion gap.

In this chapter, I explain the key findings from this study, expand on how these findings are significant to my research question, and how these findings contribute to the literature in AI, emerging technologies, and technological innovation fields. By putting the findings into context, I further explain in this chapter how the results from this research study can contribute to the creation of a framework for policymakers and practitioners to address the inclusion gaps.

5.1. Summary of Findings

The findings from this research are derived from four case studies that included semi-structured key informant interviews as a data-gathering strategy. Based on the analysis of the data collected, the findings confirm the results of the literature review, which is that there exist inclusion gaps regarding the involvement of marginalized groups in the design and development of AI solutions. The findings also revealed that AI in SSA is serving only the well-resourced communities and people.

However, the findings serve as a helpful nudge to understand the significant challenges that inhibit the achievement of inclusive innovation: (1)innovating for marginalized groups is costly due to lack of resources to develop and implement the AI solutions; (2) there exist no comprehensive national or government-led AI policies or strategies that address the problem of inclusivity; (3) Local partnerships with big technology companies focus on providing AI solutions for the global market and not a local market; and (4) the extent to which marginalized groups can be involved in the AI design and implementation process is dependent on the AI application.

These findings provide answers to the research question and help not only to understand the general landscape of how inclusive AI initiatives are in the region, but also offer significant factors that contribute to the widening of the inclusion gap. Also, the findings confirm the argument of van der Merwe et (2016) that, practical implementation of inclusive innovation projects and programs and transforming innovation systems to develop inclusive innovations is a very strenuous and complicated task to execute. As indicated by participant #3, “the difficult part

is making the solution work in low-income urban settlements, making it work, where schools have no computers, and it takes some time."

5.2. Findings in Context

The results from this study contribute to the existing literature and discussion on how AI, if not checked, will widen and create new inequalities in our societies, especially low-income countries and communities. The latest addition from this study to the ongoing discourse and literature on inclusive innovation is the discovery of some significant factors that contribute to the existence of inclusion gaps, specifically in the SSA region - (1)innovating for marginalized groups is costly due to lack of resources to develop and implement the AI solutions; (2) there exist no comprehensive national or government-led AI policies or strategies that address the problem of inclusivity; (3) Local partnerships with big technology companies focus on providing AI solutions for the global market and not a local market; and (4) the extent to which marginalized groups can be involved in the AI design and implementation process is dependent on the AI application. Also, inclusive innovation cannot be the responsibility of only the private sector, but collective work by both government, civil society groups, and the private sector.

The concept of AI, its potential benefits, and risks is still under review by many because of how complex the subject is. This means that when future researchers or industry players are addressing AI inclusion gaps that exists in this field, there is a need to think beyond the usual factors but focus on finding other unidentified factors.

Other findings suggest that the biggest challenge to AI inclusiveness on a global scale is bridging inclusion gaps between developed and developing countries and not necessarily between the marginalized groups within the society (Belinchon et al. 2019). It is important to

note that the inclusion gap in AI cannot be solved only at the global level. As my findings indicate, AI initiatives focused on bridging the gap between Africa and the global world do not focus on supporting excluded groups. Instead they work and innovate for the well-resourced communities. This focus reinforces existing power structures between developed and developing countries.

5.3. Future Direction

The limitations of this study include the low number and variety of participants recruited to participate in this research. Due to the COVID-19 pandemic in 2020, which transformed the activities and plans of many organizations, some participants reached out to did not respond or responded late to the call. A face-to-face interview was highly recommended to create comfort and trust between the researcher and participants. Still, due to the pandemic, interviews were conducted via Google Meet and recorded.

Many AI organizations, including Google, Facebook, and Microsoft, have launched their corporate diversity, equity & inclusion initiatives to improve participation of marginalized groups in their design and deployment of technological innovations. Still, there is limited research centralizing the learnings from these initiatives in terms of how well different approaches have worked in practice. Future research could further explore some of the learnings from these inclusion initiatives and assess the different approaches that have worked. Also, future research could examine how AI initiatives can develop comprehensive AI inclusive innovation systems or frameworks that measure the level of inclusivity and the impact.

5.4. Conclusion

This study examines the inclusivity of AI initiatives based in sub-Saharan Africa to understand if AI solutions or innovations are benefiting *everyone* or if everyone is involved in the process of designing and implementation. The findings from this study agree with the literature that there exists an inclusion gap (RQ 1). Still, there are some unknown factors - the high cost of innovating for marginalized groups, local partnerships focus on the global market and not local needs, etc. - that are often ignored when addressing the issue of AI inclusion gap. About RQ 2, the findings indicate that partnerships with local AI companies often focus on innovating for a global market. Finally, in answering RQ 3, the findings revealed most AI initiatives operating within SSA do not have laid-down inclusive indicators guiding their work. In other words, inclusive indicators are not prioritized as part of their strategy. Future research in this area will need to examine how AI initiatives could develop comprehensive systems or frameworks that could mitigate the challenges that prevent them from innovating for and with marginalized groups.

REFERENCES

Adejuwon, O. O., Ilori, M. O., & Taiwo, K. A. (2016). Technology adoption and the challenges of inclusive participation in economic activities: Evidence from small scale oil palm fruit processors in southwestern Nigeria. Technology in Society, 47, 111-120. Retrieved from https://doi.org/10.1016/j.techsoc.2016.09.002

Agrawal, A. Gans, J. & Goldfarb, A. (2019). Economic policy for artificial intelligence. Innovation Policy and the Economy, 19(1), 139-159. Retrieved from https://www.journals.uchicago.edu/doi/abs/10.1086/699935

Artificial Intelligence for Africa: An Opportunity for Growth, Development, and Democratisation. November (2018). Retrieved from https://www.up.ac.za/media/shared/7/ZP_Files/ai-for-africa.zp165664.pdf

Aulakh, P., Jiang, M., & Pan, Y. (2010). International technology licensing: Monopoly rents, transaction costs and exclusive rights. Journal of International Business Studies, 41(4), 587-605. Retrieved from www.jstor.org/stable/40604754

Barro, P. A. Degila, J., Zennaro, M., & Wamba, S. F. (2018). Towards Smart and Sustainable Future Cities Based on Internet of Things for Developing Countries: What Approach for Africa? EAI Endorsed Trans. Internet Things, 4. Retrieved from https://pdfs.semanticscholar.org/773a/2b911f31aeaee30605558281d230a9ae0319.pdf

Belinchon, E., Bollmann, B., Cussins Newman, J., Jobin, A., Nakonz, J. (2019). Towards an Inclusive Future in AI - A Global Participatory Process. Retrieved from https://ssrn.com/abstract=3505425

Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S., & Rickne, A. (2008). Analyzing the functional dynamics of technological innovation systems: A scheme of analysis. Research policy, 37(3), 407-429. Retrieved from https://doi.org/10.1016/j.respol.2007.12.003

Berthoumieu, J. (2017). Policy Instruments, Patents, and International Technology Diffusion in a North-South Duopoly. International Trade Journal, 31(2), 163–196. Retrieved from https://www.tandfonline.com/doi/full/10.1080/08853908.2016.1209446

Bertrand, C., & Bourdeau, L. (2010). Research interviews by Skype: A new data collection method. In Paper Presented at the Proceedings of the 9th European Conference on Research Methodology for Business and Management Studies, Madrid, Spain. Retrieved from https://www.academia.edu/2061796/USING_SKYPE_FOR_QUALITATIVE_INTERVIEW_RESEARCH?auto=download

Bessen, J. (2017). Information technology and industry concentration. Boston University School of Law Law & Economics Paper Series, (17-41). Retrieved from https://scholarship.law.bu.edu/faculty_scholarship/267/

Birhane A. (2019). The Algorithmic Colonization of Africa. Retrieved from https://reallifemag.com/the-algorithmic-colonization-of-africa/

Bowen, G. A. (2009). Document analysis as a qualitative research method. Qualitative research journal, 9(2), 27. Retrieved from https://www.researchgate.net/profile/Glenn_Bowen/publication/240807798_Document_Analysis_as_a_Qualitative_Research_Method/links/59d807d0a6fdcc2aad065377/Document-Analysis-as-a-Qualitative-Research-Method.pdf

Cath, C., Wachter, S., Mittelstadt, B., Taddeo, M., & Floridi, L. (2018). Artificial Intelligence and the 'Good Society': the US, EU, and UK approach. Science & Engineering Ethics, 24(2), 505–528. https://link.springer.com/article/10.1007/s11948-017-9901-7

Carole J. Piovesan et al., Artificial Intelligence: The Year in Review, Mccarthy Tétrault (Jan. 16, 2018). Retrieved from https://www.mccarthy.ca/en/insights/blogs/cyberlex/artificial-intelligence-year-review

Cave, S., & Ó hÉigeartaigh, S. (2018). An AI race for strategic advantage: rhetoric and risks. In AAAI/ACM Conference on Artificial Intelligence, Ethics and Society. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3446708

Chandrasekar, R., & Ramani, S. (1989). Artificial Intelligence: A Developing Country Perspective. In Proceedings of Workshop on AI Technology Transfer to Developing Countries, IJCAI (Vol. 89, pp. 21-25). Retrieved fromhttps://pdfs.semanticscholar.org/32b8/3639aeb7e4c18d9662be4291a204929ff2b1.pdf

Chataway, J., Hanlin, R., & Kaplinsky, R. (2014). Inclusive innovation: an architecture for policy development. Innovation and Development, 4(1), 33-54. Retrieved from https://www.tandfonline.com/doi/full/10.1080/2157930X.2013.876800

Christen Erlingsson, & Petra Brysiewicz. (2017). A hands-on guide to doing content analysis. African Journal of Emergency Medicine, 7(3), 93–99. Retrieved from https://www.sciencedirect.com/science/article/pii/S2211419X17300423

CIFAR Pan-Canadian Artificial Intelligence Strategy. Retrieved from https://www.cifar.ca/ai/pan-canadian-artificial-intelligence-strategy

Cozzens, S., & Sutz, J. (2014). Innovation in informal settings: Reflections and proposals for a research agenda. Innovation and Development, 4(1), 5-31. Retrieved from https://doi-org.login.ezproxy.library.ualberta.ca/10.1080/2157930X.2013.876803

Cozzens, S., & Sutz, J. (2012). Executive Summary-Innovation in Informal Settings: A Research Agenda. Retrieved from https://idl-bnc-idrc.dspacedirect.org/handle/10625/50560

Dafoe, A., & Journal of International Affairs. (2019). Global Politics and The Governance of Artificial Intelligence. Journal of International Affairs, 72(1), 121-126. Retrieved from https://www.jstor.org/stable/26588347

Denscombe, M. (2010). The Good Research Guide for small-scale social research projects, Maidenhead. Retrieved from https://eclass.srv.ualberta.ca/pluginfile.php/4617245/mod_resource/content/3/Denscombe%202010%20The%20Good%20Research%20Guide%204th.pdf

Duong, W. (2008). Effect of Artificial Intelligence on the Pattern of Foreign Direct Investment in the Third World: A Possible Reversal of Trend. Denver Journal of International Law & Policy, 36(3/4), 325–334. Retrieved from https://heinonline.org/HOL/P?h=hein.journals/denilp36&i=331

Elmawazini, K., & Nwankwo, S. (2012). Foreign direct investment: Technology gap effects on international business capabilities of sub-Saharan Africa. Thunderbird International Business Review, 54(4), 457-467.ni Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1002/tie.21476

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. Journal of advanced nursing, 62(1), 107-115. Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1365-2648.2007.04569.x

Erlingsson, C., & Brysiewicz, P. (2017). A hands-on guide to doing content analysis. African Journal of Emergency Medicine, 7(3), 93-99. Retrieved from https://www.sciencedirect.com/science/article/pii/S2211419X17300423#s0030

Fabayo, J. A. (1996). Technological dependence in Africa: its nature, causes, consequences and policy derivatives. Technovation, 16(7), 357-370. Retrieved from https://doi.org/10.1016/0166-4972(96)00013-2

Foley, A., & Ferri, B. A. (2012). Technology for people, not disabilities: ensuring access and inclusion. Journal of Research in Special Educational Needs, 12(4), 192-200. Retrieved from https://doi.org/10.1111/j.1471-3802.2011.01230.x

Foster, C., & Heeks, R. (2013). Analyzing policy for inclusive innovation: the mobile sector and base-of-the-pyramid markets in Kenya. Innovation and Development, 3(1), 103-119. Retrieved from https://doi.org/10.1080/2157930X.2013.764628

Foster, C., Heeks, R. (2013). Conceptualising Inclusive Innovation: Modifying Systems of Innovation Frameworks to Understand Diffusion of New Technology to Low-Income Consumers. Eur J Dev Res 25, 333–355. Retrieved from https://doi.org/10.1057/ejdr.2013.7

Gaon, A., & Stedman, I. (2019). A Call to Action: Moving Forward with the Governance of Artificial Intelligence in Canada. Alberta Law Review, 56(4), 1137–1165.Retrieved from https://doi.org/10.29173/alr2547

George, G., McGahan, A. M., & Prabhu, J. (2012). Innovation for inclusive growth: Towards a theoretical framework and a research agenda. *Journal of management studies*, *49*(4), 661-683. Retrieved from https://onlinelibrary.wiley.com/doi/full/10.1111/j.1467-6486.2012.01048.x

Golafshani, N. (2003). Understanding Reliability and Validity in Qualitative Research. The Qualitative Report, 8(4), 597-606. Retrieved from https://nsuworks.nova.edu/tqr/vol8/iss4/6

Govindarajan V. and Ramamurti, R (2015) 3 Ways Businesses Are Addressing Inequality in Emerging Markets. Retrieved from https://hbr.org/2015/01/3-ways-businesses-are-addressing-inequality-in-emerging-markets

Guihot, M., Matthew, A. F., & Suzor, N. P. (2017). Nudging Robots: Innovative Solutions to Regulate Artificial Intelligence. Vanderbilt Journal of Entertainment & Technology Law, (Issue 2), 385. Retrieved from http://www.jetlaw.org/wp-content/uploads/2017/12/2_Guihot-Article_Final-Review-Complete_Approved.pdf

Guthrie, G. (2010). Basic Research Methods: An Entry to Social Science Research. Sage Publications Pvt. Ltd. Retrieved from https://www.indianjournals.com/ijor.aspx?target=ijor:read&volume=8&issue=1&article=br002

Harsh, M., Woodson, T. S., Cozzens, S., Wetmore, J. M., Soumonni, O., & Cortes, R. (2018). The role of emerging technologies in inclusive innovation: the case of nanotechnology in South Africa. Retrieved from https://academic.oup.com/spp/article/45/5/597/4711134

Heeks, R., Amalia, M., Kintu, R., & Shah, N. (2013). Inclusive innovation: Definition, Conceptualisation and Future Research Priorities. Development Informatics Working Paper. Retrieved from

https://www.researchgate.net/publication/334613068_Inclusive_Innovation_Definition_Conceptualisation_and_Future_Research_Priorities

Heeks, R., Foster, C., & Nugroho, Y. (2014). New models of inclusive innovation for development. Retrieved from https://www.tandfonline.com/doi/full/10.1080/2157930x.2014.928982

Hsiu-Fang Hsieh, & Shannon, S. E. (2005). Three Approaches to Qualitative Content Analysis. Qualitative Health Research, 15(9), 1277–1288. Retrieved from https://journals-sagepub-com.login.ezproxy.library.ualberta.ca/doi/pdf/10.1177/1049732305276687

Jafarieh, H. (2001). Technology transfer to developing countries: a quantitative approach (Doctoral dissertation, University of Salford, UK). Retrieved from http://usir.salford.ac.uk/id/eprint/2101/

Joppe, M. (2000). The Research Process. Retrieved February 25, 1998. Retrieved from

http://www.ryerson.ca/~mjoppe/rp.htm

Kalkanci, B., Rahmani, M., & Toktay, L. B. (2019). The role of inclusive innovation in promoting social sustainability. Production and Operations Management, 28(12), 2960-2982. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3192623

Kaplinsky, R. (2011). Schumacher meets Schumpeter: Appropriate technology below the radar. Research Policy, 40(2), 193-203. Retrieved from https://www.sciencedirect.com/science/article/pii/S004873331000212X

Katyal, S. K. (2019). Private Accountability in the Age of Artificial Intelligence. UCLA L. Rev., 66, 54. Retrieved from https://heinonline.org/HOL/P?h=hein.journals/uclalr66&i=64

Kurz, M. (2017). On the Formation of Capital and Wealth: IT, Monopoly Power and Rising Inequality. Monopoly Power and Rising Inequality (June 25, 2017). Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3014361

Kwet, M. (2019). Digital Colonialism: South Africa's Education Transformation in the Shadow of Silicon Valley. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3496049

Lee, K. F. (2018). AI superpowers: China, Silicon Valley, and the new world order. Houghton Mifflin Harcourt.

Langdon, S. (1977). Technology Transfer by Multinational Corporations in Africa: Effects on the Economy. Africa Development / Afrique Et Développement, 2(2), 95-114. Retrieved from http://www.jstor.org/stable/24486363

Luther Osabutey, E., & Debrah, Y. A. (2012). Foreign direct investment and technology transfer policies in Africa: A review of the Ghanaian experience. Thunderbird International Business Review, 54(4), 441-456. Retrieved from https://doi.org/10.1002/tie.21475

Managi, S., & Bwalya, S. M. (2010). Foreign direct investment and technology spillovers in sub-Saharan Africa. Applied Economics Letters, 17(6), 605-608. Retrieved from https://doi.org/10.1080/13504850802167173

Miller H. and Stirling R. (2019). Government Artificial Intelligence Readiness Index

2019 Retrieved from https://ai4d.ai/wp-content/uploads/2019/05/ai-gov-readiness-report_v08.pdf

Mo, X. (2017). The impacts of institutional differences in relation to intellectual property rights protection on foreign market direct investment: FDI inflows and modes of foreign market entry. Retrieved from http://hdl.handle.net/10063/6434

Nemitz, P. (2018). Constitutional democracy and technology in the age of artificial intelligence. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 376(2133), 20180089. Retrieved from https://doi.org/10.1098/rsta.2018.0089

Noel, K., & Ellison, B. (2020). Inclusive Innovation in Telehealth. NPJ Digital Medicine, 3(1), 1-3. Retrieved from https://www-nature-com.login.ezproxy.library.ualberta.ca/articles/s41746-020-0296-5

Nwaobi, G. C. (2019). Emerging African Economies: Digital Structures, Disruptive Responses and Demographic Implications. Disruptive Responses and Demographic Implications (October 1, 2019). Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3462646

Nwaodike, C. (2017) The AI Digital Divide – An African Perspective. Retrieved from https://internews.org/opinion/ai-digital-divide-african-perspective

Odame, H. S., Okeyo-Owuor, J. B., Changeh, J. G., & Otieno, J. O. (2020). The role of technology in inclusive innovation of urban agriculture. Current Opinion in Environmental Sustainability. Retrieved for https://doi.org/10.1016/j.cosust.2019.12.007

Ohiorhenuan, J. F., & Poloamina, I. D. (1992). Building indigenous technological capacity in African industry: the Nigerian case. In Alternative Development Strategies in Sub-Saharan Africa (pp. 294-317). Palgrave Macmillan, London. Retrieved from https://link.springer.com/chapter/10.1007/978-1-349-12255-4_11

O'Leary, Z. (2017). The essential guide to doing your research project (3rd ed.). Thousand Oaks, CA: SAGE Publications, Inc. Retrieved from http://www.ru.ac.bd/wp-

content/uploads/sites/25/2019/03/402_06_00_O%E2%80%99Leary-The-Essential-Guide-to-Doing-Your-Research-Project-2017.pdf

Patnaik, J., & Bhowmick, B. (2020). Promise of inclusive innovation: A Re-look into the opportunities at the grassroots. Journal of Cleaner Production, 121124. Retrieved from https://doi.org/10.1016/j.jclepro.2020.121124

Peerally, J. A., De Fuentes, C., & Figueiredo, P. N. (2019). Inclusive innovation and the role of technological capability-building: The social business Grameen Danone Foods Limited in Bangladesh. Long Range Planning, 52(6), 101843. Retrieved from https://doi.org/10.1016/j.lrp.2018.04.005

Prahalad, C. K., & Mashelkar, R. A. (2010). Innovation's Holy Grail. Harvard Business Review, 88(7/8), 132–141. Retrieved from https://hbr.org/2010/07/innovations-holy-grail

Ramani, S. V., SadreGhazi, S., & Duysters, G. (2012). On the diffusion of toilets as bottom of the pyramid innovation: Lessons from sanitation entrepreneurs. Technological Forecasting and Social Change, 79(4), 676-687. Retrieved from https://www.sciencedirect.com/science/article/pii/S0040162511001314

Regulation of Artificial Intelligence in Selected Jurisdictions Report. (2019). Retrieved from https://www.loc.gov/law/help/artificial-intelligence/regulation-artificial-intelligence.pdf

Sandelowski M. (2000) Focus on Research Methods Whatever Happened to Qualitative Description? University of North Carolina at Chapel Hill, #7640, Carrington Hall, School of Nursing, Chapel Hill, NC 27599.

Schoeman, W., Moore, R. Yusof, S. and Chen, J. (2017). Artificial Intelligence: Is South Africa Ready? Retrieved from https://www.accenture.com/_acnmedia/pdf-107/accenture-ai-south-africa-ready.pdf

Streb, C. (2009). Exploratory case study. Encyclopedia of case study research. Retrieved from https://dx.doi.org/10.4135/9781412957397.n139

Smith, L. M. and Neupane, S. (2018) Artificial Intelligence and Human Development: Toward Research Agenda. Retrieved from https://www.idrc.ca/en/stories/artificial-intelligence-and-human-development

Taylor, P. J., Catalano, G., & Walker, D. R. (2002). Exploratory analysis of the world city network. Urban Studies, 39(13), 2377-2394. Retrieved from https://doi.org/10.1080/0042098022000027013

Travaly Y., and Muvunyi K. (2020). The future is intelligent: Harnessing the potential of artificial intelligence in Africa. Retrieved from https://www.brookings.edu/blog/africa-in-

focus/2020/01/13/the-future-is-intelligent-harnessing-the-potential-of-artificial-intelligence-in-africa/

UN Commission on Science and Technology for Development. (2014) Issues Paper on Science, Technology and Innovation (STI) for the Post-2015 Development Agenda. Retrieved from https://unctad.org/meetings/en/SessionalDocuments/CSTD2013_Issues02_STI.pdf

Vonk, M., Tripodi, T., & Epstein, I. (2007). Qualitative Methods in Practice Research. In Research Techniques for Clinical Social Workers (pp. 132-146). New York: Columbia University Press. doi:10.7312/vonk13388.13

Walliman, N. (2017). Research methods: The basics Routledge. New York.

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. American journal of theoretical and applied statistics, 5(1), 1-4.

Valentine, S. (2019). Impoverished Algorithms: Misguided Governments, Flawed Technologies, and Social Control. Fordham Urban Law Journal, 46(2), 364–427. Retrieved from https://heinonline.org/HOL/P?h=hein.journals/frdurb46&i=379

van der Merwe, E., & Grobbelaar, S. S. (2016). Evaluating inclusive innovative performance: The case of the eHealth system of the Western Cape Region, South Africa. Retrieved from https://ieeexplore-ieee-org.login.ezproxy.library.ualberta.ca/document/7806775

Yu, P. K. (2020). The algorithmic divide and equality in the age of artificial intelligence. Florida Law Review, 72(2), 331-390.

APPENDICES

Appendix A: Participants Invitation Letter and Consent Form

INFORMATION LETTER and CONSENT FORM

Study Title: Inclusive Artificial Intelligence (AI) Initiatives in sub-Saharan Africa

Background

I am a masters student at the Faculty of Extension, studying Communications and Technology, studying at the University of Alberta, Canada and working on my final capstone project. My research study will examine the extent to which AI initiatives are or could become inclusive to help foster local capacity to lead AI development in sub-Sharan Africa. The aim of this study is to provide a comprehensive and relevant framework to help organizations develop effective inclusive AI initiatives for sub-Saharan Africa to address issues of innovation exclusion of marginalized groups, diversity, etc.

I am recruiting 4-5 participants from the following groups:

- AI projects, AI research directors, AI policy directors/analysts, etc. who are working on commercial AI projects or initiatives in sub-Saharan Africa.
- AI researchers, technology advocates, etc. who are involved in non-commercial AI activities.
- Researchers who have authored a white/academic paper/reports on AI development in Africa or are part of the leadership team working on AI initiatives in sub-Saharan Africa.

I am kindly asking for your participation in this study.

Purpose: The purpose of this study is to provide a comprehensive and relevant framework to help organizations develop effective inclusive AI initiatives for sub-Saharan Africa to address issues of innovation exclusion of marginalized groups, diversity, etc.

Study Procedures: This research will conduct one-on-one interviews with participants to gather expert information. The interview will focus on conducting conversations with carefully selected 4-5 participants. The interview will use semi-structured and open-ended interview questions. There will be about 3-5 questions that guide interaction with the participants. The interviews will be done via phone and Skype/Google Meet/Zoom with selected participants, asking carefully developed and semi-structured interview questions to help provide answers to the research questions. These interviews will last between 45-60 minutes in length and be recorded using the securely in-built recording function of the online video applications.

Benefits: This study will not bring any direct benefits to the participants who take part in this study. However, participants will understand how to develop and assess inclusive AI initiatives for their organizational projects. Also, a copy of the final report will be shared with all participants which will contain an inclusive framework that can be used to inform their decisions when establishing AI initiatives in sub-Sharan Africa.

Risk: There are no known risks to participants involved in this study.

Data Accuracy: In order to resolve the potential likelihood of participants' information being misinterpreted, participants will have the chance to confirm the information they provide before the study is published. Participants will be sent, via email, a brief note containing their response a week after the interview and they will be required to confirm or clarify, if need be, within five working days via an email to the student researcher.

Data Withdrawal: Volunteers can request the withdrawal of their data, before data analysis is completed or approximately 3-4 weeks after the interview is completed, without any penalty. Volunteers may provide the researcher with the reason(s) for leaving the study, but it is not mandatory to do so.

Cost of Participation (if applicable): There is no direct personal cost to participation.

Reimbursement or Remuneration (if applicable): There are no direct personal reimbursements or incentives for participating in this study.

Voluntary Participation: I volunteer to participate in a research project conducted by Mr. Kofi Yeboah, studying MA. Communications and Technology at the University of Alberta. I

understand that the project is designed to gather information about the inclusivity of Artificial Intelligence initiatives in sub-Saharan Africa. I will be one of approximately 4-5 people being interviewed for this research. My participation in this project is voluntary. I understand that I will not be paid for my participation. I may withdraw and discontinue participation at any time without penalty. Volunteers may provide the researcher with the reason(s) for leaving the study, but it is not mandatory to do so. Volunteers can verbally inform the researcher during the interview process or can send an email or via a phone call to the researcher expressing his/her discomfort to engage or withdraw from the research. If I decline to participate or withdraw from the study, no one at my workplace or organization will be told. I feel uncomfortable in any way during the interview session, I have the right to decline to answer any question or to end the interview.

Confidentiality & Anonymity: All information collected will be coded to protect the participant's privacy, anonymity, and confidentiality. Before releasing aggregated data to the University of Alberta, any identifying indicators will be removed. Data will be kept in a secure place for a minimum of five years following the completion of the research project, and when appropriate, will be destroyed in a way that ensures privacy and confidentiality is guaranteed during your participation in this study.

Contact Information

Research Investigator:

Kofi Yeboah

kyeboah@ualberta.ca

+1-780-242-6060

This research has been approved by the Research Ethics Board of University Alberta with the ethics ID number Pro00099124. If you have questions about your rights or how research should be conducted, you can call +1-780-492-2615 or email - reoffice@ualberta.ca. This office is independent of the researchers.

Consent Statement: I have read this form and the research study has been explained to me. I have been given the opportunity to ask questions and my questions have been answered. If I have additional questions, I have been told whom to contact. I agree to participate in the research study described above and will receive a copy of this consent form. I will receive a copy of this consent form after I sign it.

To consent to this study, please sign by typing your full name in the spaces provided below and add the date. Please email this consent form back to the student researcher via kyeboah@ualberta.ca and include your contact information in the email as well.

_____ _____

Participant's Name (printed) and Signature Date

_____ _____

Researcher: Kofi Yeboah Date

Appendix B: Interview Guide

PROJECT TITLE: INCLUSIVE ARTIFICIAL INTELLIGENCE (AI) INITIATIVES IN SUB-SAHARAN AFRICA SEMI-STRUCTURED INTERVIEW GUIDE

Basic Information About Interviewee

M / F

Organization:

Professional/Job Title:

1. Qualitative interview introduction

Length: 45-60 minutes

Primary goal: To see things the way you see them… more like a conversation with a focus on your experience, your opinions and what you think or feel about the topics covered

2. Consent Confirmation

Would you like to participate in this interview?

Signed Consent was obtained from the study participant prior to this interview.

3. Background Information

Overview:

Invite interviewee to briefly tell me about him/herself:

- General information about his/her background pertaining to career and the role he/she plays.

What do you think of the role of AI development in sub-Saharan Africa?

- What role do you think your organization plays in AI development in this region?

4. Intention Innovation Level for Inclusive AI Initiative

Tell me who you think will benefit immensely from your AI initiative?

How might lower income groups benefit from this AI initiative? (Ask if not mentioned)

5. Consumption Innovation Level for Inclusive AI Initiative

In your opinion, which group of people or institutions are going to be the direct users of the products of your AI innovations in this region?

- How do you think marginalized groups can be able to adopt your products?

6. Impact Innovation Level for Inclusive AI Initiative

How is your AI initiative creating economic and non-economic opportunities for all segments of the population in this region?

- Probe: How does your organization use AI to improve the livelihoods of lower income people in this region?

What are some of the indicators used in measuring the impact of this AI initiative in this region?

7. **Process Innovation Level for Inclusive AI Initiative**

Who are the key stakeholders you work with in your AI initiative activities?

- Probe: What role do these stakeholders play?
- Probe: How does your initiative engage with marginalized groups to participate in the activities and AI innovations?

8. Structure Inclusion Level for Inclusive AI Initiative

How does your organization focus on using its AI innovations to improve the lives of the marginalized in the world?

- Are marginalized groups included at the fundamentals of organization's innovation models? If yes, please tell me more about that…

9. Post-Structure Inclusion Level for Inclusive AI Initiative

How does your AI initiative foster a culture and mindset of inclusion among its team during designing of AI solutions?

Appendix C: Qualitative Content Analysis Matrix

Research Question: How inclusive are AI initiatives in sub-Saharan Africa?		
Themes	**Categories**	**Selected Respondent Quotes**
Current state of Inclusivity in AI Initiatives	Inclusion and Resources	"The truth is, it's easy to innovate for the well resourced. So, it's really easy
		"Collecting the data that's relevant for different places can be quite costly ,
	Inclusion Dependency	"It depends on the solution . So for example, if we are dealing with
	Local Innovation and Public Good	"There are lots of apps that we have seen that have been locally
		"There's actually quite an amazing community that's developing. I'm sure you've heard of the Indaba community... a lot of people were really inspired to do something for the public good and in the public interest" - **T_4_M**
	Inclusion gap and AI policies	"The gap that we saw was around policy. Policymakers and governments
		"Even with AI, it's tempting to feel like we have AI in Africa while AI is
		"There's usually no civil society groups in these or multiple groups that
Building capacity of local AI initiatives	Curriculum Developement and Ethics Training	"Also support for PhD and master's students and support for academics
	Local Partnerships	"Facebook, is doing similar work. So, I think that those approaches are good
	Funding Opportunities and Local Research	"It's all around research, innovations and research on the policy
Strategies for Improving Inclusion in AI Intiatives	Participatory Design and Diversity	"I am a firm believer in participatory design , so that for any solution that is
		"At a higher level for us, we need to have these rights policies in place and
		"We believe in the diversity of the type of people that we hire . If you have
		"So if you're going to develop some AI solution, let's say to provide
	Comprehensive and Holistic Solution	"Inequalities are more than just it's a technology thing. It's all across the
	Organizational vision and objectivies	"For me, it's all about the vision of the organisation and what they're
	Explainability, Democratisation, Transparency and Awareness	"My argument is that we need to democratise AI , especially AI that will be
		"Making sure the AI solutions we create are explainable. So that when
Impact Indicators of Inclusive AI Initiatives	Equitable AI Policies	"Our long term metric is actually how much are we preventing deaths from
		"We would want to see these principles and values around inclusion and