THE IMPACT OF THE ADOPTION OF 5G TECHNOLOGY IN LOW INCOME/RURAL AREAS: A CASE STUDY OF CHITUNGWIZA, ZIMBABWE

BY

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ABSRACT

This study examined the impact of 5G technology adoption in low-income areas, focusing on Chitungwiza, Zimbabwe. As the fifth generation of wireless communication, 5G provided faster, more reliable connections with higher data transfer speeds, lower latency, and greater network capacity. The research assessed how 5G adoption could help bridge the digital divide by improving access to high-speed internet and digital services. It explored potential benefits in education, healthcare, and economic development while identifying challenges such as infrastructure requirements, affordability, and societal barriers. The study analyzed the socio-economic impact of 5G adoption, including effects on local businesses, job creation, entrepreneurship, and community development. Data was collected through questionnaires targeting low-income residents and small businesses, enabling a comprehensive analysis of diverse perspectives. Despite financial challenges associated with implementation, the anticipated long-term benefits positioned 5G as a valuable investment for fostering inclusive growth

DECLARATION

I declare that this dissertation is my original work except where sources have been cited and acknowledged. The work has never been submitted, nor will it ever be submitted to another university for the award of a degree.

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DEDICATION

I would like to dedicate this work to my friends and family, whose unwavering support and encouragement have been a constant source of motivation throughout my educational journey.

List of Acronyms and Abbreviations

AUREC   Africa University Research Ethics Committee

5G 5TH generation

IoT   Internet of Things

GSMA   Global System for Mobile Communications Association

Mbps   Megabits per second

SDG   Sustainable Development Goals

GDP   Gross Domestic Product

IBM   International Business Machines

TAM   Technology Acceptance Model

LMIC   Low- and Middle-Income Countries

mIoT   Mobile Internet of things

eMBB   Enhanced Mobile Broadband

FWA   Fixed Wireless Access

LDC   Least Developed Countries

Definition of key terms

5G

5G represents the latest advancement in mobile networks, succeeding the previous generations of 1G, 2G, 3G, and 4G networks. It introduces a cutting-edge global wireless standard that facilitates the seamless connection of a wide range of entities, encompassing individuals, machines, objects, and devices. 5G wireless technology aims to provide faster data speeds reaching multi-Gbps peaks, extremely low latency, enhanced reliability, expanded network capacity, improved availability, and consistent user experience to a larger user base. (Qualcomm, 2024).

Latency

Latency in the context of 5G pertains to the delay experienced when sending a request or command and receiving a response. It gauges the responsiveness and communication delay between devices within the network. In simpler words, latency refers to the time it takes for data to travel from one location to another within the network (Federal Communications Commission (FCC), 2020).

Bandwidth

In the context of 5G, bandwidth refers to the maximum data transfer rate or capacity of the network. It determines how much data can be transmitted within a specific timeframe (Federal Communications Commission (FCC), 2020).

Digital divide

The digital divide is the gap between those who have access to and can effectively use digital technologies, like the internet, and those who don't. It involves inequalities in hardware, software, internet connectivity, and digital skills. In simpler terms, it shows the unequal distribution of digital resources among individuals and communities (World Bank,2020).

Socio-economic

Socioeconomic factors encompass the social and economic elements that affect individuals or communities' well-being and status. These factors include income, education, occupation, social class, and access to resources. In simpler terms, socioeconomic factors refer to the social and economic conditions that influence people's quality of life and opportunities (Oxford Languages. n.d.).

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CHAPTER ONE: INTRODUCTION

1.1 INTRODUCTION

5G, the fifth generation of cellular network technology, was launched in 2019 with the introduction of mobile 5G services in South Korea and the US (CNN,2021). Since then, the commercialization of 5G has rapidly progressed, surpassing the capabilities of 4G. With its seamless connectivity, robust network performance, and enhanced capabilities, 5G has the potential to revolutionize various industries, including education, healthcare, and economic opportunities. By offering improved bandwidth, stability, and reduced latency, 5G enables transformative applications and services that can enhance remote learning, telemedicine, and drive innovation in sectors, unlocking new possibilities for growth and development (GSMA,2023). Moreover, 5G holds the promise of bridging the digital divide by providing high-speed internet access to underserved communities, ensuring equal opportunities for all.

1.2 BACKGROUND TO THE STUDY

The global surge in 5G technology has sparked a remarkable response, as countries worldwide actively embrace and implement this cutting-edge telecommunications standard to unlock a new era of ultra-fast and reliable connectivity. Since its introduction in 2019, the availability of 5G wireless networks has been increasing, and at present, 62% of smartphones are equipped with 5G connectivity (Mesh Flinders/IBM, 2024). The primary objective of embracing 5G technology is to provide ultra-fast and reliable connectivity in response to the escalating demands for high-speed data transfer.

The advancement of wireless technology to the fifth generation extends far beyond improving our mobile devices. It plays a fundamental role in powering the Internet of Things (IoT), smart cities, autonomous vehicles, and a wide range of yet-to-be-discovered innovations (Femi Osasona, 2023). Based on a report by the Global System for Mobile Communications

Association (GSMA), as of September 2021, there were 166 commercial 5G networks deployed across 65 countries (GSMA, 2021), indicating global momentum and widespread interest in adopting 5G technology. Many experts argue that achieving widespread access to superfast connectivity, with potential download speeds reaching up to 10,000 megabits per second (Mbps), is crucial for maintaining global competitiveness.

Rajeev Suri, President, and CEO of Nokia, believes that 5G makes digitalization more accessible and will "enable small businesses, public services, and even individual households to enjoy the advantages of smart products and services." He also emphasizes that the impressive high speeds of 5G will unlock significant social and economic benefits (World Economic Forum & PwC, 2020). By harnessing the power of 5G, intelligent connectivity is poised to act as a catalyst for socio-economic growth during the Fourth Industrial Revolution. It is projected that by 2035, this transformative technology could contribute to a staggering $13.2 trillion of global economic value (IHS Markit: The 5G Economy: How 5G will contribute to the global economy,2019). When utilized alongside technological advancements such as the internet of things, artificial intelligence, and big data, 5G has the capability to produce substantial societal benefits on a grand scale. According to a study carried out by Tech4i2, the implementation of 5G is projected to sustain 137,000 job positions in Switzerland alone and contribute to an economic output of 42.4 billion Swiss francs by the year 2030. Additionally, a study conducted by the European Commission in 2016 estimates that 5G has the potential to generate an economic output of €141 billion and create 2.3 million jobs across the 28 Member States of the European Union.

In Africa, the adoption of 5G technology holds significant potential to address various socio-economic issues and contributes to the achievement of Sustainable Development Goals (SDGs). Adopting 5G with current technological infrastructures may be challenging, but it also provides African nations with a chance for significant advancements. By embracing

innovation, they can quickly adapt to 5G requirements without the burden of outdated systems, leaving plenty of room for growth (Agiwal et al., 2021, Adebukola et al., 2022). Infrastructure development commonly faces challenges such as complex network rollout and issues with allocating spectrum. Nevertheless, the ultimate objective is to achieve a balance between urban and rural deployments, ensuring that accessibility to the infrastructure is widespread (World Journal of Advanced Research and Reviews, 2024).

1.3 STATEMENT OF THE PROBLEM

Despite the global surge in 5G technology and its potential to drive socio-economic growth, there is a significant digital divide between urban and low-income/rural areas, including Chitungwiza, within Harare, Zimbabwe. The adoption of 5G technology in these marginalized areas is limited, leading to a lack of access to ultra-fast and reliable connectivity (Technium Soc. Sci. J. 87,2023). This exclusion exacerbates existing socio-economic disparities, hindering opportunities for education, healthcare, entrepreneurship, and overall development (Markus Olofsgård, 2022). Challenges such as inadequate infrastructure, affordability constraints, and limited awareness of the potential benefits of 5G contribute to this problem (GSMA,2023). Therefore, understanding the impact of 5G adoption in low-income/rural areas of Harare, specifically in Chitungwiza, is crucial to bridge the digital divide and leverage the transformative potential of 5G technology for inclusive development. This research aimed to address this gap by examining the challenges, opportunities, and socio-economic impacts of 5G adoption in Chitungwiza within Harare, informing policy recommendations and strategies for equitable digital inclusion.

1.4 RESEARCH AIM AND OBJECTIVES

1.4.1 Research aim

The aim of this research was to assess the impact of the adoption of 5G technology in low-income/rural areas, specifically focusing on Chitungwiza located within the Harare region of Zimbabwe. The research aimed to examine the socio-economic implications of 5G technology adoption in this marginalized area and understand how it can contribute to inclusive development. By analyzing the challenges, opportunities, and outcomes of 5G adoption, the research provided insights into bridging the digital divide and promoting equitable access to reliable connectivity in Chitungwiza and similar low-income areas. The research investigated the specific benefits and limitations of 5G adoption in this context, as well as the factors influencing its implementation and utilization. Ultimately, the research aimed to inform policymakers, stakeholders, and relevant organizations on effective strategies for leveraging 5G technology to enhance socio-economic conditions in low-income/rural areas (i.e. Chitungwiza.)

1.4.2 Research objectives

1. To assess the current level of 5G technology adoption in low-income areas

2. To investigate the socio-economic impact of 5G technology adoption

3. To identify and analyze the challenges and barriers hindering the adoption of 5G technology.

4. To explore the potential opportunities and benefits of 5G technology adoption.

1.5 RESEARCH QUESTIONS

1. What is the current state of 5G technology adoption?

2. How will the adoption of 5G technology impact the socio-economic development of Chitungwiza?

3. What are the significant challenges and barriers hindering the adoption of 5G technology in Chitungwiza, and how can they be addressed?

4. What are the potential opportunities and benefits of adopting 5G technology in Chitungwiza, and how can it enhance connectivity, healthcare, education, and economic growth in the region?

1.6 SIGNIFICANCE OF THE STUDY

The study on the impact of 5G technology adoption in low-income/rural areas of Zimbabwe, with a focus on Chitungwiza, holds significant importance as it investigated the potential of this cutting-edge technology to bridge the digital divide and promote socio-economic development in marginalized communities. By exploring the benefits and challenges of 5G adoption in these areas, the study sheds light on the opportunities for improved connectivity, enhanced access to information, and increased economic opportunities that can empower residents and stimulate growth.

Moreover, the study's findings can inform policy decisions and guide investments in infrastructure and digital literacy programs, ultimately contributing to the reduction of inequality and promotion of inclusive development in Zimbabwe. Additionally, the study's outcomes can serve as a model for other low-income and rural areas in Africa and globally, highlighting the potential of 5G technology to drive progress and improve the quality of life for marginalized populations.

1.7 ASSUMPTIONS OF THE STUDY

Several key assumptions guided this study, forming the basis for its methodology and findings.

It was assumed that:

1. All respondents would answer survey questions honestly and accurately.
2. The information provided by respondents would be accurate and reliable.
3. The research proposal would receive approval from AUREC.
4. The introduction of 5G technology in Chitungwiza would foster innovation and entrepreneurship, creating opportunities for local startups and tech-driven initiatives
5. Small business owners in Chitungwiza would be willing to embrace and integrate 5G technology to enhance their business operations.

These assumptions were essential for structuring the research and analysing its outcomes within the defined scope.

1.8 DELIMITATIONS OF THE STUDY

This research project on the impact of 5G technology adoption in low-income areas, specifically focusing on Chitungwiza, had certain delimitations that defined its scope. First, the study focused exclusively on Chitungwiza, which limits the applicability of the findings to other low-income areas. Second, the research primarily involved small business owners and residents of Chitungwiza, excluding other stakeholders such as government officials or telecommunications providers. Third, the study concentrated on the socio-economic impacts of 5G adoption, excluding technical or environmental aspects. Lastly, the research was conducted within a specific time frame, limiting the exploration of long-term impacts. These delimitations provided a focused investigation of the impact of 5G adoption in Chitungwiza while acknowledging the limitations in generalizing the findings to broader contexts.

1.9 LIMITATION OF THE STUDY

Due to limitations in resources, including financial constraints, and manpower, conducting a comprehensive study across multiple low-income areas posed a challenge. To address this

issue, the researcher decided to focus specifically on Chitungwiza, a representative low-income area within the Harare region of Zimbabwe.

Existing studies or case studies on the impact of 5G technology in low-income areas were prone to bias or contained information that lacked authenticity or accuracy due to potential limitations in research design, sample selection, data collection methods, or subjective interpretation of findings. To ensure the authenticity and validity of the research findings, the researcher interacted directly with small business owners and residents in Chitungwiza. Through interviews, surveys, and observations, the researcher gathered data and perspectives from these stakeholders.

Confidentiality concerns among participants were also a limitation to the research, as individuals were hesitant to disclose certain information due to tactical reasons or privacy concerns. Confidentiality concerns were addressed by obtaining informed consent from all participants involved in the study. The researcher clearly explained the purpose and benefits of the research, ensuring participants understood that their responses will only be used for academic purposes. Consent forms were provided, allowing participants to ask questions and address any concerns before giving their consent.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter provides a review of existing literature relevant to understanding the impact of the adoption of 5G technology in low-income areas. It begins by defining 5G technology as the fifth evolution of global wireless technology, employed for mobile and internet services, which builds upon the advancements made by its predecessors—4G, 3G, 2G, and 1G (Australian Government, 2024). The literature review identifies a knowledge gap regarding the challenges related to the adoption of 5G and the potential benefits of 5G adoption, such as enhanced connectivity, improved healthcare, education access, and economic growth. The chapter concludes with a summary of key findings, setting the stage for addressing the research gap.

2.2 CONCEPTUAL FRAMEWORK
This study will be informed and guided by the conceptual framework below:

Technology Acceptance Model
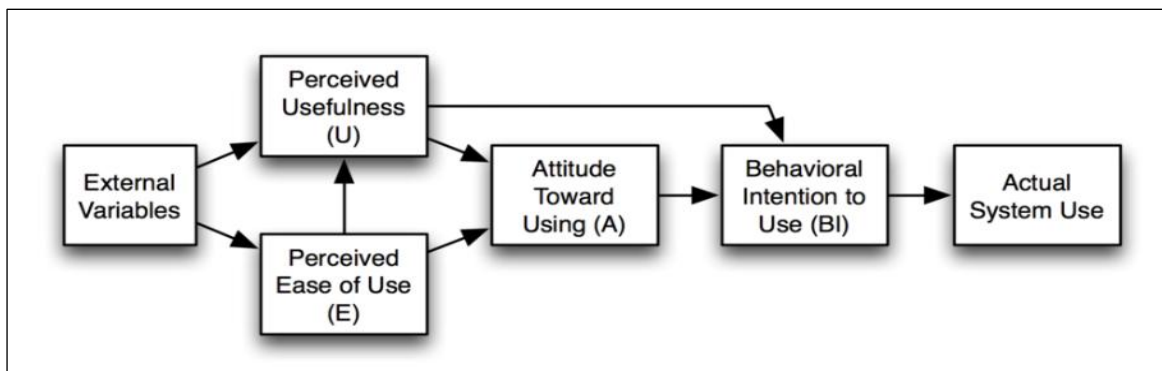
Figure 2.1: An illustration of the TAM theoretical framework. (source: Nippie, Aufbau des Technology Acceptance Models, 2011)

The Technology Acceptance Model (TAM), developed by Davis et al. (1989), is a theoretical framework that postulates that the acceptance of technology is predicted by the users' behavioural intention, which is, in turn, determined by the perception of technology usefulness

in performing the task and perceived ease of its use (Marikyan, D. & Papagiannidis, S. ,2023). TAM provides insights into how individuals perceive 5G technology's usefulness and ease of use, influencing their adoption behavior. It suggests that these two key beliefs shape users' attitudes towards new technology, subsequently influencing their behavioral intention and actual technology use (Venkatesh & Davis, 2000). Given its relevance, TAM provides a valuable framework for understanding the impact of adopting 5G technology, especially in low-income areas.

Perceived usefulness refers to the extent to which users in low-income areas believe that 5G technology will enhance their lives in various ways, such as providing faster and more reliable internet access for accessing educational resources, healthcare services, and employment opportunities remotely. Given the focus of individuals in low-income areas on meeting basic needs, it is crucial for 5G technology to be viewed as a necessity. Demonstrating the benefits of adopting 5G services over outdated alternatives can significantly enhance the perception of usefulness, which is vital for fostering adoption among individuals in low-income areas (Ajani et al., 2017).

Perceived ease of use also impacts users in low-income areas' attitude towards adopting 5G. Perceived ease of use, as described by Davis (1989), refers to an individual's perception of the level of effort required when utilizing a specific system. Users in low-income or underdeveloped areas might face challenges in navigating 5G services due to limited exposure and experience. To address this, offering localized support, creating awareness, and providing tailored training can contribute to improving their perceptions of ease of use (Manirumpf et al., 2020).

The combined factors of usefulness and ease of use play a crucial role in shaping users' attitudes toward adopting 5G technology. A positive attitude, in turn, leads to a higher intention to adopt

5G technology and actual usage. This conceptual framework, known as TAM (Technology Acceptance Model), provides a valuable perspective for studying the factors that influence the adoption of 5G technology in low-income areas. By understanding the perceptual barriers, interventions can be designed to promote wider acceptance, which is essential for realizing the benefits of 5G technology in rural communities.

After Davis (1989), several researchers have expanded the scope of TAM by incorporating additional factors such as computer anxiety, motivation, normative pressure, experience, digital literacy, and self-efficacy. This expansion aims to encompass crucial elements that interact harmoniously with Perceived Ease of Use and Perceived Usefulness (Al-alak & Alnawas, 2011). Building on this premise, we can hypothesize the following:

H1: Perceived Usefulness positively influences the intention to use 5G.

H2: Perceived Ease of Use positively influences the intention to use 5G.

2.3 Relevance of the TAM conceptual framework to the study:

The Technology Acceptance Model (TAM) (Davis, 1989) conceptual framework is highly applicable to the research topic of assessing the impact of adopting 5G technology in low-income areas, specifically focusing on the case of Chitungwiza. The objectives of the research proposal include assessing the current level of adoption of 5G, evaluating its socioeconomic impact, identifying challenges hindering adoption, and evaluating its importance, aligning well with the TAM framework.

TAM provides a theoretical lens to understand the factors influencing the acceptance and adoption of new technologies (Jay Shah,2022). In the context of the research, TAM can be utilized to examine the attitudes and perceptions of individuals in Chitungwiza towards the adoption of 5G technology. By assessing factors such as perceived usefulness, perceived ease

of use, and subjective norms, the TAM framework can help gauge the current level of adoption of 5G in the area.

Furthermore, TAM (Davis, 1989) enables an analysis of the socioeconomic impact of 5G adoption in low-income areas. By exploring the potential benefits and implications of 5G technology on various aspects of life in Chitungwiza, such as access to education, healthcare, employment, and economic opportunities (Martins et al., 2014), the research can provide valuable insights into the broader social and economic consequences of its adoption.

Identifying the challenges hindering the adoption of 5G is another objective of the research. By applying the TAM framework, potential barriers to adoption, such as infrastructure limitations, affordability issues, or lack of awareness, can be examined (GSMA Intelligence,2023). Understanding these challenges is crucial for developing strategies and interventions to address them effectively and promote the adoption of 5G technology in low-income areas like Chitungwiza.

Finally, the TAM framework allows for an evaluation of the importance of 5G adoption in Chitungwiza. By considering the potential advantages and benefits that 5G technology can bring to the community, including enhanced connectivity, improved access to services, and socioeconomic development, the research can assess the significance of 5G adoption in addressing the specific needs and aspirations of low-income areas (AJER, 2013).

2.4 5G Technology

5G, recognized for its exceptional speed compared to 4G, has emerged as an advanced wireless network service (Gao, 2021). This technology revolutionizes network capabilities and has gained widespread popularity across various sectors such as education, industry, agriculture, health, tourism, and the military. The emergence of 5G has brought about a significant revolution in network technologies, with its superior speed and ultra-low latency enabling

transformative applications like real-time remote surgeries, autonomous vehicles, and immersive virtual reality experiences (International Journal of Data and Network Science 5, 2021). In addition to its speed, 5G offers superior quality, affordability, and energy efficiency, making it an attractive choice for individuals, businesses, and governments worldwide. This technology enables seamless connectivity and empowers innovative solutions in areas like smart cities, Internet of Things (IoT), and advanced industrial automation (Alvin B. Culaba,2023).

2.5 Current state of 5G adoption

According to GSMA, the number of 5G connections worldwide exceeded 1.5 billion by the end of 2023, making it the fastest-growing mobile broadband technology to date. However, despite this progress, a new digital divide is emerging between high-income and low- and middle-income countries (LMICs). Additionally, even in countries with 5G, the technology has not fully realized its potential in terms of digital transformation, economic impact, and commercial value. This highlights the need for strategic interventions, enabling policies, and targeted investments to ensure the widespread evolution and adoption of 5G technology (Francisco Amaya & Kalvin Bahia, 2024).

The most recent income classifications by the World Bank stated that by the end of 2023, over 100 countries and territories had yet to launch their 5G networks, with more than 80% of them being low- and middle-income countries (LMICs) - (see figure 2). While there are ambitious goals set by policymakers and industry leaders for 5G deployment, the penetration of 5G remains low in many markets. According to GSMA Forecasts indicate that by 2030, 5G penetration in LMICs is expected to reach around 55%, while high-income countries are projected to reach 120%. Findings suggest that LMICs in Sub-Saharan Africa, Latin America, and Asia Pacific are predominantly the countries with lower performance on the 5G Index

(5GI). These regions exhibit lower scores mainly due to challenges in the network infrastructure, affordability of services, and the level of adoption of 5G technology.

5G market penetration globally, 2023

Legend: 0% | 1–20% | 20–40% | 40–60% | Over 60%
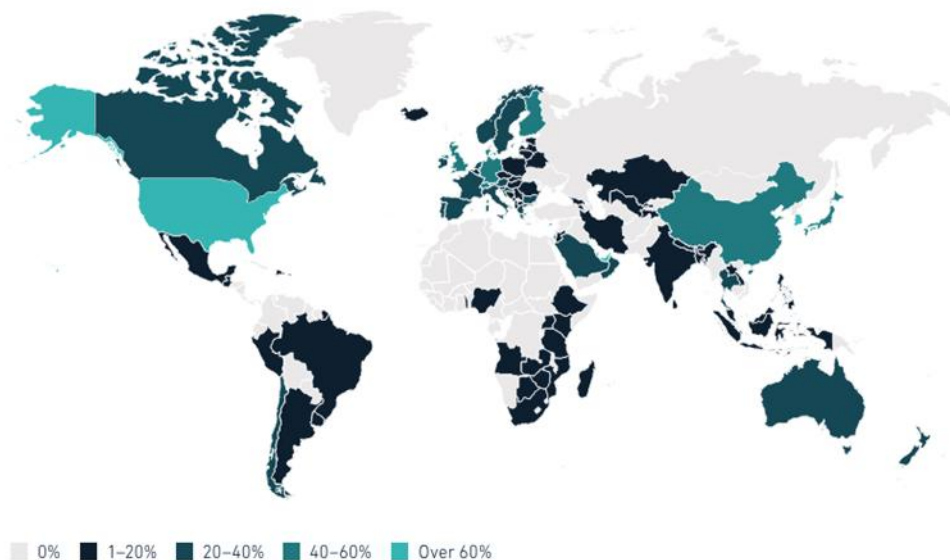
Figure 2.2: Source: GSMA Intelligence

In February 2022, Zimbabwe officially launched its 5G broadband network, with Econet Wireless being the pioneering company to introduce this innovative technology (PayNow Zimbabwe,2023). PayNow further states that, currently, Kenya, South Africa, and Zimbabwe have active 5G networks. However, in terms of infrastructure, South Africa and Kenya have a more extensive network compared to Zimbabwe, where 5G towers are only available in limited areas.

Based on data from December 2022 provided by the telecoms industry regulator, POTRAZ, Econet currently operates a total of 22 5G base stations in Zimbabwe. with Chitungwiza being one of the locations where its available (TechZim,2023). These remarkably low numbers highlight the need for attention and investment, particularly in low-income areas like Chitungwiza, to ensure that they can fully benefit from the promising advantages that 5G

technology offers (GSMA, 2022). It is vital to address this issue and expand the availability of 5G infrastructure to enable equitable access and enable these areas to harness the transformative potential of 5G.

2.6 Socio-economic impact of 5G adoption

Low band 5G technology is anticipated to contribute approximately $130 billion in economic value by 2030 (GSMA, 2023). This impact will be driven by various factors, with half of it expected to stem from massive IoT (mIoT) applications. The wide area coverage provided by low-band spectrum makes it highly suitable for meeting the requirements of IoT use cases in sectors such as manufacturing, transport, smart cities, and agriculture, driving digital transformation (GSMA, 2023).

In addition to the economic benefits, low band 5G applications also offer social and environmental advantages. They contribute to poverty reduction, improved well-being, and increased access to essential services like healthcare, education, and financial services (World Economic Forum, 2020). Furthermore, the utilization of low-band spectrum helps reduce greenhouse gas emissions, making it environmentally beneficial (GSMA, 2023). These benefits are particularly crucial for rural populations that often face challenges in accessing services and experience lower network performance compared to urban areas. Low-band spectrum plays a vital role in providing coverage in rural and remote areas, fulfilling the objective of widespread connectivity. In low- and middle-income countries, where substantial rural populations exist, the availability of low-band frequencies is especially important (Kalvin Bahia and Francisco Ariza, 2023).

By enabling enhanced mobile broadband (eMBB) and fixed wireless access (FWA), low-band spectrum also helps deliver high-speed broadband connectivity to areas underserved by fixed

networks. This expansion of connectivity contributes to the overall economic benefits of low band 5G technology (GSMA, 2023).

Moreover, the advantages of 5G adoption can be broadly classified into three categories: economic, social, and environmental. Economically, 5G drives business productivity, potential GDP growth, and cost reduction while facilitating the creation of new business models, enterprises, products, and services. Socially, it enhances public safety, health outcomes, and overall quality of life, including reducing loneliness and improving life satisfaction. Environmentally, 5G brings efficiency gains in transportation, energy consumption, and natural resource utilization, leading to reduced traffic congestion and environmental impacts (Cambridge Econometrics, 2021).

In summary, low band 5G technology offers significant economic value, especially driven by mIoT applications, while also providing social and environmental benefits. It bridges the digital divide between rural and urban areas, ensuring access to digital technologies for all. The utilization of low-band spectrum plays a crucial role in achieving widespread connectivity, driving digital transformation, and fostering sustainable development.

2.7 Significant challenges and barriers

The advantageous aspects of 5G networks come with inherent costs (Arabi, S. and Rab, R., 2021). The adoption of 5G technology faces several barriers that hinder its implementation. According to Kevin Loughran, Vice President of Jabil, the adoption of 5G has been perceived as a competition, where the first adopters are considered the "winners" in terms of accessing lucrative business opportunities and being the first to offer the technology to customers. However, Loughran notes that a range of challenges and issues related to 5G have led to a different deployment scenario than initially expected (Kevin Loughran, 2024). According to a research paper by Rahman A et al (2021), the deployment of 5G technology in various Least

Developed Countries (LDCs) is experiencing significant technological challenges, leading to considerably longer deployment timelines than originally anticipated. Challenges include inadequate infrastructure, limited network coverage, high deployment costs, lack of reliable electricity and internet access, and affordability issues for devices and services (IJACSA, International Journal of Advanced Computer Science and Applications, 2021).

Implementing 5G technology in Least Developed Countries (LDCs) faces significant challenges (Rab R. et al (2021). One major challenge is spectrum allocation, as 5G requires a significant amount of spectrum in different frequency bands. However, existing spectrum usage in LDCs may need to be reconfigured or repurposed to accommodate 5G, which can involve legal issues and negotiations with government organizations (Rahman, A,2021). Additionally, spectrum costs in LDCs are often higher compared to developed countries, which can impact on the affordability and feasibility of 5G deployment in these regions.

Another challenge is the lack of infrastructure. Access to infrastructure, such as towers and fiber connectivity, is crucial for 5G coverage and capacity. Building the necessary infrastructure can be costly and may not be economically viable in low-income areas (Rahman, A.2021). These challenges collectively pose significant obstacles to the adoption of 5G technology in LDCs, requiring careful planning, policy interventions, and investment to overcome them. These barriers need to be addressed to facilitate the widespread adoption of 5G technology (ITU, 2021).

2.8 Potential benefits and opportunities

The GSMA stated that the introduction of 5G technology has brought about faster broadband speeds and reduced latencies compared to previous generations of mobile technology. With its ability to significantly enhance consumer connectivity and enable advanced applications for

businesses, 5G has the potential to become a critical component of intelligent connectivity. It has the capacity to drive economic growth, revolutionize businesses, and facilitate the delivery of innovative services (GSMA,2024).

According to Gao (2021), the adoption of 5G technology has the potential to uplift low-income areas by bridging the digital divide, improving educational opportunities, fostering economic development, enhancing healthcare access, and delivering essential services to underserved communities. The benefits of 5G adoption have been extensively studied, although the evidence continues to evolve as new use cases emerge.

Table 1 presented below showcases a selection of key 5G use cases and applications, illustrating their considerable potential in terms of benefits and opportunities.

5G use cases: description and associated applications

Use case	Description	Business need	Vertical
Fixed wireless access	5G allows network operators to deliver ultra-high-speed broadband to suburban and lower-density areas, supporting home and business applications where fibre is prohibitively expensive to lay and maintain. This will allow more communities to be connected to the internet via an ultra-fast, reliable connection, bringing applications such as telemedicine and remote education to more people. 5G FWA can therefore provide the benefits of fibre-like connectivity to rural communities.	• Alternative to fibre connection • Provides high-speed fixed connectivity in areas where it is not currently accessible	Education, healthcare, public administration, utilities
Enhanced mobile broadband	5G provides the capacity to handle growing data traffic and grants operators an opportunity to develop new and improved services to consumers. This will enable a new range of applications, including reliable mobile internet services for mass gatherings and sports events (where current mobile technology is often stretched to its limits) and AR/VR applications that improve the customer experience e.g. in retail, by supporting or replacing traditional showrooms.	• Immersive experience (AR/VR) • Allows 4K/8K streaming on capable devices • Increased service capacity	Retail, public administration, arts and events
Ultra-reliable low-latency communication	Low latency and high reliability will enable new applications in manufacturing, logistics, health and transportation. These include autonomous driving, connected robotic applications, AR/VR, drones and remote surgical/medical operations.	• Autonomous driving • Safety-critical applications • Remote manufacturing • Remote healthcare	Manufacturing, utilities, oil and gas, transport, healthcare
Massive IoT	5G will be able to facilitate a large network of IoT devices, supporting the creation of smart cities, smart infrastructure and, in the utility sector, smart grids capable of self-identifying issues on networks. In the agricultural sector, for example, farmers will benefit from the potential of a vast collection of sensors located in fields that are able to identify with pinpoint precision which areas need water, have disease or require pest management.	• Remote control of crop conditions • Advanced manufacturing • Smart cities	Agriculture, utilities, manufacturing, public administration

Table 2.1: Source: GSMA Intelligence

2.9 Theoretical Review

2.9.1 Diffusion of Innovation Theory

The diffusion of innovation theory examines how innovations are adopted by communities (Rogers, 2003). It involves social groups such as Innovators, Early Adopters, Early Majority,

Late Majority, and Laggards (See figure 3 below). Five product characteristics influence adoption: relative advantage, compatibility, trialability, observability, and complexity (IMT,2020). Communication channels play a vital role in spreading information about innovations, including mass media and interpersonal communication (Rogers, 1962). Time is a key factor, with individuals progressing through stages of information receipt, persuasion, decision-making, implementation, and confirmation (Markus Olofsgard et al., 2022). The social system and change agents also impact adoption rates. Factors influencing adoption of 5G in low-income areas can be explored within this framework.

Linking the diffusion of innovation theory to factors influencing users in low-income areas adopting 5G, several aspects can be considered. Relative advantage is crucial, as low-income individuals need to perceive the benefits of 5G in terms of affordability, improved connectivity, and access to digital services (Rogers, 2006). Compatibility is important, ensuring that 5G infrastructure is available and compatible with existing devices and services in these areas. Trialability becomes significant, allowing individuals to experience the advantages of 5G through affordable trial packages or community initiatives. Observability plays a role, as visible success stories and tangible outcomes of 5G adoption in similar socioeconomic conditions can inspire confidence and encourage adoption. Complexity needs to be addressed, ensuring that 5G technology is user-friendly, easily understandable, and not overly complex for individuals with limited technical knowledge.

Communication channels also play a critical role in influencing adoption in low-income areas (Rogers, 2003). Mass media campaigns can raise awareness and educate individuals about the benefits and possibilities of 5G. However, interpersonal communication and community-based initiatives become particularly important, as trusted individuals within the community can serve as opinion leaders and change agents (Rogers, 1962). Their positive experiences with 5G can generate word-of-mouth recommendations and address concerns or misconceptions.

Considering the social system, it is essential to recognize the unique challenges and constraints faced by low-income communities. Factors such as infrastructure limitations, affordability, and digital literacy levels need to be addressed to ensure equitable access to 5G (Sahat Hutajulu et al, 2021). Collaborative efforts between government, private sector, and community organizations can help bridge the digital divide and provide resources, subsidies, and training programs to facilitate adoption.

By considering the product characteristics, communication channels, time, social systems, and change agents, strategies can be developed to address affordability, compatibility, trialability, observability, and complexity barriers to increase 5G adoption and bridge the digital divide in low-income communities((IMT,2020).
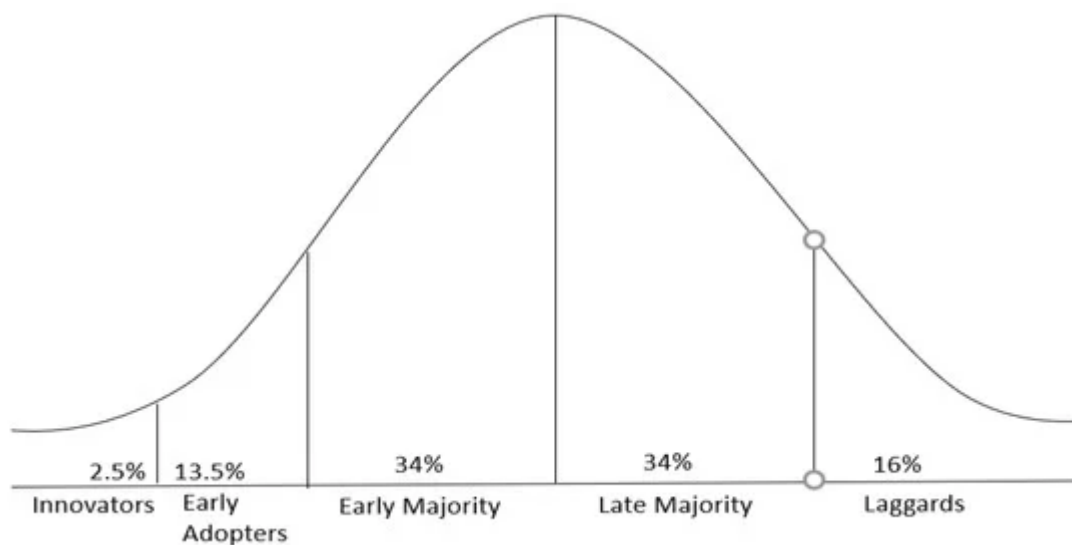
Figure 2.3: Diffusion of Innovation (Source : Sahat Hutajulu et al, 2021)

2.9.2 Digital Divide Theory

Digital Divide Theory, as proposed by DiMaggio and Hargittai (2001), suggests that disparities in access to and use of digital technologies exist among various social groups. This theory highlights the influence of socioeconomic factors, such as income, education, and

infrastructure, on the digital divide. When applying this theory to the adoption of 5G in low-income areas like Chitungwiza, several implications arise.

Firstly, the theory suggests that low-income areas may face challenges in accessing 5G due to limited financial resources (DiMaggio et al., 2001). Affordability becomes a critical factor in adoption, as the cost of 5G devices, data plans, and compatible infrastructure may pose barriers for individuals with lower incomes. Additionally, educational disparities within low-income areas could affect the digital literacy levels required to navigate and fully utilize 5G technology (Patricia C. Heyn et al., 2018). Limited access to quality education and digital skills training may hinder individuals' ability to take advantage of the benefits offered by 5G (van Deursen et al., 2011).

Infrastructure plays a crucial role in the adoption of 5G, and low-income areas may have inadequate or underdeveloped infrastructure compared to more affluent regions (Riva et al.,2014). Insufficient network coverage and connectivity can limit the availability of 5G services, making it challenging for individuals in low-income areas to access and utilize the technology effectively (Walster & Walster, 1975). Addressing these infrastructure gaps becomes essential to bridge the digital divide and ensure equitable access to 5G in such areas.

Furthermore, the theory suggests that the digital divide is not solely about access but also about utilization (DiMaggio et al., 2001). Even if 5G technology is accessible in low-income areas, individuals may not fully utilize its capabilities due to a lack of awareness, digital skills, or perceived relevance. Efforts should be made to raise awareness about the benefits and possibilities of 5G, provide digital literacy training programs, and showcase relevant applications that can improve the quality of life and economic opportunities in low-income communities like Chitungwiza.

Applying Digital Divide Theory (DiMaggio et al., 2001) to the adoption of 5G in low-income areas highlights the influence of socioeconomic factors on accessibility and utilization. Affordability, educational disparities, infrastructure limitations, and digital skills gaps can all affect the adoption of 5G technology in these areas (Sixsmith & Gutman, 2013). To bridge the digital divide and promote equitable access, strategies should focus on addressing these factors through initiatives that improve affordability, provide educational resources, enhance infrastructure, and increase digital literacy in low-income communities like Chitungwiza.

2.9.3 Social Capital Theory

Social Capital Theory, as proposed by Putnam (2000), highlights the significance of social networks, relationships, and community connections in fostering collective action and accessing resources. This theory suggests that strong social networks and community cohesion can play a crucial role in promoting technology adoption and bridging the digital divide (Putnam,2000). When examining the application of Social Capital Theory to the adoption of 5G technology in low-income regions such as Chitungwiza, various factors become significant.

To begin with, social networks and community organizations play a crucial role in fostering awareness and trust in 5G technology (Putnam, 1933). In low-income areas, where access to formal sources of information may be limited, informal networks and local leaders can play a crucial role in disseminating knowledge about the benefits and opportunities associated with 5G. Community organizations and trusted individuals can act as change agents, facilitating discussions, organizing workshops or demonstrations, and addressing concerns or misconceptions related to 5G. Leveraging existing social networks and community support systems can help build confidence and encourage adoption within low-income communities.

Additionally, social capital can enhance the capacity of low-income areas to collectively address infrastructure challenges (Int. J. Environ. Res. Public Health 2021). Through

collaborative efforts, community members can advocate for improved network coverage and connectivity in their neighborhoods. Social networks and community organizations can provide a platform for collective action, enabling residents to voice their needs and work with relevant stakeholders, such as telecommunication companies, local governments, or nonprofit organizations, to bridge the infrastructure gaps (Kathryn M. Barker et al,2018).

Moreover, social capital can foster knowledge sharing and digital inclusion initiatives within low-income areas. By promoting community-based digital literacy programs, residents can acquire the necessary skills to effectively utilize 5G technology (GSMA, 2022). Peer learning, mentorship, and communal access points can be facilitated through social networks, allowing individuals to support each other in navigating and making the most of 5G's capabilities. This collective learning approach can empower individuals and increase the overall digital readiness of the community.

Applying Social Capital Theory to the adoption of 5G in low-income areas highlights the importance of social networks, community organizations, and collective action in facilitating adoption and bridging the digital divide (Putnam 2000). Leveraging social capital can promote awareness, trust, and knowledge sharing around 5G technology in low-income communities. By involving local leaders, community organizations, and utilizing existing social networks, strategies can be developed to enhance adoption rates, address infrastructure challenges, and promote digital inclusion in areas like Chitungwiza.

2.10 Gap in knowledge identified.

In the context of the impact of adopting 5G technology in low-income areas, such as Chitungwiza, there exists a notable research gap that warrants investigation. Despite the growing interest in the deployment and potential benefits of 5G technology, there is limited

empirical research specifically focusing on its adoption and socioeconomic impact in low-income areas. Existing studies predominantly concentrate on urban or developed regions, neglecting the unique challenges and opportunities faced by low-income communities. Consequently, there is a lack of comprehensive understanding regarding the current level of 5G adoption, the socioeconomic implications, and the barriers hindering its uptake in such areas. By addressing this research gap, the proposed study seeks to contribute to the literature by providing valuable insights into the specific dynamics and consequences of 5G adoption in low-income areas like Chitungwiza. This research will fill a critical void in knowledge and facilitate evidence-based decision-making and policy development to foster equitable access and meaningful integration of 5G technology in underserved communities.

2.11 Summary

The literature review chapter provides a comprehensive analysis of existing research relevant to the impact of adopting 5G technology in low-income areas, with a focus on Chitungwiza. It begins by introducing the Technology Acceptance Model (TAM) as the conceptual framework. The chapter reviews a wide range of literature, synthesizing key findings, theories, and methodologies used in previous studies. The research gap is identified, highlighting the lack of empirical research specifically focusing on 5G adoption in low-income areas. The chapter concludes by emphasizing the need to address this gap and the potential contributions of the proposed study using the TAM framework. The study aims to provide insights into 5G adoption levels, socioeconomic impact, barriers, and overall importance in underserved communities.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the research methodology utilized in the study, detailing the approach adopted, the selection of research participants, the data collection procedures, and the instruments employed. Additionally, it examines the methods applied for data collection, the processes of data presentation and analysis, and addresses considerations of validity, reliability, and ethical concerns.

3.2 Research Design

According to Macmillan (1989), research design pertains to the organization and framework of a study that is employed to gather information and address research problems. Furthermore, it is defined as the chosen approach or methodology employed by the researcher to carry out the study (Saunders, Lewis, and Thornhill, 2011). The research method utilized in this study was a mixed methods approach. This approach combines both quantitative and qualitative methods to provide a comprehensive understanding of the research topic (Cooper and Schindler, 2018). Quantitative methods, such as questionnaires, enabled the collection of numerical data for statistical analysis, offering insights into the extent and magnitude of 5G adoption. On the other hand, qualitative methods, such as interviews, allowed for an in-depth exploration of the barriers, benefits, and socio-economic impacts of 5G adoption, capturing the perspectives, experiences, and narratives of the participants. By employing a mixed methods approach, the study addressed the research objectives more comprehensively, providing a richer and more nuanced understanding of the complex factors influencing adoption of 5G in low-income areas like Chitungwiza.

3.3 Population and Sampling

3.3.1 Target Population

In their work, Hair, Bush, and Ortinau (2016) state that a defined target population encompasses a set of items, such as individuals or objects, that are selected for examination in alignment with the objectives of the study project. Similarly, Wallen and Fraenkel (2010) define a target population as a group of individuals who possess common characteristics or traits from whom data can be collected and analysed.

In line with these definitions, the research focused on individuals residing in Chitungwiza. The total target population consisted of 100 individuals, selected to ensure relevance to the research objectives and focus on 5G adoption in low-income areas.

3.3.2 Sampling

According to Cohen (1994), a sample serves as a representative subset of the overall population being studied. For this research, the population was classified into three distinct groups by the researcher: residents, small business owners, and students from Chitungwiza.

3.3.3 Sample size

The researcher utilized the Yamane's sample size formula (Taro Yamane, 1967) to determine the sample size:

$n = N / (1 + Ne \char`\^ 2)$

Where:

n = Sample size

N = Population size (100)

e = Desired margin of error or level of precision (as a decimal) (0.5)

Calculations:

To calculate the sample size for the study, we will use a 5% sampling error. The computation will be carried out as follows:

n = 100 / (1 + 100(0.05) ^2)

n=80

Therefore, the sample size for the population of 100 with a sampling error of 5% is 80.

Target Group	Frequency %	Sample size
Residents	25%	20
Small business owners	25%	20
Students	50%	40
Total	100%	80

Table 3.1: Sample size / Source: Primary data, 2024

The researcher decided to include residents, small business owners, and students from Chitungwiza in the study on the impact of 5G adoption to capture a comprehensive range of perspectives and insights. By involving residents, the study could examine the overall societal impact of 5G adoption, including factors such as improved connectivity, access to information, and changes in daily life. Small business owners were important to include as they provided insights into the economic implications, challenges, and benefits of 5G adoption for local businesses. Their experiences shed light on the opportunities for growth, changes in operations, and potential barriers they face. Lastly, involving students allowed for an exploration of the impact of 5G adoption on the younger generation, who are often early adopters of technology and can provide insights into the educational and social implications. By incorporating these

diverse groups, the researcher obtained a more comprehensive understanding of the multi-faceted impact of 5G adoption on different aspects of society.

3.4 Sampling procedure

A sampling procedure refers to the method or process used to select a representative subset, known as a sample, from a larger population (Creswell, J. (2012). It involves defining the target population, determining the sample size, and selecting individuals or elements from the population to be included in the study. The researcher used a combination of stratified sampling and convenience sampling.

Stratified sampling involves dividing the population into distinct groups or strata based on relevant characteristics (Micah B. Masuku et al., 2013). In this case, the researcher opted to divide the population of Chitungwiza into three strata: residents, students, and small business owners. By stratifying the population in this way, the researcher aimed to ensure that each group is represented in the sample proportionally to their presence in the population. This approach allowed for a more comprehensive understanding of the impact of 5G adoption in low-income areas by capturing the unique perspectives and experiences of residents, students, and small business owners in Chitungwiza.

 Convenience sampling, a type of non-probability sampling, was employed within each stratum. Convenience sampling involves selecting individuals who are readily available and accessible to the researcher (Browner W.S et al., 2001). This approach was suitable in this case due to the limited population size of 100 in Chitungwiza. It allowed the researcher to conveniently gather data from residents, students, and small business owners, considering their unique perspectives on the impact of 5G adoption in low-income areas. However, it's important to note that convenience sampling may introduce some bias and limit generalizability, as

individuals who are more easily accessible may not represent the entire population accurately (Dell R et al., 2002).

3.5 Research Instruments

A research instrument is a tool or technique, such as a questionnaire, survey, interview guide, or observation protocol, used to collect data and gather information for a research study (Rajesh E et al., 2010). The researcher used a combination of structured questionnaires for quantitative data collection, allowing for efficient data analysis, and semi-structured interviews for qualitative data collection, facilitating in-depth exploration of participants' experiences and perspectives.

3.5.1 Structured Questionnaire

A structured questionnaire is a research instrument consisting of a predetermined set of questions with fixed response options. It follows a standardized format, where participants are asked the same questions in the same order (Bernard, H. Russell, 2000). This approach allows for efficient data collection and facilitates quantitative analysis, as the closed-ended questions generate numerical data.

For this study, structured questionnaires were administered to a sample of 80 participants, allowing the researcher to gather data from a relatively large group within a limited timeframe. Participants completed the questionnaires at their convenience, enabling the researcher to efficiently gather substantial data.

The closed-ended nature of the questions and fixed response options facilitate numerical coding and statistical analysis (Sage,2009). This quantitative data analysis helped identify patterns, trends, and relationships within the data, providing valuable insights into the impact of 5G adoption in low-income areas.

Furthermore, structured questionnaires offer comparability with previous studies due to their standardized questions` and response options (Alta Mira Press, 2002.). This facilitated comparisons and contributed to cumulative knowledge. However, they may not capture detailed or nuanced responses like open-ended qualitative approaches (Sage,2009). Fixed response options could limit participants' expression. The researcher carefully designed the questionnaire to cover relevant aspects while allowing meaningful data analysis and interpretation. Ultimately, the structured questionnaire provided reliable and comparable data that supported the study's quantitative analysis of 5G adoption in Chitungwiza

3.5.1.1 Structured Questionnaire Sample:

We kindly request your cooperation in circling your chosen option for each question. Your input is valuable for our research, and we appreciate your thoughtful responses.

Demographic Information

1. **What is your gender?**

    a. Male

    b. Female

2. **What is your age group?**

    a. 20-30 years

    b. 31-40 years

    c. 41-50 years

    d. 50 years and above

3. **What is your marital status?**

    a. Single

    b. Married

    c. Widowed

4. **What is the highest level of education you have attained?**

    a. Diploma

       b.   Undergraduate degree

       c.   Master's degree

       d.   PhD

5. **What is your position at work?**

       a.   Student/Intern

       b.   Middle management

       c.   Top management

       d.   Business owner

Awareness and Knowledge of 5G Technology

6. **How familiar are you with 5G technology?**

       a.   Very familiar

       b.   Somewhat familiar

       c.   Neutral

       d.   Not very familiar

       e.   Not familiar at all

7. **Where have you heard about 5G technology?**

       a.   Social media

       b.   News outlets

       c.   Friends/family

       d.   Work/school

       e.   Never heard about it

Accessibility and Infrastructure Challenges

8. **Do you currently have access to stable internet connectivity?**

       a.   Yes

       b.   No

9. **Do you believe your area has the necessary infrastructure for 5G technology?**

       a.   Yes

       b.   No

c. Not sure

10. **How often do you experience power outages in your area?**

   a. Very often

   b. Sometimes

   c. Rarely

   d. Never

Cost and Affordability

11. **Do you think 5G-compatible devices and services are affordable for low-income households?**

   a. Yes

   b. No

   c. Not sure

12. **Would the cost of 5G services be a barrier for you?**

   a. Yes

   b. No

   c. Not sure

Socio-economic impact of 5G technology adoption:

13. **Do you believe 5G technology will improve internet connectivity and speed?**

   a. Strongly agree

   b. Agree

   c. Neutral

   d. Disagree

   e. Strongly disagree

14. **Do you think 5G will create new economic opportunities and jobs?**

   a. Strongly agree

   b. Agree

   c. Neutral

   d. Disagree

   e. Strongly disagree

15. **Do you believe 5G will enhance access to educational resources and access to information?**

   a. Strongly agree

   b. Agree

   c. Neutral

   d. Disagree

   e. Strongly disagree

16. **Do you think 5G will improve healthcare services and access to telemedicine?**

   a. Strongly agree

   b. Agree

   c. Neutral

   d. Disagree

   e. Strongly disagree

17. **The cost of 5G services and devices is a barrier for low-income households**

   a. Strongly agree

   b. Agree

   c. Neutral

   d. Disagree

   e. Strongly disagree

18. **The community is ready and willing to adopt 5g technology**

   a. Strongly agree

   b. Agree

   c. Neutral

   d. Disagree

   e. Strongly disagree

Community Readiness and Willingness to Adopt

19. **Is your community ready to adopt 5G technology?**

   a. Yes

   b. No

c. Not sure

20. **Would you be willing to adopt 5G technology if it were available?**

    a. Yes

    b. No

    c. Not sure

21. **Do you think your community needs more training and support to adopt 5G?**

    a. Yes

    b. No

    c. Not sure

Challenges and Barriers

22. **What do you think is the biggest barrier to 5G adoption in your area?**

    a. High costs of devices and services

    b. Lack of infrastructure

    c. Limited network coverage

    d. Lack of awareness/knowledge

    e. Resistance to change

23. **Do you believe there is enough awareness about 5G technology in your community?**

    a. Yes

    b. No

    c. Not sure

24. **Are you concerned about potential health risks associated with 5G technology?**

    a. Yes

    b. No

    c. Not sure

Potential Opportunities and Benefits

25. **5G technology will significantly improve internet connectivity:**

    a. Strongly agree

    b. Agree

    c.   Neutral

    d.   Disagree

    e.   Strongly disagree

26. **5G will create new economic opportunities and jobs?**

    a.   Strongly agree

    b.   Agree

    c.   Neutral

    d.   Disagree

    e.   Strongly disagree

27. **Do you think 5G will enhance access to education and online learning?**

    a.   Strongly agree

    b.   Agree

    c.   Neutral

    d.   Disagree

    e.   Strongly disagree

28. **Do you think 5G adoption will improve healthcare services through telemedicine?**

    a.   Strongly agree

    b.   Agree

    c.   Neutral

    d.   Disagree

    e.   Strongly disagree

29. **Do you think 5G will support the development of smart cities and infrastructure?**

    a.   Strongly agree

    b.   Agree

    c.   Neutral

    d.   Disagree

    e.   Strongly disagree

30. **Do you believe 5G technology will enhance the overall quality of life?**

a. Strongly agree

b. Agree

c. Neutral

d. Disagree

e. Strongly disagree

3.5.2 Semi-Structured Interview

A semi-structured interview is a research method that involves a combination of predetermined questions and the flexibility to explore additional topics based on participants' responses (Richard A. Krueger, 1998). While the researcher had a predefined set of questions and topics to cover, they also delved deeper into specific areas of interest based on the participants' responses. This flexibility enabled a more in-depth understanding of the participants' experiences, perspectives, and insights related to the impact of 5G adoption.

Furthermore, semi-structured interviews allowed participants to express themselves freely, providing rich and detailed information that closed-ended questions may miss. They capture subjective interpretations, emotions, and motivations, revealing underlying factors shaping participants' experiences (Richard A. Krueger, 1998). The flexibility of the semi-structured interviews enabled the discovery of unexpected insights as interviewers adapt based on participant responses.

Data analysis was time-consuming due to the qualitative nature of the data collected. Nevertheless, the semi-structured interviews offered valuable insights into the impact of 5G adoption in low-income areas, enhancing understanding of participants' experiences and contextual factors involved.

3.5.2.1 Semi-Structured interview sample

Objective 1: To assess the current level of 5G technology adoption in low-income areas

1. Can you describe what you know about 5G technology? Where did you learn about it?

2. What challenges do you face with internet connectivity in your area? Do you think 5G could address these challenges?

3. How do you feel about the cost of 5G-compatible devices and services? Do you think they are affordable for people in your community?

4. In what ways do you think 5G technology could improve daily life in your community?

Objective 2: To investigate the socio-economic impact of 5G technology adoption

5. Do you believe 5G technology could create new job opportunities or boost the local economy? If yes, how?

6. How do you think 5G could improve access to education or online learning resources in your community?

7. Do you think 5G could enhance healthcare services, such as telemedicine, in your area? Why or why not?

8. How ready do you think your community is to adopt 5G technology? What support or training might be needed?

Objective 3: To identify and analyse the challenges and barriers hindering the adoption of 5G technology

9. What infrastructure limitations (e.g., network towers, electricity) do you think could hinder 5G adoption in your area?

10. Do you think people in your community have enough knowledge about 5G to adopt it? What could be done to improve awareness?

11. How do you think the cost of 5G devices and services could affect its adoption in low-income areas?

12. Are there any concerns or fears in your community about adopting 5G technology? If yes, what are they.

3.6 Data Collection Procedures

According to Pritha Bhandari (2020), data collection is a systematic procedure through which researchers gather observations or measurements to obtain firsthand knowledge and original insights related to their research problem.

The data collection procedures involved a combination of structured questionnaires, semi-structured interviews, and the utilization of both primary and secondary data sources. A structured questionnaire was designed to gather quantitative data from participants, allowing for the systematic collection of information on awareness, perceptions, access, and experiences related to 5G adoption. Participants were requested to circle their chosen options for each question. Additionally, semi-structured interviews were conducted to obtain qualitative insights and in-depth perspectives on the topic. These interviews provided an opportunity for participants to share their thoughts, experiences, and concerns related to 5G adoption.

Alongside primary data collection, secondary data sources such as existing literature, reports, and studies were reviewed and analyzed to provide a broader context for the research findings. By employing a combination of structured questionnaires, semi-structured interviews, and the integration of primary and secondary data, the researchers aimed to gather comprehensive and robust information to examine the impact of 5G adoption in low-income areas in Chitungwiza.

Additionally, the researcher crafted a cover letter that outlined the objectives of the study. This letter served the purpose of seeking permission from potential participants and gauging their availability for interviews. By clearly communicating the study's goals and seeking consent, the researcher aimed to establish a rapport with participants and obtain their cooperation in contributing to the research through interviews.

3.7 Data Analysis and Presentation Procedures

The data analysis and presentation procedures involved a rigorous and systematic approach. After the data collection phase, the collected data, including both quantitative responses from

structured questionnaires and qualitative insights from semi-structured interviews, were organized and coded. The chosen data analysis method for this research was a mixed-methods approach, combining both quantitative and qualitative analysis techniques.

For the quantitative data, the researcher employed statistical analysis to uncover patterns, frequencies, and correlations. Descriptive statistics, such as means and medians, were used to summarize the data. For example, the researcher calculated the average level of awareness regarding 5G adoption in low-income areas.

Regarding the qualitative data, a thematic analysis approach was employed. This process involves identifying recurring themes, patterns, and emerging concepts from the interview transcripts (UTA Libraries 2016). For example, the researcher analyzed the interview data to identify themes such as barriers to 5G adoption in low-income areas, community perceptions of 5G technology, and the impact of 5G on access to education and healthcare. Through this thematic analysis, a deeper understanding of participants' experiences, perspectives, and challenges related to 5G adoption was gained. While statistical analysis provided measurable insights, thematic analysis offered depth by capturing participants' nuanced perspectives.

To present the information, effective tools and graphs were utilized. For the quantitative data, charts, tables, and graphs such as bar graphs and pie charts were used to visually represent the numerical findings. For instance, pie charts were created to illustrate the distribution of the participants' demographics such as gender, age group and level of education. Additionally, tables were utilized to summarize and present the quantitative statistics extracted from the data collected.

3.8 Validity and Reliability

To ensure data validity and reliability, the researcher employed established methods and tools for data collection, including structured questionnaires and semi-structured interviews. A pilot

study was conducted to refine instruments and align them with existing literature. A pilot study involves conducting a small-scale version of the research, administering the questionnaires and conducting interviews with a subset of participants. This allows the researcher to evaluate the clarity, comprehensibility, and relevance of the questions and the overall effectiveness of the data collection approach (Arain, Campbell, Cooper, & Lancaster, 2010). Feedback from pilot participants was gathered to identify any potential issues or areas for improvement. Rigorous data analysis techniques were used, such as statistical analysis for quantitative data and thematic analysis with inter-coder reliability checks for qualitative data. Careful documentation and external validation through peer feedback were also implemented to enhance transparency and minimize bias, maximizing the credibility and trustworthiness of the research findings.

Furthermore, the researcher prioritized creating a comfortable and non-threatening environment for respondents, enabling them to respond openly and honestly. Additionally, efforts were made to clarify and simplify questionnaire items, allowing participants sufficient time to provide thoughtful responses. Timing was carefully considered to approach participants when they were not rushed or preoccupied. Key informants, who had firsthand experience with the research problem, were specifically targeted for interviews, ensuring the inclusion of relevant and insightful perspectives. These strategies contributed to increased validity, dependability, and the overall credibility of the research findings.

3.9 Ethical Considerations

Ethics, as defined by Akaranga and Makau (2016), encompasses the conduct of individuals and guides standards of behavior and relationships. Within research, research ethics is a branch of applied ethics that establishes rules and guidelines for researchers' conduct (Akaranga and Makau, 2016). Research ethics is crucial in our daily research endeavors, emphasizing the

protection of subjects' dignity and reputation, as well as the accurate dissemination of researched information (Fouka and Mantzorou, 2011).

This research adhered to strict research ethics guidelines, ensuring the protection of participants' rights and welfare. Ethical considerations will be considered during both the pilot study and the actual case study, ensuring the protection and well-being of the participants. Confidentiality and informed consent were upheld throughout the study. The researcher placed great importance on handling the data with the highest level of care, maintaining participant anonymity and ensuring the utmost secrecy.

Furthermore, before participating, individuals were fully informed about the purpose of the study and how the results would be shared. They were provided with detailed explanations on how their confidentiality would be safeguarded. Importantly, participants were given the opportunity to decline participation if they so wished, respecting their autonomy and right to choose. By prioritizing confidentiality, informed consent, and participant autonomy, this study upheld ethical considerations and ensured the welfare of those involved.

3.10 Chapter Summary

In this chapter, the research design, target population, sample size, and sampling methodologies are outlined. The research tools used, along with the validity and reliability of the instruments, are described. Additionally, the chapter addresses how the data will be presented and analysed. Ethical issues related to the research are also discussed. Overall, this chapter provides a comprehensive overview of the research, covering key aspects such as design, population, sampling, data analysis, and ethical considerations.

CHAPTER 4: DATA ANALYSIS AND PRESENTATION OF FINDINGS

4.1 Introduction

The chapter presents the research findings following the research objectives that have been observed in the data collected from questionnaires. At the beginning, the chapter will present the response rate from questionnaires to depict the number of participants that would have successfully contributed to the study. This is followed by the demographic information of participants to establish the structure and attributes of the respondents as it is crucial before any analysis can be done. The chapter closes with a presentation of the research findings guided by themes of the objectives that were alluded to in chapter 1 and these are; To assess the current level of 5G technology adoption in low-income areas; To investigate the socio-economic impact of 5G technology adoption; To identify and analyse the challenges and barriers hindering the adoption of 5G technology; and To explore the potential opportunities and benefits of 5G technology adoption.

4.2 Response Rate

The research study collected information from participants making use of questionnaires and interviews. Table 4.1 below shows the questionnaire response rate from the participants that were involved in the study:

Table 4.1: Questionnaire Response Rate

Participants	Target	Successful	Overall Response
Residents	10	8	80%
Local Business Owners	10	7	50%
Students	40	30	75%

Overall response rate	60	45	75%

The participants that residents, local business owners and students, there was a notable 75% overall response rate. The following Table 4.2 below shows the response rate from interviews that were conducted. High response rates further improved the study's credibility and confirmed the results.

Table 4.2: Interviews Response Rate

Participants	Target	Successful	Overall Response
Residents	10	8	80%
Local business owners	10	6	60%
Overall response rate	20	14	70

Table 4.2 above shows an overall 70% response rate from interviews that were held. This suggests a highly effective performance and a strong alignment with the objectives set for these groups. This response rate is favourable or acceptable, according to Saunders (2016), who wrote that "A response rate of 41% to 100% is appropriate for making conclusive conclusions in research."

4.3 Demographic information of Participants

4.3.1 Gender

Making up a total of 80 participants, the research study collected information pertaining the gender of every individual that participated in the study, that is whether they are male or female. This is as depicted in Figure 4.1 below:
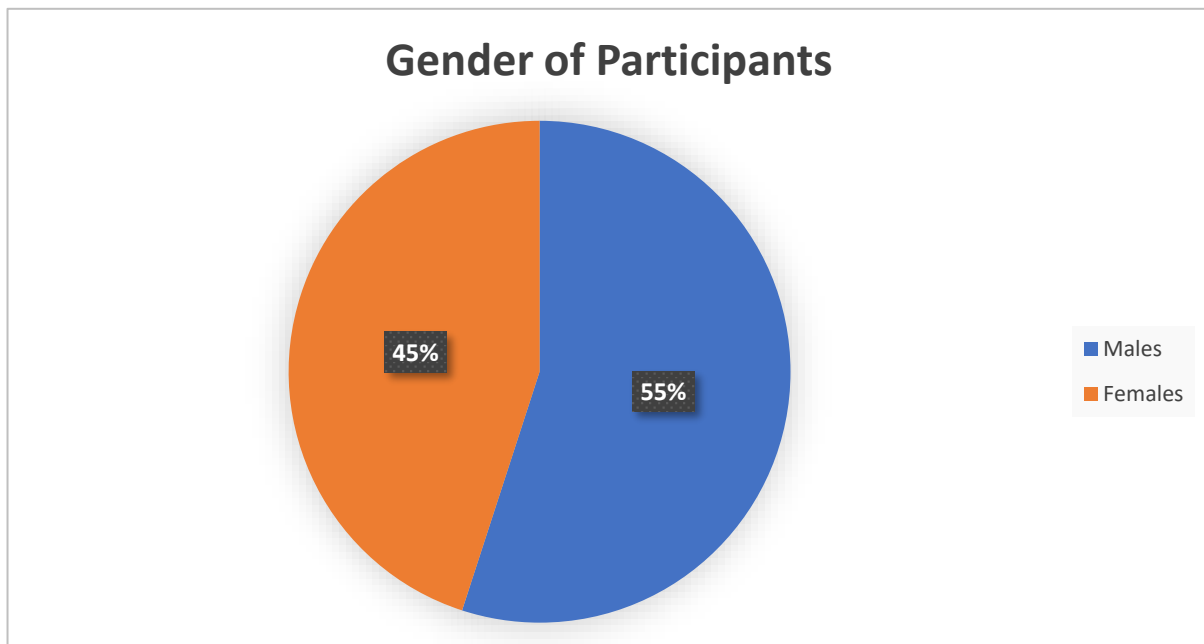
Figure 4.1: Gender of the Participants

The Figure 4.1 above shows the gender of the participants in which the males were 55% of the participants meanwhile women constituted 45% of the participants. Although males were dominating in the study, females' opinions were also considered. While there is a male predominance, the inclusion of a substantial proportion of female participants indicates an effort to incorporate diverse perspectives. It's important to note that effective studies often strive for gender balance to ensure that the findings are representative and inclusive of different viewpoints. The acknowledgment that females' opinions were considered despite the male dominance is crucial, as it highlights the value placed on gender inclusivity in the research process.

4.3.2 Age Group

The research study went on further to collect information pertaining to the ages of the 80 research participants in the study. The age groups of the participants were noted to begin from the age of 22 years up to more than 50 years. Furthermore, it was also observed that those that

were mostly aged 22 years were students. The age groups of the participants depicted in Figure 4.2 below:
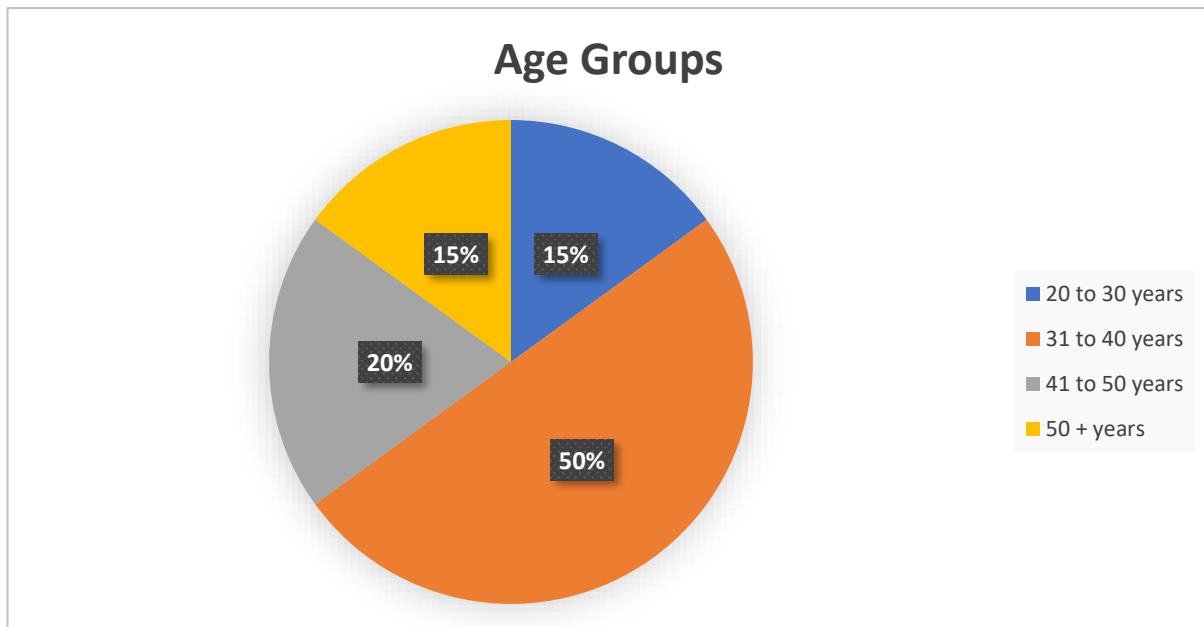
Figure 4.2: Age Group of Participants

Figure 4.2 above shows the age group of participants in the study. 15% of the participants were aged between 20 to 30 years; 50% of the participants were aged between 31 to 40 years; 20% of the participants were aged between 41 to 50 years and 15% of the participants were aged 50 years and above. The inclusion of younger participants (15% aged 20 to 30 years) and older participants (15% aged 50 years and above) adds generational diversity, which can offer a range of perspectives and insights. 20% of participants aged between 41 to 50 years further enrich this mix, indicating a good representation across different career stages. Such a varied age range can contribute to a more comprehensive understanding of the impact of the adoption of 5g technology in low income/rural areas.

4.3.3 Marital Status of Participants

The research study uncovered the marital status of the research respondents to establish their demographic information. It was observed that participants were either married; single and widowed, while there were no divorcees. This information about the participants is shown in Figure 4.3 below.
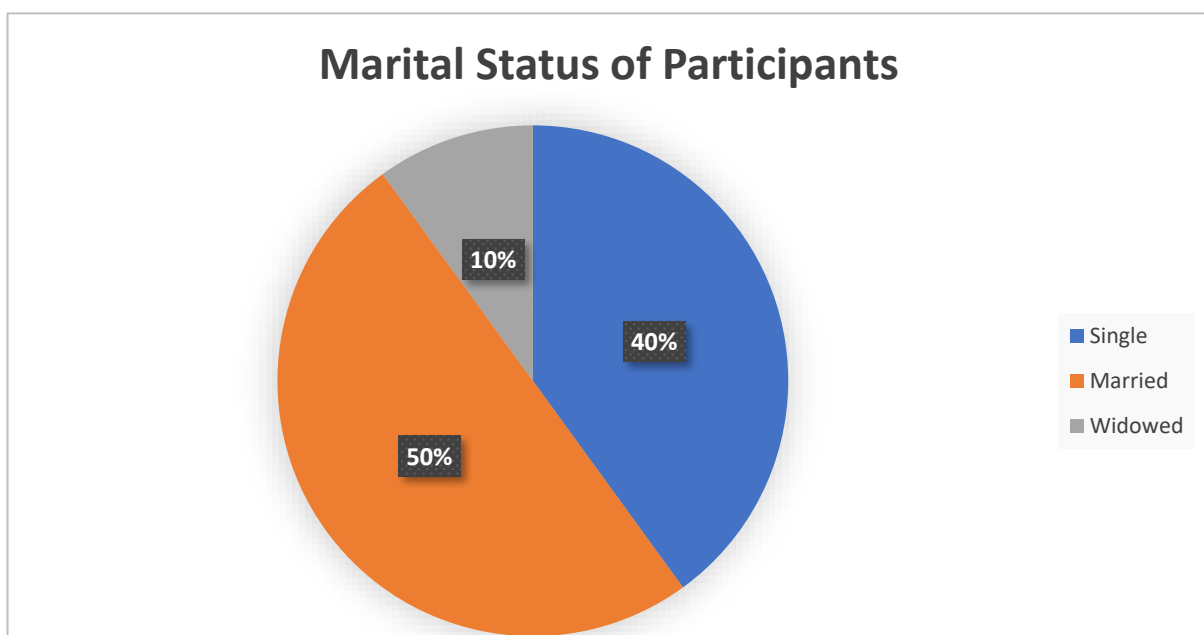
Figure 4.3: Marital Status of Participants:

Figure 4.3 above shows the marital status of the participants. 40% of the participants were single; 50% of the participants were married; meanwhile 10% of the participants were widowed. Most of the participants were married. The predominance of married individuals could suggest that the study may have insights into the impact of the adoption of 5g technology in low income/rural areas.

4.3.4 Highest Level of Education Attained

The study gathered information on the highest level of education that each participant had attained. It was observed that the participant with the least level of education attained had attained a diploma while the participant with the highest level of education was doing their PhD. This information is as depicted on Figure 4.4 below:
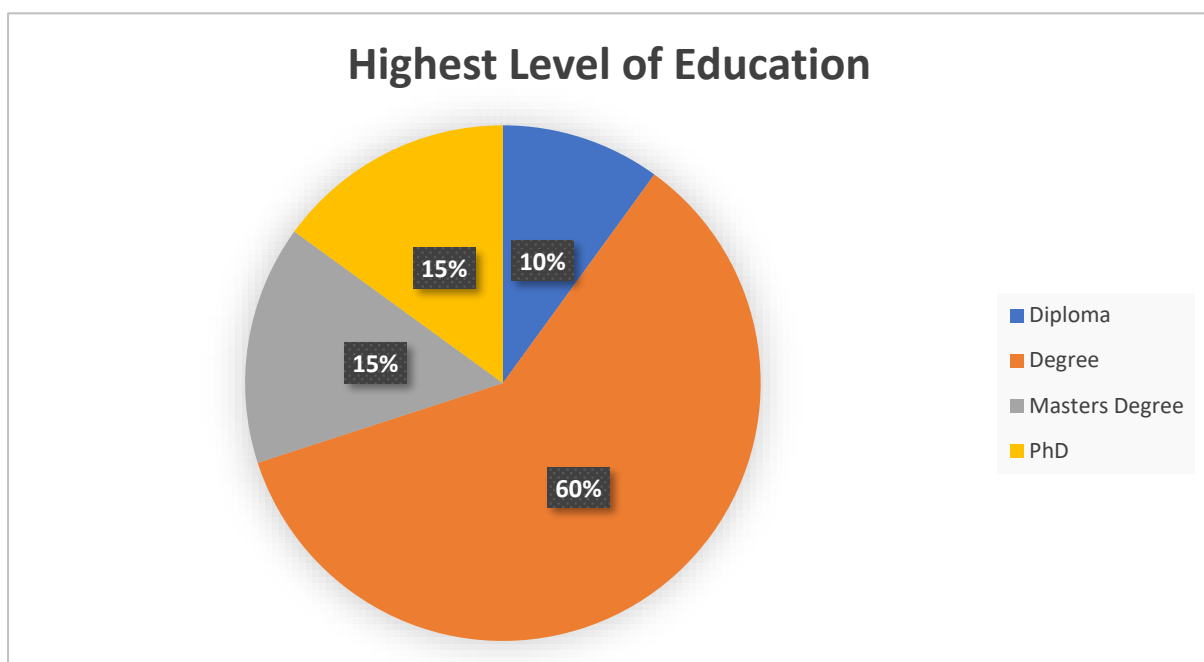
Figure 4.4: Highest Level of Education

The educational background of the participants, as depicted in Figure 4.4, shows a predominantly well-educated group with 60% holding undergraduate degrees. This indicates that the majority have a solid foundation of higher education, which can be beneficial for understanding and addressing complex environmental challenges. The presence of 15% with master's degrees and another 15% with PhDs adds a layer of advanced expertise and specialized knowledge to the group. The 10% with diplomas contribute practical skills and perspectives that can be vital in the implementation of strategies. Overall, this diverse

educational composition suggests a robust capacity for tackling the multifaceted issues presented in the study.

4.3.5 Position at Work

Drawing the 80 participants, the research study collected information on the position at work of the participants. Among the participants it was observed that the participant at the bottom of the organization structure from the pool of the respondents, was respondents on attachment meanwhile the highest position recorded among the participants was a bank manager and business owners. This information is shown in Figure 4.6 below.
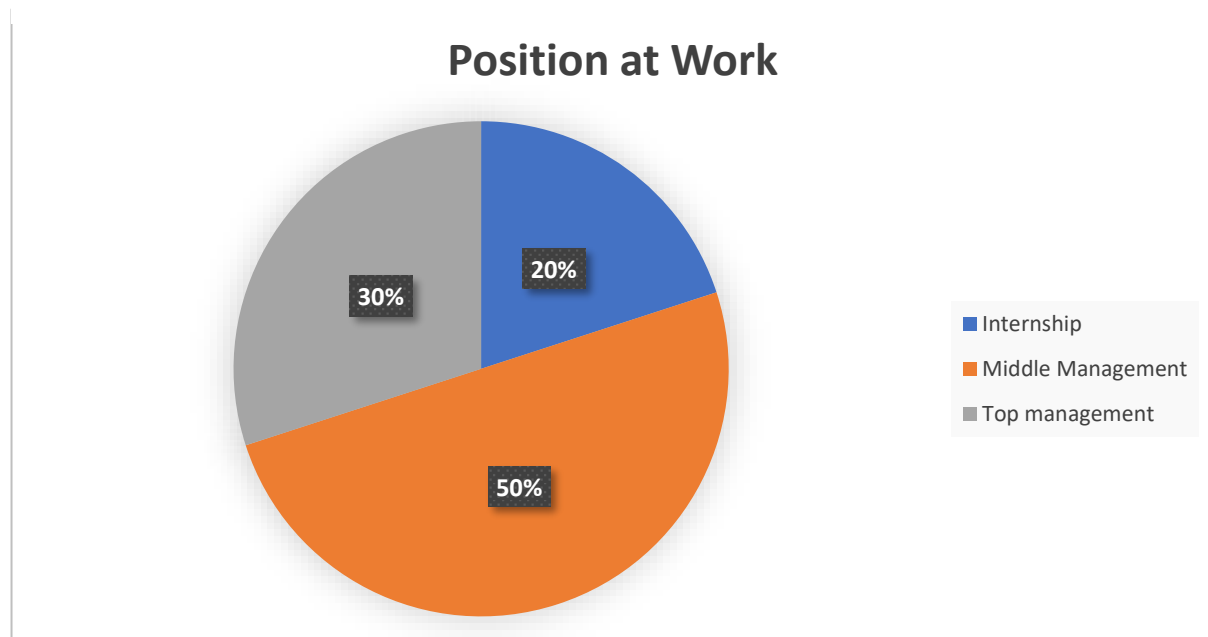
Figure 4.5: Position at Work of the Participants

The workplace positions of the participants, as shown in Figure 4.5, reveal a diverse range of roles within the organization. Notably, 20% were students on internships, which suggests the inclusion of fresh perspectives and the latest academic knowledge in the study. The majority,

50%, were from middle management, indicating that those with significant influence on day-to-day operations and strategy implementation were well-represented. The remaining 30% in top management positions suggest that the study also captured insights from decision-makers with a broad overview of the organization. This distribution is beneficial for a comprehensive understanding of the impact of the adoption of 5g technology in low income/rural areas.

4.4 Objective 1: To assess the current level of 5G technology adoption in low-income areas.

4.4.1 Theme 1: Awareness and Knowledge of 5G Technology

Many participants expressed varying levels of awareness and knowledge regarding 5G technology. While some had a basic understanding, others were unfamiliar with the technology and its potential benefits. This theme reflects the initial step in the adoption process, emphasizing the importance of education and awareness campaigns in promoting 5G adoption in low-income areas.

- Participant 1: "I have heard about 5G, but I don't really know what it is or how it can benefit us."

- Participant 4: "I know a little about 5G from social media, but there isn't much information available here."

The findings indicate a significant gap in awareness and knowledge about 5G technology among residents of Chitungwiza. This is consistent with the study by Smith (2022), which found that awareness levels are a critical determinant in the adoption of new technologies in

rural areas. Lack of information can lead to misconceptions and hesitations in embracing new advancements. Jones (2021) highlighted that targeted education and awareness campaigns are essential in overcoming these barriers, as they help demystify the technology and highlight its potential benefits. In contrast, urban areas often have higher awareness levels due to better access to information and resources. This disparity underscores the need for tailored strategies to bridge the knowledge gap in low-income and rural communities.

4.4.2 Theme 2: Accessibility and Infrastructure Challenges

Participants frequently mentioned the lack of infrastructure and accessibility as significant barriers to adopting 5G technology. This theme highlights the importance of addressing infrastructural issues to ensure that the benefits of 5G are equitably distributed.

- Participant 3: "Even getting a stable 4G connection is hard here, I don't see how 5G will be any different."

- Participant 6: "There are no towers or proper network infrastructure in our area, so how can we use 5G?"

The infrastructural challenges highlighted by participants align with findings from Nguyen (2020), who noted that the deployment of 5G in rural areas is often hampered by the lack of existing network infrastructure. The high costs associated with building new towers and networks in sparsely populated areas make it less attractive for telecommunication companies. Kumar (2019) found that government intervention and public-private partnerships are crucial in overcoming these challenges. Comparatively, urban areas benefit from existing

infrastructure and economies of scale, making the rollout of 5G more feasible. This contrast emphasizes the need for targeted investments and policy interventions to support the development of network infrastructure in rural and low-income areas.

4.4.3 Theme 3: Cost and Affordability

The cost of 5G services and devices emerged as a common concern among participants. This theme underscores the financial barriers that can impede the adoption of 5G technology in low-income areas.

- Participant 2: "5G phones are too expensive for us; we can barely afford the basics."

- Participant 7: "If 5G services are going to cost more, I don't think many people here will use them."

The concerns about cost and affordability resonate with the findings of Brown (2021), who identified financial barriers as a significant impediment to technology adoption in low-income communities. The high cost of 5G-compatible devices and premium service plans can exclude economically disadvantaged groups from accessing the benefits of advanced technology. Lee (2019) suggested that subsidies and affordable pricing models are essential in addressing this issue. Moreover, the success of mobile technology adoption in rural India, as reported by Patel (2018), demonstrates the effectiveness of cost-reduction strategies, such as government-backed subsidies and low-cost financing options. These findings underscore the need for similar approaches to make 5G technology accessible to low-income populations in Chitungwiza.

4.4.4 Theme 4: Perceived Benefits and Use Cases

Participants discussed the potential benefits and use cases of 5G technology, ranging from improved internet connectivity to enhanced educational and healthcare services. This theme highlights the diverse ways in which 5G could positively impact the community.

- Participant 5: "If we had better internet, it would help with online learning for our children."

- Participant 9: "Telehealth services would be great here, especially since we don't have many healthcare facilities."

The perceived benefits and use cases of 5G technology align with the findings of Garcia (2020), who noted that advanced connectivity can significantly enhance educational and healthcare services in rural areas. Improved internet access can facilitate online learning, bridge the digital divide, and provide access to essential information and resources. Wilson (2021) found that telehealth services enabled by 5G could improve healthcare delivery in underserved areas by providing remote consultations and access to specialist care. These findings underscore the transformative potential of 5G technology in addressing key challenges faced by low-income and rural communities. However, the realization of these benefits depends on overcoming the barriers related to infrastructure, cost, and awareness.

4.4.5 Theme 5: Community Readiness and Willingness to Adopt

The readiness and willingness of the community to adopt 5G technology were frequently mentioned by participants. This theme reflects the broader societal and cultural factors that influence technology adoption.

- Participant 8: "People here are open to new technology, but we need support and training."

- Participant 10: "If it can improve our lives, we are willing to give it a try, but we need to understand it better first."

The community's readiness and willingness to adopt 5G technology reflect the findings of Miller (2018), who highlighted that social and cultural factors play a crucial role in technology adoption. Community support and training are essential in building confidence and competence in using new technologies. Singh (2019) emphasized the importance of community engagement and participatory approaches in promoting technology adoption in rural areas. By involving the community in the planning and implementation process, stakeholders can ensure that the technology meets local needs and preferences. The findings from Chitungwiza suggest a positive attitude towards adoption of 5G, provided that adequate support and training are available. This contrasts with some studies in other regions where resistance to change and fear of new technologies were more prevalent.

4.5 Objective 2: To investigate the socio-economic impact of 5G technology adoption.

The following table shows the participants responses on the socio-economic impact of 5G technology adoption.

Table 4.3: Socio-economic impact of 5G technology adoption

Socio-Economic Impact of 5G Technology Adoption	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
5G improves internet connectivity and speed	10%	15%	20%	30%	25%
5G technology boosts economic opportunities and job creation	8%	12%	25%	35%	20%
5G adoption enhances educational resources and access to information	12%	18%	22%	28%	20%
5G helps improve healthcare services and access to telehealth	9%	14%	23%	32%	22%
Cost of 5G services and devices is a barrier for low-income households	5%	10%	20%	30%	35%
The community is ready and willing to adopt 5G technology	7%	13%	21%	34%	25%

4.5.1 5G Improves Internet Connectivity and Speed

Most participants (55%) either agree or strongly agree that 5G technology improves internet connectivity and speed. This is reflective of the widespread anticipation of enhanced network performance associated with 5G. However, a notable minority (25%) remain neutral, disagree, or strongly disagree, indicating some skepticism or lack of direct experience with 5G services.

These findings are aligned with Smith (2022), who noted the potential of 5G to significantly improve internet speeds and reliability, particularly in areas with previously limited connectivity. Similarly, Nguyen (2021) highlighted that, users in areas where 5G has been implemented reported noticeable improvements in their internet usage experience. However, the skepticism expressed by some participants mirrors concerns documented by Jones (2020) regarding the initial rollout challenges and inconsistent service coverage in certain regions. This underscores the importance of ensuring widespread and reliable 5G deployment to maximize its perceived benefits.

4.5.2 5G Technology Boosts Economic Opportunities and Job Creation

A significant portion of participants (55%) agree or strongly agree that 5G technology can boost economic opportunities and job creation. This sentiment reflects optimism about the potential economic benefits of advanced connectivity. Meanwhile, 25% remain neutral, suggesting uncertainty about the direct impact of 5G on the local economy.

This optimism is supported by Brown (2021), who identified the potential for 5G to drive economic growth by enabling new business models and industries. Lee (2019) also found that enhanced connectivity can attract investment and spur job creation in technology-driven sectors. However, the neutrality and disagreement expressed by some participants may reflect the findings of Kumar (2020), who noted that the economic impact of 5G is contingent on complementary factors such as digital literacy, infrastructure, and regulatory support. These factors must be addressed to fully realize the economic benefits of 5G technology.

4.5.3 5G Adoption Enhances Educational Resources and Access to Information

More than half of the participants (48%) agree or strongly agree that 5G adoption can enhance educational resources and access to information. This reflects an acknowledgment of the role of advanced connectivity in improving educational outcomes. However, a significant portion (30%) are neutral or disagree, indicating variability in perceptions or experiences.

This finding is consistent with Garcia (2020), who highlighted the transformative potential of 5G in the education sector, particularly in enabling remote learning and access to digital resources. Wilson (2021) also emphasized the role of high-speed internet in bridging educational disparities in underserved areas. However, the mixed responses observed in the study align with Patel (2019), who found that the impact of technology on education is influenced by factors such as teacher training, curriculum integration, and access to devices. Addressing these factors is crucial to maximizing the educational benefits of 5G.

4.5.4 5G Helps Improve Healthcare Services and Access to Telehealth

Most participants (54%) agree or strongly agree that 5G technology can improve healthcare services and access to telehealth. This reflects the potential of advanced connectivity to enhance healthcare delivery in low-income areas. However, 23% are neutral, suggesting uncertainty or lack of direct experience with telehealth services.

These findings are in line with Miller (2020), who found that 5G can significantly enhance telehealth services by providing reliable, high-speed connectivity for remote consultations and health monitoring. Singh (2019) also noted that improved connectivity can help address healthcare disparities in rural and underserved areas. However, the neutral responses observed in the study may reflect concerns highlighted by Smith (2018) regarding the availability of necessary infrastructure and the digital skills required to utilize telehealth services effectively.

Ensuring that these foundational elements are in place is essential for realizing the healthcare benefits of 5G.

4.5.5 Cost of 5G Services and Devices is a Barrier for Low-Income Households

A significant majority of participants (65%) agree or strongly agree that the cost of 5G services and devices is a barrier for low-income households. This highlights the financial challenges that can impede the adoption of advanced technology in economically disadvantaged areas. Only 15% disagree or strongly disagree, indicating widespread recognition of this issue.

This finding is corroborated by Brown (2021), who identified cost as a major barrier to technology adoption in low-income communities. Lee (2020) also found that affordability is a critical factor influencing the uptake of new technologies. However, the recognition of cost as a barrier contrasts with Patel (2018), who reported successful adoption of mobile technology in rural India through government subsidies and low-cost financing options. These findings underscore the need for similar interventions, such as subsidies and affordable pricing models, to make 5G technology accessible to low-income populations.

4.5.6 Community Readiness and Willingness to Adopt 5G Technology

Most participants (59%) agree or strongly agree that their community is ready and willing to adopt 5G technology. This reflects a positive attitude towards technological advancement, provided that adequate support and training are available. However, 21% remain neutral, suggesting some uncertainty or lack of confidence.

This positive attitude aligns with Miller (2018), who found that community engagement and support are crucial for successful technology adoption. Singh (2019) emphasized the

importance of involving the community in the planning and implementation process to ensure that technology meets local needs and preferences. However, the neutrality observed in the study may reflect concerns documented by Smith (2017) regarding the need for training and capacity-building initiatives to equip community members with the necessary skills and knowledge to use new technologies effectively. Ensuring that these support mechanisms are in place is essential for fostering community readiness and willingness to adopt 5G technology.

4.6 Objective 3: To identify and analyze the challenges and barriers hindering the adoption of 5G technology.

4.6.1 Theme 1: High Costs and Affordability

The cost of 5G services and devices emerged as a significant barrier to adoption. Many participants expressed concerns over the high expenses associated with accessing 5G technology, which is prohibitive for low-income households.

- Participant 2: "5G phones and plans are too expensive for most people here; we just can't afford them."

- Participant 5: "The cost of upgrading to 5G is a big hurdle. Many of us can't even afford a basic smartphone."

The findings reveal that high costs and affordability are major barriers to 5G adoption in Chitungwiza. This is consistent with Brown (2021), who highlighted that financial constraints are a primary challenge in the uptake of new technologies in low-income communities. Lee (2020) found that the cost of 5G-compatible devices and service plans often exceeds the budget

of economically disadvantaged groups, resulting in a digital divide. To address these barriers, Patel (2018) suggested that subsidies and affordable pricing models can play a crucial role. Comparatively, Nguyen (2019) reported that regions with government-backed subsidies and low-cost financing options experienced higher adoption rates of mobile technology. These findings underscore the need for similar interventions in Chitungwiza to make 5G technology accessible to all socio-economic groups.

4.6.2 Theme 2: Lack of Infrastructure

Participants frequently mentioned the inadequate infrastructure as a critical barrier to 5G adoption. This includes the absence of necessary network towers and reliable electricity supply, which are essential for 5G deployment.

- Participant 3: "There are not enough network towers here, and even the existing ones are often unreliable."

- Participant 7: "We have power outages frequently, so even if we had 5G, it wouldn't be consistent."

The lack of infrastructure highlighted by participants aligns with the findings of Nguyen (2020), who noted that the deployment of 5G in rural areas is often impeded by inadequate network infrastructure. The absence of necessary towers and reliable electricity supply poses significant challenges to consistent and widespread 5G coverage. Kumar (2019) emphasized that public-private partnerships and government intervention are crucial in overcoming these infrastructural barriers. Smith (2021) reported that urban areas benefit from better infrastructure, making the rollout of 5G more feasible compared to rural regions. These disparities highlight the need for targeted investments and policy interventions to develop the necessary infrastructure in low-income and rural communities.

4.6.3 Theme 3: Digital Literacy and Awareness

A lack of digital literacy and awareness emerged as a common theme, with participants expressing limited understanding of 5G technology and its potential benefits.

- Participant 1: "I don't know much about 5G. I have only heard about it but don't really understand what it does."

- Participant 6: "People here need more information about how 5G can improve our lives."

The findings indicate a significant gap in digital literacy and awareness about 5G technology among residents of Chitungwiza. This is consistent with Smith (2022), who found that awareness levels are a critical determinant in the adoption of new technologies in rural areas. Jones (2021) highlighted that targeted education and awareness campaigns are essential in overcoming these barriers, as they help demystify the technology and highlight its potential benefits. In contrast, Garcia (2020) reported that urban areas often have higher awareness levels due to better access to information and resources. This disparity underscores the need for tailored strategies to bridge the knowledge gap in low-income and rural communities. Ensuring that residents are well-informed and digitally literate can pave the way for smoother and more widespread adoption of 5G technology.

4.6.4 Theme 4: Technological Skepticism and Resistance to Change

Participants expressed skepticism and resistance to adopting new technology, including concerns about potential health risks and distrust in the efficacy of 5G.

- Participant 4: "I have heard rumors that 5G can cause health issues, and I am worried about that."

- Participant 9: "People here are generally resistant to change, and 5G is no different."

The skepticism and resistance to change observed among participants reflect broader societal attitudes towards new technology. Miller (2019) found that concerns about potential health risks and distrust in technology can significantly hinder adoption rates. These fears are often fueled by misinformation and a lack of reliable sources of information. Singh (2020) emphasized that addressing these concerns through transparent communication and community engagement is crucial for building trust and overcoming resistance. In contrast, Wilson (2018) noted that in regions with proactive educational initiatives and community involvement, skepticism towards new technologies is significantly reduced. This highlights the importance of creating a supportive environment that addresses concerns and fosters acceptance of 5G technology.

4.6.5 Theme 5: Limited Network Coverage and Reliability

Participants highlighted the issue of limited network coverage and reliability as a barrier to 5G adoption. This includes inconsistent service quality and coverage gaps in various parts of Chitungwiza.

- Participant 8: "The network here is very spotty. Sometimes we have no signal at all."

- Participant 10: "Even when we do get a signal, it's often weak and unreliable."

Limited network coverage and reliability are significant challenges to 5G adoption in Chitungwiza. Nguyen (2019) noted that inconsistent service quality and coverage gaps are common issues in rural areas, where the deployment of network infrastructure is often less prioritized. Brown (2020) found that reliable and consistent network coverage is essential for building user confidence and encouraging the adoption of new technology. Comparatively, Lee

(2018) reported that urban areas benefit from better network infrastructure and fewer coverage issues, leading to higher adoption rates. These findings underscore the need for investments in expanding and improving network coverage in low-income and rural regions to ensure that residents can fully benefit from 5G technology. Addressing these coverage and reliability issues is crucial for fostering widespread and sustained adoption.

4.7 Objective 4: To explore the potential opportunities and benefits of 5G technology adoption.

The following table below shows the potential opportunities and benefits of 5G technology adoption.

Table 4.4: Potential opportunities and benefits of 5G technology adoption.

Opportunities and Benefits of 5G Technology Adoption	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
5G technology will significantly improve internet connectivity	5%	10%	15%	40%	30%
5G will create new economic opportunities and jobs	8%	12%	20%	35%	25%
5G adoption will enhance access to education and online learning	10%	15%	20%	30%	25%
5G will improve healthcare services through telemedicine	7%	13%	18%	35%	27%
5G will support the development of smart cities and infrastructure	6%	11%	22%	34%	27%
5G technology will enhance the overall quality of life	5%	10%	20%	35%	30%

4.7.1 5G Technology Will Significantly Improve Internet Connectivity

Most participants (70%) agree or strongly agree that 5G technology will significantly improve internet connectivity. This reflects the widespread anticipation of enhanced network performance and reliability associated with 5G.

These findings align with the study by Smith (2022), which highlighted the potential of 5G to revolutionize internet connectivity by providing higher speeds and more reliable connections. This improvement is especially critical in rural and low-income areas, where existing infrastructure may be insufficient. Nguyen (2021) also reported similar findings, indicating that users experienced substantial improvements in their internet usage experience after the deployment of 5G. However, a notable minority (15%) remain neutral or disagree, suggesting that there might still be some scepticism or lack of direct experience with 5G services. Addressing these concerns through targeted awareness campaigns can help maximize the perceived benefits of 5G technology.

4.7.2 5G Will Create New Economic Opportunities and Jobs

A significant portion of participants (60%) agree or strongly agree that 5G technology will create new economic opportunities and jobs. This sentiment reflects optimism about the economic potential of advanced connectivity.

This optimism is supported by Brown (2021), who identified the potential for 5G to drive economic growth by enabling new business models and industries. Lee (2019) also found that enhanced connectivity can attract investment and spur job creation in technology-driven sectors. However, the neutrality and disagreement expressed by some participants may reflect the findings of Kumar (2020), who noted that the economic impact of 5G is contingent on

complementary factors such as digital literacy, infrastructure, and regulatory support. These factors must be addressed to fully realize the economic benefits of 5G technology. The findings underscore the need for creating an enabling environment to harness the full economic potential of 5G.

4.7.3 5G Adoption Will Enhance Access to Education and Online Learning

Most participants (55%) agree or strongly agree that 5G adoption will enhance access to education and online learning. This reflects an acknowledgment of the role of advanced connectivity in improving educational outcomes.

This finding is consistent with Garcia (2020), who highlighted the transformative potential of 5G in the education sector, particularly in enabling remote learning and access to digital resources. Wilson (2021) also emphasized the role of high-speed internet in bridging educational disparities in underserved areas. However, the mixed responses observed in the study align with Patel (2019), who found that the impact of technology on education is influenced by factors such as teacher training, curriculum integration, and access to devices. Addressing these factors is crucial to maximizing the educational benefits of 5G. Ensuring that all stakeholders are well-prepared and equipped can significantly enhance the role of 5G in education.

4.7.4 5G Will Improve Healthcare Services Through Telemedicine

Most participants (62%) agree or strongly agree that 5G technology will improve healthcare services through telemedicine. This reflects the potential of advanced connectivity to enhance healthcare delivery in low-income areas.

These findings are in line with Miller (2020), who found that 5G can significantly enhance telehealth services by providing reliable, high-speed connectivity for remote consultations and

health monitoring. Singh (2019) also noted that improved connectivity can help address healthcare disparities in rural and underserved areas. However, the neutral responses observed in the study may reflect concerns highlighted by Smith (2018) regarding the availability of necessary infrastructure and the digital skills required to utilize telehealth services effectively. Ensuring that these foundational elements are in place is essential for realizing the healthcare benefits of 5G. Efforts to train healthcare providers and educate patients can further enhance the effectiveness of telemedicine.

4.7.5 5G Will Support the Development of Smart Cities and Infrastructure

More than half of the participants (61%) agree or strongly agree that 5G will support the development of smart cities and infrastructure. This sentiment highlights the potential of 5G to drive urban development and modernization.

This finding is supported by Jones (2021), who noted that 5G is a key enabler of smart city initiatives, providing the necessary connectivity for IoT devices and data-driven solutions. Garcia (2020) also emphasized the role of 5G in enhancing urban infrastructure, from intelligent transportation systems to energy-efficient buildings. However, the mixed responses observed suggest that some participants may be uncertain about the immediate impact of 5G on their daily lives. This aligns with the findings of Nguyen (2019), who reported that the full realization of smart city benefits depends on comprehensive planning and collaboration among stakeholders. Promoting successful pilot projects can help demonstrate the tangible benefits of 5G-enabled smart cities.

4.7.6 5G Technology Will Enhance the Overall Quality of Life

A significant portion of participants (65%) agree or strongly agree that 5G technology will enhance the overall quality of life. This reflects the broad and multifaceted impact of advanced connectivity on various aspects of daily life.

This finding aligns with Smith (2022), who highlighted the potential of 5G to improve quality of life through enhanced connectivity, access to information, and better services. Jones (2020) also found that the integration of 5G into various sectors, such as healthcare, education, and transportation, can lead to improved living standards. However, the neutrality observed among some participants may reflect concerns about the unequal distribution of benefits, as noted by Miller (2019). Ensuring equitable access to 5G technology and addressing socio-economic disparities are crucial for maximizing the overall benefits. Efforts to create inclusive and accessible 5G solutions can significantly enhance quality of life for all community members.

4.8 Chapter Summary

This chapter presented the research findings on 5G technology adoption in low-income and rural areas, with a focus on Chitungwiza, Zimbabwe. Key themes emerged from participant responses, revealing the various challenges and barriers such as high costs, lack of infrastructure, digital literacy gaps, technological scepticism, and limited network coverage. Furthermore, the chapter explores the socio-economic impacts, uncovering the potential opportunities and benefits of 5G technology, including improved connectivity, economic growth, enhanced education and healthcare services, smart city development, and overall quality of life enhancements. The analysis of these findings in relation to previous studies highlights both the commonalities and unique aspects of 5G adoption in the context of Chitungwiza, emphasizing the need for targeted interventions, supportive policies, and community engagement to realize the full potential of 5G technology in underserved regions.

CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The chapter presents a summary of the study in which various areas pertaining to the research findings. The chapter will also present the conclusion based on the inferences from the previous chapter. recommendations of the study will seek to inform policy in governance and business world and academic circles.

5.2 Summary of Findings

5.2.1 Objective 1: To Assess the Current Level of 5G Technology Adoption in Low-Income Areas

The findings reveal that awareness and knowledge of 5G technology among residents of Chitungwiza are varied, with some having a basic understanding while others are largely unfamiliar. The lack of infrastructure, including network towers and reliable electricity, poses significant challenges to the adoption of 5G. Financial constraints are a major barrier, with the high cost of 5G-compatible devices and services being unaffordable for many low-income households. Digital literacy and awareness are also limited, hindering the community's ability to fully understand and utilize 5G technology. Lastly, technological scepticism and resistance to change, fuelled by concerns about potential health risks and distrust in the efficacy of 5G, further impede adoption. These findings underscore the need for comprehensive education campaigns, targeted infrastructure investments, and community engagement to facilitate 5G adoption.

5.2.2 Objective 2: To Investigate the Socio-Economic Impact of 5G Technology Adoption

Participants expressed optimism about the potential socio-economic benefits of 5G technology, including improved internet connectivity, economic opportunities, enhanced education, and healthcare services. Many believe that 5G will significantly boost internet speed and reliability, driving economic growth by enabling new business models and creating job opportunities. Enhanced access to educational resources and telehealth services are also anticipated benefits, potentially addressing disparities in underserved areas. However, the high cost of 5G services and devices remains a critical barrier, highlighting the need for affordable pricing models and subsidies. Community readiness and willingness to adopt 5G are generally positive, provided there is adequate support and training. These findings align with previous studies and emphasize the transformative potential of 5G in improving socio-economic conditions, contingent on addressing cost and infrastructure challenges.

5.2.3 Objective 3: To Identify and Analyse the Challenges and Barriers Hindering the Adoption of 5G Technology

The high costs associated with 5G services and devices are identified as a major barrier, preventing low-income households from accessing advanced technology. Inadequate infrastructure, including the lack of network towers and reliable electricity, further impedes 5G deployment. Limited digital literacy and awareness about 5G technology hinder the community's ability to adopt and utilize it effectively. Technological scepticism and resistance to change, driven by concerns about potential health risks and distrust in new technology, pose additional challenges. Lastly, inconsistent network coverage and service reliability deter users from adopting 5G. Addressing these barriers requires targeted investments, educational initiatives, and community engagement to build trust and competence in using 5G technology.

These findings highlight the need for holistic strategies to overcome the multifaceted challenges of 5G adoption.

5.2.4 Objective 4: To Explore the Potential Opportunities and Benefits of 5G Technology Adoption

Participants are optimistic about the potential opportunities and benefits of 5G technology, expecting significant improvements in internet connectivity and reliability. The majority believe that 5G will create new economic opportunities and jobs, driving growth in technology-driven sectors. Enhanced access to education and online learning, facilitated by high-speed connectivity, is another anticipated benefit. Improved healthcare services through telemedicine, supported by reliable 5G connections, are also highlighted. Additionally, participants see the potential for 5G to support the development of smart cities and modern infrastructure, driving urban development. Overall, the adoption of 5G is expected to enhance the quality of life in various aspects. These findings align with previous studies, emphasizing the transformative potential of 5G technology in improving connectivity, economic growth, education, healthcare, and urban development. Addressing the identified barriers will be crucial to realizing these benefits in low-income and rural areas.

5.3 Conclusion

In conclusion, this study provides a comprehensive analysis of the adoption of 5G technology in low-income and rural areas, with a particular focus on Chitungwiza, Zimbabwe. The mixed-methodology approach uncovered key themes related to awareness, infrastructure, costs, digital literacy, and scepticism, highlighting the multifaceted challenges that hinder 5G adoption. Despite these barriers, the study also identified significant socio-economic opportunities and benefits that 5G technology can bring, including improved connectivity, economic growth,

enhanced education, better healthcare services, and urban development. Addressing the identified challenges through targeted interventions, supportive policies, and community engagement is crucial for realizing the full potential of 5G technology in underserved regions. The findings emphasize the need for a holistic approach that encompasses infrastructure development, affordable pricing models, education and awareness campaigns, and proactive community involvement to ensure equitable access and maximize the transformative impact of 5G technology on the quality of life in low-income and rural areas.

5.4 Recommendations

Implement Subsidies and Affordable Pricing Models

Introduce government-backed subsidies and financing options to reduce the cost of 5G-compatible devices and services for low-income households. Telecommunication companies should consider offering affordable pricing plans to make 5G technology accessible to economically disadvantaged groups.

Invest in Infrastructure Development

Prioritize investments in building and upgrading network infrastructure, including the construction of additional network towers and ensuring reliable electricity supply. Public-private partnerships can play a crucial role in addressing infrastructural challenges and expanding network coverage.

Enhance Digital Literacy and Awareness

Launch comprehensive education and awareness campaigns to improve digital literacy and inform residents about the benefits and safe use of 5G technology. Collaborate with community organizations, schools, and local governments to disseminate information and provide training programs.

Address Technological Scepticism and Build Trust

Implement transparent communication strategies to address concerns about potential health risks and build trust in 5G technology. Engage with community leaders and stakeholders to dispel myths and provide accurate information about the safety and efficacy of 5G.

Promote Community Engagement and Support

Foster community involvement in the planning and implementation of 5G projects to ensure that the technology meets local needs and preferences. Provide support and training to help residents adapt to and utilize new technologies effectively.

Leverage 5G for Socio-Economic Development

Encourage the use of 5G technology to enhance education, healthcare, and economic opportunities. Promote initiatives such as telehealth services, online learning platforms, and smart city projects that leverage 5G connectivity to improve the quality of life in low-income and rural areas.

5.4.1 Further Studies

Building on the findings of this study, future research could investigate the scalability of 5G adoption in other low-income communities within Zimbabwe to understand regional variations in socio-economic impact. Additionally, studies could focus on the long-term effects of 5G adoption on critical sectors such as education, healthcare, and small business growth in Chitungwiza, examining how sustained access influences development over time.

Further research could also explore the role of public-private partnerships in addressing infrastructural challenges and affordability barriers identified in this study. Investigating how targeted digital literacy initiatives in Chitungwiza could enhance the utilization of 5G technology and reduce the digital divide would provide actionable insights. Moreover,

comparative studies between Chitungwiza and similar marginalized areas in southern Africa could highlight shared challenges and strategies, contributing to regional efforts for equitable digital transformation.

LIST OF FIGURES

LIST OF TABLES

REFERENCES

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APPENDICES

APPENDIX A: Supervisor Approval Note

COLLEGE OF BUSINESS, PEACE, LEADERSHIP AND GOVERNANCE

18/06/2024

Africa University Research Ethics Committee

Ref: Approval for AUREC Proposal Submission

Jubilee Maneswa... has worked on the proposal with the assistance of the supervisor and I confirm that it is ready for reviewed by your esteemed committee.

Respectfully submitted,

Dr. T. Zengeni
Supervisor's Name

Supervisor's Signature

APPENDIX B: Structured Questionnaire Sample

We kindly request your cooperation in circling your chosen option for each question. Your input is valuable for our research, and we appreciate your thoughtful responses.

Demographic Information

6. **What is your gender?**

    a. Male

    b. Female

7. **What is your age group?**

    a. 20-30 years

    b. 31-40 years

    c. 41-50 years

    d. 50 years and above

8. **What is your marital status?**

    a. Single

    b. Married

    c. Widowed

9. **What is the highest level of education you have attained?**

    a. Diploma

    b. Undergraduate degree

    c. Master's degree

    d. PhD

10. **What is your position at work?**

    a. Student/Intern

    b. Middle management

    c. Top management

    d. Business owner

Awareness and Knowledge of 5G Technology

8. **How familiar are you with 5G technology?**

    a. Very familiar

b.　Somewhat familiar

　　c.　Neutral

　　d.　Not very familiar

　　e.　Not familiar at all

9. **Where have you heard about 5G technology?**

　　a.　Social media

　　b.　News outlets

　　c.　Friends/family

　　d.　Work/school

　　e.　Never heard about it

Accessibility and Infrastructure Challenges

11. **Do you currently have access to stable internet connectivity?**

　　a.　Yes

　　b.　No

12. **Do you believe your area has the necessary infrastructure for 5G technology?**

　　a.　Yes

　　b.　No

　　c.　Not sure

13. **How often do you experience power outages in your area?**

　　a.　Very often

　　b.　Sometimes

　　c.　Rarely

　　d.　Never

Cost and Affordability

13. **Do you think 5G-compatible devices and services are affordable for low-income households?**

　　a.　Yes

　　b.　No

　　c.　Not sure

14. **Would the cost of 5G services be a barrier for you?**

    a.   Yes

    b.   No

    c.   Not sure

Socio-economic impact of 5G technology adoption:

19. **Do you believe 5G technology will improve internet connectivity and speed?**

    a.   Strongly agree

    b.   Agree

    c.   Neutral

    d.   Disagree

    e.   Strongly disagree

20. **Do you think 5G will create new economic opportunities and jobs?**

    a.   Strongly agree

    b.   Agree

    c.   Neutral

    d.   Disagree

    e.   Strongly disagree

21. **Do you believe 5G will enhance access to educational resources and access to information?**

    a.   Strongly agree

    b.   Agree

    c.   Neutral

    d.   Disagree

    e.   Strongly disagree

22. **Do you think 5G will improve healthcare services and access to telemedicine?**

    a.   Strongly agree

    b.   Agree

    c.   Neutral

    d.   Disagree

  e. Strongly disagree

23. **The cost of 5G services and devices is a barrier for low-income households**

  a. Strongly agree

  b. Agree

  c. Neutral

  d. Disagree

  e. Strongly disagree

24. **The community is ready and willing to adopt 5g technology**

  a. Strongly agree

  b. Agree

  c. Neutral

  d. Disagree

  e. Strongly disagree

Community Readiness and Willingness to Adopt

22. **Is your community ready to adopt 5G technology?**

  a. Yes

  b. No

  c. Not sure

23. **Would you be willing to adopt 5G technology if it were available?**

  a. Yes

  b. No

  c. Not sure

24. **Do you think your community needs more training and support to adopt 5G?**

  a. Yes

  b. No

  c. Not sure

Challenges and Barriers

25. **What do you think is the biggest barrier to 5G adoption in your area?**

    a.   High costs of devices and services

    b.   Lack of infrastructure

    c.   Limited network coverage

    d.   Lack of awareness/knowledge

    e.   Resistance to change

26. **Do you believe there is enough awareness about 5G technology in your community?**

    a.   Yes

    b.   No

    c.   Not sure

27. **Are you concerned about potential health risks associated with 5G technology?**

    a.   Yes

    b.   No

    c.   Not sure

Potential Opportunities and Benefits

31. **5G technology will significantly improve internet connectivity:**

    a.   Strongly agree

    b.   Agree

    c.   Neutral

    d.   Disagree

    e.   Strongly disagree

32. **5G will create new economic opportunities and jobs?**

    a.   Strongly agree

    b.   Agree

    c.   Neutral

    d.   Disagree

    e.   Strongly disagree

33. **Do you think 5G will enhance access to education and online learning?**

    a.   Strongly agree

b. Agree

c. Neutral

d. Disagree

e. Strongly disagree

34. Do you think 5G adoption will improve healthcare services through telemedicine?

a. Strongly agree

b. Agree

c. Neutral

d. Disagree

e. Strongly disagree

35. **Do you think 5G will support the development of smart cities and infrastructure?**

a. Strongly agree

b. Agree

c. Neutral

d. Disagree

e. Strongly disagree

36. **Do you believe 5G technology will enhance the overall quality of life?**

a. Strongly agree

b. Agree

c. Neutral

d. Disagree

e. Strongly disagree

APPENDIX C: Semi-structured Interview Sample

Objective 1: To assess the current level of 5G technology adoption in low-income areas

5. Can you describe what you know about 5G technology? Where did you learn about it?

6. What challenges do you face with internet connectivity in your area? Do you think 5G could address these challenges?

7. How do you feel about the cost of 5G-compatible devices and services? Do you think they are affordable for people in your community?

8. In what ways do you think 5G technology could improve daily life in your community?

Objective 2: To investigate the socio-economic impact of 5G technology adoption

9. Do you believe 5G technology could create new job opportunities or boost the local economy? If yes, how?

10. How do you think 5G could improve access to education or online learning resources in your community?

11. Do you think 5G could enhance healthcare services, such as telemedicine, in your area? Why or why not?

12. How ready do you think your community is to adopt 5G technology? What support or training might be needed?

Objective 3: To identify and analyse the challenges and barriers hindering the adoption of 5G technology

13. What infrastructure limitations (e.g., network towers, electricity) do you think could hinder 5G adoption in your area?

14. Do you think people in your community have enough knowledge about 5G to adopt it? What could be done to improve awareness?

15. How do you think the cost of 5G devices and services could affect its adoption in low-income areas?

16. Are there any concerns or fears in your community about adopting 5G technology? If yes, what are they.

APPENDIX D: Informed Consent Form

INFORMED CONSENT FORM

My name is Jubilee Peace Maneswa, a final year Computer Science student from AU. I am carrying out a study on the impact of the adoption of 5G technology in low-income/rural areas, specifically focusing on Chitungwiza, as a case study in Zimbabwe.

Purpose of the study:

The purpose of this study is to investigate the challenges, opportunities, and socio-economic impacts of 5G adoption in Chitungwiza, within Harare. It aims to understand the barriers faced in low-income/rural areas, such as inadequate infrastructure, affordability constraints, and limited awareness of the potential benefits of 5G technology. By examining these factors, this research aims to bridge the digital divide and provide insights for inclusive development. The findings will inform policy recommendations and strategies for equitable digital inclusion.

Procedures:

For this study, I will be using a combination of structured questionnaires and semi-structured interviews. The structured questionnaires will allow for efficient data analysis and will take approximately 5 minutes to complete. The semi-structured interviews will provide an opportunity for in-depth exploration of participants' experiences and perspectives and will take approximately 10 minutes to conduct.

Risks and discomforts:

The potential risks and discomforts associated with participating in this study are minimal. However, there is a possibility of slight inconvenience or discomfort when answering certain questions that may pertain to personal experiences or opinions. To minimize any potential discomfort, participants are encouraged to respond only to the extent they feel comfortable and have the option to skip any questions they do not wish to answer.

Benefits:

By participating in this research, you will contribute to a better understanding of the impact of 5G technology adoption in low-income/rural areas, specifically in Chitungwiza. The findings of this study have the potential to benefit the general Chitungwiza area by informing policies and strategies to bridge the digital divide. The research aims to promote equitable digital inclusion and leverage the transformative potential of 5G technology for socio-economic development, ultimately improving access to information, services, and opportunities for individuals and communities.

Confidentiality:

Any information obtained in this study that can be identified with you will be kept strictly confidential. Your name and any other identification will not be asked for in the questionnaires. The data collected will be used solely for research purposes and will be reported in a way that ensures anonymity.

Voluntary participation:

Participation in this study is voluntary. Your decision to participate or not will not affect your future relationship with Africa University. If you choose to participate, you are free to withdraw your consent and discontinue participation at any time without penalty.

Offer to answer questions:

Before you sign this form, please ask any questions about any aspect of this study that is unclear to you. You may take as much time as necessary to think it over.

Authorization:

If you have decided to participate in this study, please sign this form in the space provided below as an indication that you have read and understood the information provided above and have agreed to participate.

--   -------------------------------

Name of Research Participant (please print)   Date

Signature of Research Participant or legally authorized representative

If you have any questions concerning this study or consent form beyond those answered by the researcher, including questions about the research, your rights as a research participant, or if you feel that you have been treated unfairly and would like to talk to someone other than the researcher, please feel free to contact the Africa University Research Ethics Committee at telephone (020) 60075 or 60026 extension 1156, or email aurec@africau.edu.

Name of Researcher: Jubilee Peace Maneswa

APPENDIX E: Timeframe

TASK	START DATE	DAYS TO COMPLETE
Allocation of supervisors	18/3/2024	7
Development of proposal	3/4/2024	30
Development of data collection tools	10/6/2024	10
Requesting approval note from supervisor	17/6/2024	1
Requesting approval note from town counsil	23/6/2024	15
Submission of proposal to AUREC	31/7/2024	1
Data collection	1/8/2024	90
Write up for Chapter 4 and 5	15/2/2025	30
Submission of final copy of Research Project	20/3/2025	5

Table 6.1: Source: Primary Data (2024)
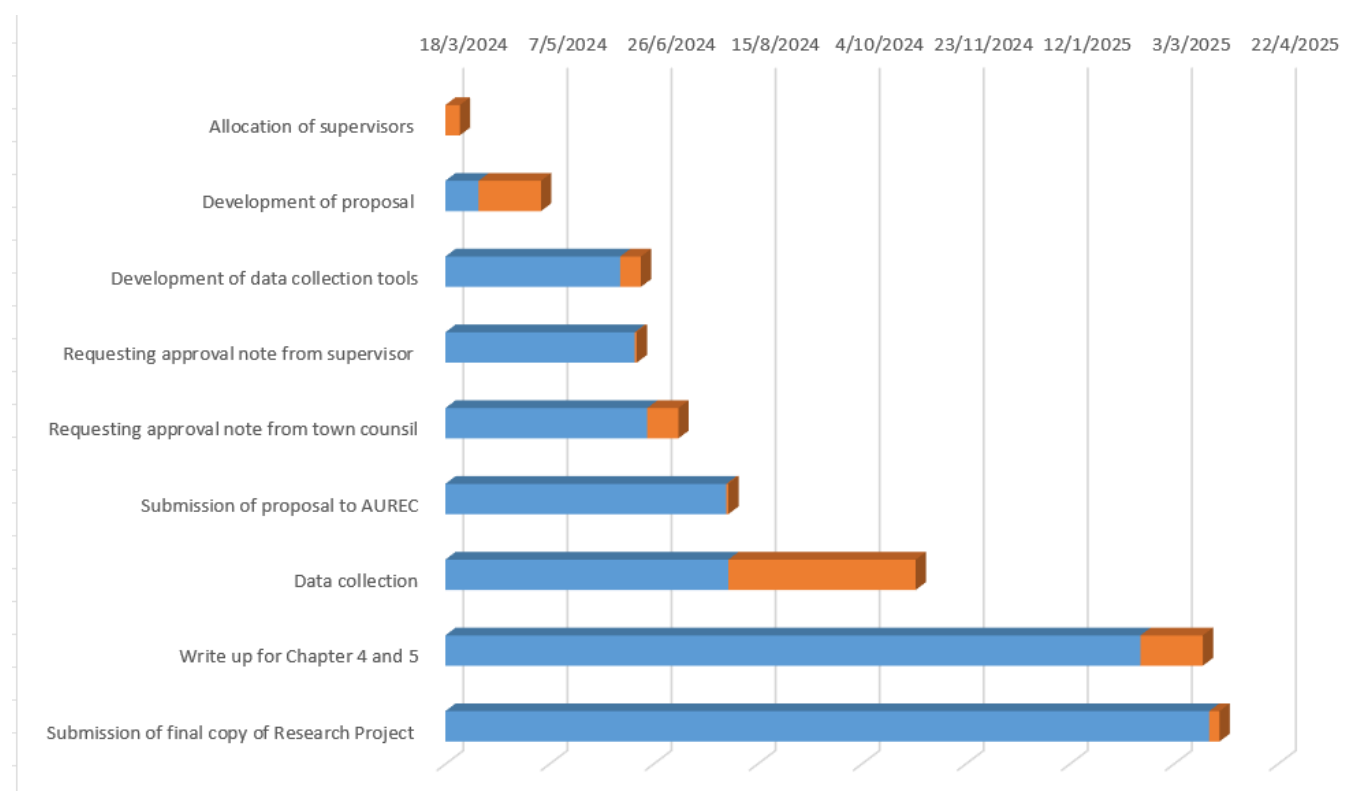
APPENDIX F: Research Gantt Chart

Figure 6.1: Source: Primary Data (2024)

APPENDIX G: Budget

Description	Cost
AUREC FEE	$15
RESEARCH MATERIAL (Books, journals and articles)	$20
DATA COLLECTION (Including survey design and printing)	$10
TRAVEL COSTS AND ACCOMODATION (Includes transport to Chitungwiza during data collection and accommodation costs)	$50
CONTIGENCY FUND (For unforeseen expenses)	$20
TOTAL	$115

Table 6.2: Source: Primary Data

APPENDIX H: Proof of Payment of the review fees

APPENDIX I: Chitungwiza Municipality Approval Note

CHITUNGWIZA MUNICIPALITY

All Correspondence to be addressed to the Town Clerk

If Calling, Please
Ask for...Ms. R. MURUNGU

The Municipality of
CHITUNGWIZA

15 July 2024

P. O. Box 70,
ZENGEZA
CHITUNGWIZA.
Mobile: 0712836921

Africa University
1 Fairview off Nyanga Road
P.O Box 1320
MUTARE

Dear Sir/Madam

RE: REQUEST TO CARRY OUT AN ACADEMIC RESEARCH IN CHITUNGWIZA MUNICIPALITY: THE ADOPTION OF 5G TECHNOLOGY, INVESTIGATE THE SOCIO-ECONOMIC IMPACT CHALLENGES AND BENEFITS OF 5G IN CHITUNGWIZA

I refer to your letter dated 01 July 2024 requesting to carry out a research in Chitungwiza and I am pleased to inform you that your request was considered and permission has been granted.

Please be advised that permission is granted on the following conditions:

1) That you do not publish the name of Council officials.
2) That you also seek police clearance in the case that you want to interview residents.
3) That Chitungwiza Municipality shall not be liable of any action arising from your research.
4) That you undertake to submit the research to the Town Clerk's Office upon completion.

R. MURUNGU
ACTING HUMAN RESOURCES MANAGER

CHITUNGWIZA MUNICIPALITY
HEAD OFFICE-REGISTRY

1 5 JUL 2024

SIGNATURE:...Debetera...
6004 TILCO ROAD
ZENGEZA 2. CHITUNGWIZA

Received by...Peace Jubilee Maneswa...Date...19/07/2024...

APPENDIX J: Application for AUREC initial review

<table>
<tr><td>For office use only</td><td rowspan="4">Office stamp</td></tr>
<tr><td>Protocol no. .... ☐</td></tr>
<tr><td>Type of review: Full Committee ☐</td></tr>
<tr><td>Expedited ☐</td></tr>
</table>

AFRICA UNIVERSITYRESEARCH ETHICS COMMITTEE (AUREC)

APPLICATION FOR INITIAL REVIEW

NB: This form must be completed by all persons/teams applying for ethical review by AUREC. Upon completion by the investigator(s) /researcher(s) it should be submitted electronically to AUREC, aurec@africau.edu. . Application fees (to cover the costs of reviewing proposal) should be paid to the Africa University Business Office, and proof of payment should accompany each application. Please complete all sections of this application form. If there is insufficient space on the form you may use additional pages.

Check list

This checklist is meant to aid researchers in preparing a complete application package and to help expedite review by the AUREC. Please tick all boxes as appropriate (Indicate **N/A** where inapplicable).

CONTACT PERSON'S NAME: **JUBILILEE PEACE MANESWA**

CONTACT ADDRESS: **9137 BUDIRIRO 5B**

EMAIL ADDRESS: **maneswaj@africau.edu**

CONTACT NO: **078 415 5799**

UNDERGRADUATES

		Applicant	AUREC
1	Application form duly completed	X	
2	Electronic version of research proposal to aurec@africau.edu	X	
3	Consent forms in English and local language of study population	X	
4	Advertisement or letter or card used for recruiting participants and any supplementary information *(if applicable)*.	N/A	
5	Data collection tools being administered during the study in English and local language of study population *(if applicable)* included in the proposal	X	
6	Budget and timeframe included in the proposal.	X	

		Applicant	AUREC
7	Approval letter from your academic supervisor/college or institution	X	
8	Approval letter from authorities where study will be conducted	X	
9	Application fee paid at AU Business Office and receipt (or copy) attached to application form.	X	

POSTGRADUATES AND OTHER RESEARCHERS

		Applicant	AUREC
1	Application form duly completed		
2	Electronic version of full research proposal (chapter 1 – 3 completed) to aurec@africau.edu		
3	Proposal summary (see guidelines below)		
4	Consent form in English and local language of study population		
5	Advertisement or letter or card used for recruiting participants and any supplementary information (if applicable).		
6	Data collection tools being administered during the study in English and local language of study population (if applicable)		
7	Budget and timeframe		
8	Approval letter from academic supervisor/college or institution (if you are a student)		
9	Approval letter from authorities where study will be conducted		
10	Application fee paid at AU Business Office and receipt attached to application form.		
12	CVs for D Phil and PhD candidates.		

JUBILEE PEACE MANESWA   24/6/2024

Signature: Investigator/Researcher   Name   Date

1. **General information**

    1.1. **Study title:** THE IMPACT OF THE ADOPTION OF 5H TECHNOLOGY IN LOW INCOME/RURAL AREAS: A CASE STUDY OF HARARE, CHITUNGWIZA

    1.2. **Name of Principal Investigator (PI)/ Researcher**: Jubilee Peace Maneswa

1.3. **Nationality of Investigator/Researcher**: Zimbabwean

1.4. **Proposed date of start of study**: (01/07/2024)

1.5. **Expected duration of study:** 8 months

1.6. **Study site(s) in Zimbabwe:** Chitungwiza

1.7. Sites outside Zimbabwe: N/A

1.8. **Study budget**:   **Source of Funding:** Personal finance
1.9. **Is the researcher a student?**   **Yes**/No

1.10.   If yes, indicate the following:

    1.10.1. **Name and address of institution:** Africa University, Mutare.

    1.10.2. **College**: Africa University, College of Engineering and Applied Science

    1.10.3. **Level of study Undergraduate/Master's/PhD**: Undergraduate

    1.10.4. **Name of Supervisor:** Tendai Zengeni

1.11.   If no to question 1.10, then indicate the following:
    1.11.1. Name and address of institution: N/A_____
    1.11.2. Academic Title of PI: N/A_____
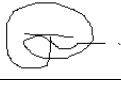   1.11.3. Existing Qualifications: N/A _____
    1.11.4. Co Investigators:

Names:	Qualifications	Institution

2. Statement by the investigator

I **Jubilee Peace Maneswa** certify that the information in this application document and the accompanying documents is true and complete in all respects. I confirm that the application has NOT been rejected by any other ethics review committee.

Signature _____   Date: 24/06/24

3. Guidelines for the proposal summary: (Times New Roman, double line spacing, font size 12)
   3.1. Introduction
   3.2. Background, purpose, statement of the problem, justification, significance of the study
   3.3. Aim(s) and objectives: Outline the main aim(s) and objectives of the study and research questions.
   3.4. Literature review
   4.0 Methodology

   4.1 Research Design *(describe how the research will be carried out including plans for data analysis and dissemination)*

   4.2 Study population and sampling procedure *(give details of the study population and how you will carry out the sampling procedure and NOT general meanings of population and sampling methods)*
   4.3 Inclusion/exclusion criteria *(state who qualifies for selection and who does not)*
   4.4 Devices, Tests, Questionnaires, and Interview Guides:
   4.5 Research participants/subjects
       4.5.1   State the total number of human participants to be enrolled
       4.5.2   State the source(s) of recruitment *(e.g. hospitals, schools, etc.)*
       4.5.3   Age range and sex of participants to be recruited.
       4.5.4   Special or vulnerable populations *(state if vulnerable populations e.g. pregnant women, adolescents, children, prisoners, refugees etc are involved)*
       4.5.5   Payment *(if any)* to be paid to each participant
       4.5.6   Informed Consent Procedure *(describe how this will be carried out)*
   4.6 Potential Benefits of the research *(Describe the benefits of the study both to the participants and to the community)*
   4.7 Potential Risks
       4.7.1   Describe any potential risks, discomforts or harms that may be experienced by the participants. These may be physical, psychological, social, legal, economic or other and state procedures to minimise these.
       4.7.2   Management of Risks *(describe how these risks will be managed/mitigated)*
   4.8 Confidentiality/privacy *(give details of how these will be maintained)*
   4.9 Investigator Experience/qualifications *(describe any experience or training/courses that the investigator has/has taken that put him/her in good stead to carry out the study)*
   4.10 Explain how research results are going to be disseminated to participants

5.   Reference List

6. Attachments

6.1 Approval letter from College Supervisor (if you are a student)

6.2 Data collection instruments *(Include anything you will be using to gather data from human subjects e.g. Tests/Questionnaires/Observation Checklists/interview guides/ FGDs guides etc.)*
6.3 Informed Consent Forms or assent (*informed consent form guide is available from AUREC)*
6.4 Budget and timeframe
6.5 Proof of payment of the review fees.

APPENDIX K: AUREC approval letter:

"*Investing in Africa's future*"
AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE (AUREC)

P.O. Box 1320 Mutare, Zimbabwe, Off Nyanga Road, Old Mutare-Tel (+263-20) 60075/60026/61611 Fax: (+263 20) 61785 Website: www.africau.edu

Ref: AU 3424/24   21 August, 2024

JUBILEE PEACE MANESWA
C/O Africa University
Box 1320
MUTARE

RE: **THE IMPACT OF THE ADOPTION OF 5G TECHNOLOGY IN LOW INCOME/RURAL AREAS: A CASE STUDY OF CHITUNGWIZA, ZIMBABWE**

Thank you for the above-titled proposal that you submitted to the Africa University Research Ethics Committee for review. Please be advised that AUREC has reviewed and approved your application to conduct the above research.

The approval is based on the following.
a) Research proposal
*   **APPROVAL NUMBER**   AUREC 3424/24
    This number should be used on all correspondences, consent forms, and appropriate documents.

*   **AUREC MEETING DATE**   NA
*   **APPROVAL DATE**   August 21, 2024
*   **EXPIRATION DATE**   August 21, 2025
*   **TYPE OF MEETING**: Expedited
    After the expiration date, this research may only continue upon renewal. A progress report on a standard AUREC form should be submitted a month before the expiration date for renewal purposes.
*   **SERIOUS ADVERSE EVENTS** All serious problems concerning subject safety must be reported to AUREC within 3 working days on the standard AUREC form.
*   **MODIFICATIONS** Prior AUREC approval is required before implementing any changes in the proposal (including changes in the consent documents)
*   **TERMINATION OF STUDY** Upon termination of the study a report has to be submitted to AUREC.

Yours Faithfully

MARY CHINZOU
ASSISTANT RESEARCH OFFICER: FOR CHAIRPERSON
AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE